中国运筹学会数学规划分会
第十四届全国数学优化学术会议
暨第七次会员代表大会

四川·成都

2023 年 5 月 12-15 日

主办：中国运筹学会数学规划分会
承办：电子科技大学数学科学学院
协办：四川大学数学学院

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https://www.orsc.org.cn/conferences/detail?id=666#C

一、会议宗旨

为了加强全国数学优化研究者之间的联系，交流优化理论、算法和应用方面的最新成果，了解数学优化的国际发展动态和研究热点，促进数学优化和工业工程、人工智能与机器学习等领域的融通共进，中国运筹学会数学规划分会第十四届全国数学优化学术会议暨第七次会员代表大会（MOS2023）于 2023 年 5 月 12-15 日在成都召开。会议由中国运筹学会数学规划分会主办，电子科技大学数学科学学院承办，四川大学数学学院协办。MOS2023 就数学优化各分支的理论、方法、应用和教学等进行学术报告与交流，并选举产生中国运筹学会数学规划分会第八届理事会。

二、会议主题

交流最优化理论、算法及其应用的最新成果。议题包括（但不局限于）：线性与非线性规划、锥优化、全局优化、变分不等式与互补问题、组合优化、整数规划、网络优化、博弈论、向量与集值优化、非光滑优化、动态规划、不确定性优化、金融优化、通信中的优化、管理中的优化、统计中的优化、工程中的优化、人工智能与机器学习中的优化等。

三、顾问委员会（按照姓氏汉语拼音排序）

堵丁柱（德克萨斯大学达拉斯分校）　　　　　韩继业（中科院数学院）
罗智泉（香港中文大学（深圳））　　　　　　叶荫宇（斯坦福大学/香港中文大学（深圳））
袁亚湘（中科院数学院）

四、学术委员会

主　任：修乃华（北京交通大学）
委　员：（按照姓氏汉语拼音排序）
白延琴（上海大学）　　　　　陈光亭（浙江水利水电学院）　　　陈小君（香港理工大学）
戴彧虹（中科院数学院）　　　郭田德（中国科学院大学）　　　　孙德锋（香港理工大学）
邢文训（清华大学）　　　　　徐大川（北京工业大学）　　　　　张国川（浙江大学）
张立卫（大连理工大学）

五、程序委员会

主　任：徐大川（北京工业大学）
副主任：（按照姓氏汉语拼音排序）
陈小君（香港理工大学）　　　陈旭瑾（中科院数学院）　　　　　范金燕（上海交通大学）
黄正海（天津大学）　　　　　简金宝（广西民族大学）　　　　　凌　晨（杭州电子科技大学）
文再文（北京大学）　　　　　张立卫（大连理工大学）
委　员：（按照姓氏汉语拼音排序）
白延琴（上海大学）　　　　　陈光亭（浙江水利水电学院）　　　陈国庆（内蒙古大学）
陈中文（苏州大学）　　　　　方奇志（中国海洋大学）　　　　　高岳林（北方民族大学）
郭田德（中国科学院大学）　　韩德仁（北京航空航天大学）　　　何斯迈（上海财经大学）

胡祥培（大连理工大学）	黄南京（四川大学）	蒋建林（南京航空航天大学）
孔令臣（北京交通大学）	李声杰（重庆大学）	刘新为（河北工业大学）
鲁习文（华东理工大学）	吕锡亮（武汉大学）	潘少华（华南理工大学）
尚有林（河南科技大学）	申培萍（华北水利水电大学）	舒　嘉（东南大学）
宋　文（哈尔滨师范大学）	谈之奕（浙江大学）	童小娇（湖南第一师范学院）
王川龙（太原师范学院）	王宜举（曲阜师范大学）	邢文训（清华大学）
徐凤敏（西安交通大学）	徐寅峰（西安交通大学）	杨　辉（贵州大学）
杨庆之（南开大学）	杨晓光（中科院数学院）	杨晓琪（香港理工大学）
杨周旺（中国科学技术大学）	张玉忠（曲阜师范大学）	赵克全（重庆师范大学）
郑喜印（云南大学）	朱文兴（福州大学）	朱志斌（桂林电子科技大学）

六、组织委员会

主　任：（按照姓氏汉语拼音排序）

| 陈旭瑾（中科院数学院） | 王宝富（四川大学） | 徐立伟（电子科技大学） |

副主任：（按照姓氏汉语拼音排序）

| 黄南京（四川大学） | 孔令臣（北京交通大学） | 吴晨晨（天津理工大学） |
| 肖义彬（电子科技大学） | 张　昭（浙江师范大学） | |

委　员：（按照姓氏汉语拼音排序）

丁　超（中科院数学院）	方亚平（四川大学）	胡　捷（武汉大学）
兰恒友（四川轻化工大学）	李　军（西华师范大学）	李雪松（四川大学）
李　为（成都理工大学）	刘　彬（中国海洋大学）	刘亚锋（中科院数学院）
罗自炎（北京交通大学）	梅丽丽（杭州电子科技大学）	孟开文（西南财经大学）
闵　超（西南石油大学）	王长军（中科院数学院）	王承竞（西南交通大学）
夏福全（四川师范大学）	徐　岩（北京科技大学）	叶德仕（浙江大学）
张晓军（电子科技大学）	张晓伟（电子科技大学）	赵欣苑（北京工业大学）

七、大会报告人 （按照姓氏汉语拼音排序）

| 邓小铁（北京大学） | 林华珍（西南财经大学） | 孙德锋（香港理工大学） |
| 夏　勇（北京航空航天大学） | 张　寅（香港中文大学（深圳）） | 朱文兴（福州大学） |

八、青年邀请报告人 （按照姓氏汉语拼音排序）

包承龙（清华大学）	陈　林（德州理工大学）	焦雨领（武汉大学）
江如俊（复旦大学）	刘　彬（中国海洋大学）	罗俊杰（北京交通大学）
孙　聪（北京邮电大学）	吴自军（合肥学院）	许宜诚（中科院深圳先进院）
杨　磊（中山大学）	袁　坤（北京大学）	周　宏（福州大学）

九、短期课程

课程名称：Submodular optimization: an introduction to the theory, algorithms and applications

主讲教师：杜东雷教授（加拿大新布朗什维克大学）

十、会议日程概要

5 月 12 日 (星期五)	5 月 13 日 (星期六)		5 月 14 日 (星期日)	5 月 15 日 (星期一)
报到 10:00-21:00 金牛宾馆礼堂	开幕式、合影、大会报告 会员代表大会 8:30-11:40 礼堂		大会报告 8:30-12:00 礼堂	青年邀请报告 闭幕式 8:30-12:00 中苑正厅、中苑西侧
短期课程 13:30-17:50 中苑正厅	专题报告 自由报告 13:30-17:35 金牛宾馆	中国科协青托报告会 13:30-15:40 蜀韵楼一层 11 号	专题报告 自由报告 13:30-17:30 金牛宾馆	代表离会
	纪念越民义先生专题活动 16:00-17:40 川汇楼二层 1 号			
ORSC 数学规划分会 第七届理事会第三次会议 20:30-21:30 川汇楼二层 1 号	ORSC 数学规划分会 第八届理事会第一次会议 第八届常务理事会第一次会议 20:00-21:30 中苑正厅			

中国运筹学会数学规划分会
第十四届全国数学优化学术会议暨第七次会员代表大会
会议日程简表

5 月 12 日 （星期五)		
时间	地点	内容
10:00-21:00	金牛宾馆	报到
11:30-13:00	北苑餐厅	午餐
13:30-17:50	中苑正厅	《次模优化选讲》短期课程 主讲：杜东雷　新布朗什维克大学　主持：张　昭
18:00-19:30	北苑餐厅	晚餐
20:30-21:30	川汇楼二层 1 号会议厅	第七届理事会第三次会议

5 月 13 日 （星期六）			
时间	地点	议程	主持人
8:30-8:50	礼堂	**开幕式** 电子科技大学党委副书记靳敏致辞 中国运筹学会数学规划分会理事长徐大川致辞 中国运筹学会理事长戴彧虹致辞	陈旭瑾
8:50-9:20	礼堂门口	集体合影、茶歇	
9:20-10:10	礼堂	**大会报告**：On Some Optimization-Related Issues in Deep Learning 张　寅　香港中文大学（深圳）	陈小君
10:10-11:00	礼堂	**大会报告**：MARL = PPAD 邓小铁　北京大学	文再文
11:00-11:30	礼堂	会员代表大会	陈旭瑾
11:30-13:30		午餐 （北苑餐厅、天府楼餐厅）	
13:30-15:40	蜀韵楼一层 11 号会议厅	**第五届中国科协青年人才托举工程报告会** 戴彧虹：致辞 韩德仁：青托项目介绍 郦旭东：汇报（托举导师与评委点评） 罗志兴：汇报（托举导师与评委点评）	陈旭瑾
13:30-14:45	川汇楼二层 1 号会议厅	**专题报告 A1　线性与非线性规划** （组织者：简金宝) 杨林峰　广西大学 尹江华　广西民族大学 张　晨　上海理工大学	徐　姿
	川汇楼二层 3 号会议厅	**专题报告 A2　张量优化及其应用-I** （组织者：魏益民、陈艳男、胡胜龙) 车茂林　西南财经大学 丁维洋　复旦大学 刘冬冬　广东工业大学	凌　青
	天府楼二层 5 号会议厅	**专题报告 A3　非光滑非凸优化理论和算法-I** （组织者：蔡邢菊、吴中明) 贾泽慧　南京信息工程大学 姜　帆　南京信息工程大学 李　婷　南京师范大学	蔡邢菊
	天府楼二层 6 号会议厅	**专题报告 A4　人工智能与机器学习中的优化-I** （组织者：何洪津、王祥丰、张文星) 张纵辉　香港中文大学（深圳） 李希君　华为诺亚方舟实验室 濮　实　香港中文大学（深圳）	刘　歆
	中苑迎晖厅	**专题报告 A5　近似算法与机制设计** （组织者：Chau Vincent) 陈　婳　浙江大学 盖　玲　东华大学 孙　鑫　中国科学院大学	叶德仕
	中苑西侧厅	**专题报告 A6　网络与博弈**（组织者：陈旭瑾) 操宜新　香港理工大学 王晨豪　北京师范大学（珠海）	谈之奕

		肖　汉　中国海洋大学	
	天府楼一层 10 号会议厅	**专题报告 A7　最优化及其在金融中的应用** （组织者：董志龙、徐凤敏） 董志龙　西安交通大学 刘　嘉　西安交通大学 赵志华　西安电子科技大学	徐凤敏
	天府楼二层 7 号会议厅	**专题报告 A8　微分变分不等式的理论、方法与应用** （组织者：黄南京、曾生达） 曾生达　玉林师范学院 罗建锋　香港理工大学深圳研究院 吴增宝　洛阳师范学院	黄南京
	中苑贵宾厅	**专题报告 A9　多项式优化与张量计算-I**（组织者：唐新东） 胡胜龙　杭州电子科技大学 瞿　铮　香港大学 唐新东　香港理工大学	王宜举
	川汇楼二层 2 号会议厅	**专题报告 A10　统计中的优化-I** （组织者：肖运海，彭定涛，樊军） 李海洋　广州大学 潘丽丽　山东理工大学 修贤超　上海大学	潘少华
	东苑七层	**专题报告 A11　随机优化及其应用-I** （组织者：边　伟、孙海琳、张　超） 李　超　太原师范学院 张　超　北京交通大学 周　斌　南京师范大学	贺素香
14:50-16:05	川汇楼二层 1 号会议厅	**专题报告 B1　全局优化-I**（组织者：夏　勇） 罗和治　浙江理工大学 郑小金　同济大学 注：本会议室 16:00 开始举行纪念越公专题活动	韩乔明
	川汇楼二层 3 号会议厅	**专题报告 B2　张量优化及其应用-II** （组织者：魏益民、陈艳男、胡胜龙） 李朝迁　云南大学 李建泽　深圳市大数据研究院 李昱帆　中山大学	白敏茹
	天府楼二层 5 号会议厅	**专题报告 B3　非光滑非凸优化理论和算法-II** （组织者：蔡邢菊、吴中明） 马玉敏　南京财经大学 王青松　北京航空航天大学 谢家新　北京航空航天大学	杨晓琪
	天府楼二层 6 号会议厅	**专题报告 B4　人工智能与机器学习中的优化-II** （组织者：何洪津、王祥丰、张文星） 沈春根　上海理工大学 盛　洲　安徽工业大学 李欣欣　吉林大学	苏文藻
	中苑迎晖厅	**专题报告 B5　排序优化与椭球覆盖**（组织者：韩　璐） Chau Vincent 东南大学	录岭法

		王银玲　郑州大学 张　威　华南理工大学	
	中苑西侧	**专题报告 B6　组合优化**　（组织者：程郁琨） 程郁琨　苏州科技大学 黄志毅　香港大学 肖鸣宇　电子科技大学	张　鹏
	天府楼一层 10 号会议厅	**专题报告 B7　非光滑优化**　（组织者：白建超、常小凯） 陈　亮　湖南大学 何洪津　宁波大学 张立平　清华大学	郑喜印
	天府楼二层 7 号会议厅	**专题报告 B8　稀疏优化算法与应用**　（组织者：王国强） 高雪瑞　上海工程技术大学 姜　珊　厦门大学 李　倩　上海工程技术大学	王国强
	中苑贵宾厅	**专题报告 B9　多项式优化与张量计算-II**　（组织者：唐新东） 王　杰　中国科学院数学与系统科学研究院 叶　科　中国科学院数学与系统科学研究院	杜守强
	川汇楼二层 2 号会议厅	**专题报告 B10　统计中的优化-II** （组织者：肖运海，彭定涛，樊军） 樊　军　河北工业大学 李培丽　河南大学 周声龙　北京交通大学	庞丽萍
	东苑七层	**专题报告 B11　随机优化及其应用-II** （组织者：边伟、孙海琳） 贺一凡　香港理工大学 邱子程　香港理工大学 王　悦　香港理工大学 周　洋　山东师范大学	江　波
16:05-16:20		茶歇	
16:00-17:20	川汇楼二层 1 号会议厅	**纪念越民义先生专题活动** 胡晓东：越民义先生与中国运筹学 张汉勤：Stochastic Operations Research: An Overview from the Work Initiated by Prof Minyi Yue 孙德锋：从越-韩转轴法谈起 张国川：组合优化，山高水长	徐大川
17:20-17:40	川汇楼二层 1 号会议厅	**纪念越民义先生专题活动** 自由发言	张玉忠
16:20-17:35	川汇楼二层 3 号会议厅	**分组报告 C1　线性与非线性规划** 李明华　重庆文理学院 马国栋　广西民族大学 吴朋程　香港理工大学 袁雁城　香港理工大学 张在坤　香港理工大学	韩丛英
	天府楼二层 5 号会议厅	**分组报告 C2　线性与非线性规划** 陈　彤　北京航空航天大学	刘永朝

	何 玥　大连海事大学 晋家晨　广西民族大学 刘鹏杰　中国矿业大学		
天府楼二层 6 号会议厅	**分组报告 C3 非光滑优化** 方长杰　重庆邮电大学 王 婷　西安邮电大学 吴世良　云南师范大学 张海森　四川师范大学	杨俊锋
中苑迎晖厅	**分组报告 C4 组合优化与算法** 崔 敏　北京工业大学 黄宏宇　江西财经大学 林宇权　东南大学 刘敏琴　华东理工大学 王凤敏　中国航天科工三院	王 勤
中苑西侧	**分组报告 C5 博弈论** 毕 艳　贵州大学 敬新奇　中国科学院数学与系统科学研究院 刘珍丽　贵州大学 任春莹　北京工业大学 王 琦　东南大学	杨 辉
天府楼一层 10 号会议厅	**分组报告 C6 组合优化与图论** 刘晓非　云南大学 唐中正　北京邮电大学 谢润陶　云南大学 余 炜　华东理工大学 张新功　重庆师范大学	张晓岩
天府楼二层 7 号会议厅	**分组报告 C7 变分不等式与互补问题** 贺月红　重庆工商大学 侯金闫　中南大学 刘丽亚　西南大学 王 迪　北京交通大学	李 军
中苑贵宾厅	**分组报告 C8 线性与非线性规划** 高菲菲　北京邮电大学　浙江工商大学 王 杰　重庆交通大学 伍 浩　南京航空航天大学 杨贺舒　广西大学 杨慧慧　广西民族大学	周志昂
川汇楼二层 2 号会议厅	**分组报告 C9 整数规划** 陈 乾　香港中文大学(深圳) 黄诗语　北京邮电大学 梁 洁　北京理工大学 刘 霞　北方民族大学 杨林鑫　香港中文大学(深圳)　深圳市大数据研究院	艾文宝
东苑七层	**分组报告 C10 非光滑优化** 尚天佑　河北大学 省沙杰　广西大学 史子剑　广西大学 卫 阳　北京交通大学	吕一兵

时间	地点	议程	主持人
		吴育洽　香港理工大学	
18:00-19:30	娇子厅	晚餐	
20:00-21:30	中苑正厅	第八届理事会第一次会议、第八届常务理事会第一次会议	

<table>
<tr><td colspan="4" align="center">5月14日（星期日）</td></tr>
</table>

时间	地点	议程	主持人
8:30-9:20	礼堂	**大会报告：** Nonsmooth Analysis and Sparse Optimization 孙德锋　香港理工大学	简金宝
9:20-10:10	礼堂	**大会报告：** 正则化辅助的统计学习 林华珍　西南财经大学	张立卫
10:10-10:20	礼堂门口	茶歇	
10:20-11:10	礼堂	**大会报告：** 数字集成电路布图规划、混合模块布局和总体布线的优化算法 朱文兴　福州大学	范金燕
11:10-12:00	礼堂	**大会报告：** 非凸优化的一些理解 夏　勇　北京航空航天大学	黄正海
12:00-14:00		午餐　（北苑餐厅、天府楼餐厅）	
13:30-14:45	川汇楼二层 1号会议厅	**专题报告 D1　全局优化-II**　（组织者：夏　勇） 陈伟坤　北京理工大学 邓亚萍　华北水利水电大学 邓智斌　中国科学院大学	尚有林
	川汇楼二层 3号会议厅	**专题报告 D2　张量优化及其应用-III** （组织者：魏益民、陈艳男、胡胜龙） 陈艳男　华南师范大学 宋义生　重庆师范大学 赵熙乐　电子科技大学	魏益民
	天府楼二层 5号会议厅	**专题报告 D3　非线性规划**　（组织者：孙　聪） 高　斌　中国科学院数学与系统科学研究院 田文义　天津大学 尧　伟　南方科技大学	刘新为
	天府楼二层 6号会议厅	**专题报告 D4　人工智能与机器学习中的优化-III** （组织者：何洪津、王祥丰、张文星） 闫喜红　太原师范学院 乐航睿　南开大学	吴春林
	中苑迎晖厅	**专题报告 D5　组合优化反问题及其应用**　（组织者：关秀翠） 关秀翠　东南大学 李　霄　东南大学 张昀蔚　东南大学	张　安
	中苑西侧	**专题报告 D6　随机优化理论与方法-I**（组织者：王　晓、肖现涛） 邓　琪　上海财经大学 白建超　西北工业大学 丁　超　中国科学院数学与系统科学研究院	肖现涛
	天府楼一层 10号会议厅	**专题报告 D7　数据驱动的管理优化-I**　（组织者：金庆伟） 金庆伟　浙江大学 陆海旻　浙江工业大学 翟倩茹　西南财经大学	王明征

	天府楼二层 7号会议厅	**专题报告 D8 向量与集值优化-I** (组织者: 陈加伟) 陈加伟　西南大学 韩　瑜　江西财经大学 徐阳栋　重庆邮电大学	宋　文
	中苑贵宾厅	**专题报告 D9 多项式优化与张量计算-III** (组织者: 唐新东) 张　敏　中国科学院新疆生态与地理研究所 张新珍　天津大学 周安娃　上海大学	杨宇宁
	川汇楼二层 2号会议厅	**专题报告 D10 统计中的优化-III** 　(组织者: 肖运海、彭定涛、樊军) 彭定涛　贵州大学 杨翔宇　河南大学 张　辉　北京交通大学 张　弦　贵州大学	肖运海
	东苑七层	**专题报告 D11 随机优化及其应用-III** 　(组织者: 边　伟、孙海琳、张　超) 蒋　杰　重庆大学 李汶静　哈尔滨工业大学 温　博　河北工业大学	孙海琳
14:50-16:05	川汇楼二层 1号会议厅	**专题报告 E1 全局优化-III** (组织者: 夏　勇、路　程) 李玥瑶　清华大学 徐瑾涛　清华大学 张　博　宁夏大学	路　程
	川汇楼二层 3号会议厅	**专题报告 E2 优化前沿算法及其应用** (组织者: 黄亚魁) 黄亚魁　河北工业大学 刘泽显　贵州大学 曾燎原　浙江工业大学	高岳林
	天府楼二层 5号会议厅	**专题报告 E3 大规模数学优化问题的求解理论与快速算法** 　(组织者: 王承竞) 高　雪　河北工业大学 李庆娜　北京理工大学 王承竞　西南交通大学	刘勇进
	天府楼二层 6号会议厅	**专题报告 E4 大规模机器学习-稀疏和分布式技术** 　(组织者: 袁　坤) 严　明　香港中文大学(深圳) 叶海山　西安交通大学 袁　坤　北京大学	胡耀华
	中苑迎晖厅	**专题报告 E5 网络优化** (组织者: 姬　赛) 李宪越　兰州大学 孙　建　南开大学 张　巧　常州大学	陈光亭
	中苑西侧	**专题报告 E6 随机优化理论与方法-II** 　(组织者: 王　晓、肖现涛) 梁经纬　上海交通大学 龙宪军　重庆工商大学 罗　珞　复旦大学	王　晓
	天府楼一层 10号会议厅	**专题报告 E7 数据驱动的管理优化-II** (组织者: 裴　植) 王倩倩　浙江大学	何斯迈

		吴萌婷　浙江工业大学 周靖悦　西南财经大学	
	天府楼二层 7 号会议厅	**专题报告 E8　向量与集值优化-II**　（组织者：陈加伟） 姚朝李　海南大学 余国林　北方民族大学 赵晓苂　天津工业大学	彭再云
	中苑贵宾厅	**专题报告 E9　航空交通运筹与优化**　（组织者：徐海文） 顾　燕　南京航空航天大学 徐海文　中国民用航空飞行学院 张思佳　南京航空航天大学	蒋建林
	川汇楼二层 2 号会议厅	**专题报告 E10 非光滑变分不等式的最优化控制与算法** 　（组织者：肖义彬、曾生达） 荆菲菲　西北工业大学 刘建勋　广西民族大学 彭自嘉　广西民族大学 王中宝　西南交通大学	李声杰
	东苑七层	**专题报告 E11　最优控制方法及其应用**　（组织者：刘重阳） 刘重阳　山东工商学院 叶剑雄　福建师范大学 袁金龙　大连海事大学	陈东彦
16:05-16:20		茶歇	
16:20-17:30	川汇楼二层 1 号会议厅	**分组报告 F1　线性与非线性规划** 刘玉凤　桂林电子科技大学 曲文涛　北京交通大学 赵弘欣　北京交通大学	朱志斌
	川汇楼二层 3 号会议厅	**分组报告 F2　线性与非线性规划** 陈文睿　广西大学 丁明才　石河子大学 郭　峰　大连理工大学	唐春明
	天府楼二层 5 号会议厅	**分组报告 F3　线性与非线性规划** 张　茜　北京交通大学 张雨涵　中南大学 赵永欣　北京交通大学 朱亦晗　广西民族大学	余长君
	天府楼二层 6 号会议厅	**分组报告 F4　非光滑优化** 蔡靖民　广西民族大学 何　毫　广西大学 杨振平　嘉应学院 张　美　四川大学	袁功林
	中苑迎晖厅	**分组报告 F5　次模优化与聚类** 刘治成　北京工业大学 孙　悦　北京工业大学 田晓云　北京工业大学 张洪祥　北京工业大学	郭龙坤
	中苑西侧	**分组报告 F6　博弈论、管理中的优化** 王国玲　贵州大学 武文俊　贵州大学	肖义彬

		王彦儒　北京理工大学 魏彦姝　河北大学 赵　冰　河北大学	
	天府楼一层 10 号会议厅	**分组报告 F7 管理中的优化** 李　梅　北京交通大学 刘　欢　燕山大学 张　勇　吉首大学	孟志青
	天府楼二层 7 号会议厅	**分组报告 F8 通信中的优化、变分不等式与互补问题** 王子岳　中国科学院数学与系统科学研究院 武哲宇　中国科学院数学与系统科学研究院 杨澈洲　重庆工商大学 杨　静　重庆工商大学 谭露琳　华南师范大学	刘亚锋
	中苑贵宾厅	**分组报告 F9 张量优化** 曹圣宇　上海财经大学 甘　甜　中南大学 秦　康　广西大学	屈　彪
	川汇楼二层 2 号会议厅	**分组报告 F10 金融中的优化、统计中的优化** 李伟梅　辽宁工程技术大学 尚　盼　北京交通大学 王　鑫　北京交通大学 张明堃　石河子大学 房才雅　贵州大学	龙宪军
	东苑七层	**分组报告 F11 人工智能与机器学习中的优化** 常静雅　广东工业大学 高　娟　河北工业大学 高　琦　北京交通大学 莫明煜　华南师范大学	赵欣苑
18:00-19:30	北苑餐厅、天府楼 餐厅	晚餐	

5 月 15 日（星期一）			
时间	地点	议程	主持人
8:30-10:00	中苑正厅	**连续优化青年邀请报告 I** 孙　聪　北京邮电大学 江如俊　复旦大学 焦雨领　武汉大学	孔令臣
	中苑西侧	**离散优化青年邀请报告 I** 陈　林　德州理工大学 刘　彬　中国海洋大学 罗俊杰　北京交通大学	韩　鑫
10:00-10:20	茶歇		
10:20-11:50	中苑正厅	**连续优化青年邀请报告 II** 包承龙　清华大学 杨　磊　中山大学 袁　坤　北京大学	丁　超
	中苑西侧	**离散优化青年邀请报告 II** 吴自军　合肥学院 许宜诚　中国科学院深圳先进技术研究院 周　宏　福州大学	张　涌
11:50-12:00	中苑正厅	闭幕式	新一届理事会秘书长
12:00-14:00	北苑餐厅	午餐	
会议结束，代表离会			

报告题目和摘要

短期课程

Submodular Optimization: An Introduction to the Theory, Algorithms and Applications

杜东雷

新布朗什维克大学

Abstract: Submodular optimization investigates optimizing a submodular function subject to various constraints. It is a highly interdisciplinary field of optimization with ubiquitous applications in economics, operations research, management science, industry engineering, applied mathematics, and computer science. Its popularity is further enhanced recently due to its applications and relevance to machine learning and artificial intelligence.

Submodularity and its sibling supermodularity characterize the economics phenomenon of substitute and complement, and manifesting itself as the diminishing return and increasing return respectively. Submodularity, like convexity, strikes a nice balance as an abstract concept that is both special enough to have a deep theory and general enough to have vast real-life applications.

As a separate discipline within discrete optimization, submodular theory experiences several phases of development with difference focuses. A signature trend is the emerging of some basic and fundamental (rather than ad-hoc) techniques, such as extension and rounding principle (convex (Lovasz) extension, concave extension, biconjugate bounding, multilinear extension, contention resolution rounding), variational principle (Lyapunov and potential function algorithm design paradigm), symmetric gap inappromimability framework, and configuration linear program, etc.

In this short course, we will introduce the theory, algorithm, and applications of submodular optimization; highlight some of the basic techniques in algorithm design and analysis; offer directions for future research. The tentative topics include:

1. Basic theory of submodular function on general lattice.

2. Various extensions, such as Lovasz extension, multilinear extension.

3. Approximation algorithm design via Lyapunov function.

4. More materials and lecture slides can be found on my personal website:

https://sites.google.com/view/donglei-du/teaching/submodularoptimization

报告人简介： 杜东雷教授现就职加拿大新布朗什维克管理学院。从事运筹及管理科学研究。其主要研究兴趣为离散优化，量化投资管理，社会网络分析，供应链管理，选址问题及排序理论。现任多家学术期刊编委会委员，担任多个国际学术会议的学术分委会主席、程序委员会委员、嘉宾和主讲嘉宾。

担任加拿大科学与工程基金委员会上会评审专家 (2017-2020)。其科研成果发表在诸多国际一流学术期刊上，如 Operations Research, Algorithmica, European Journal of Operation Research 等。并多次获得所在学校及学院的奖励，包括 University Research Scholar（校级, 2014），University Merit Award（校级, twice, 2006 and 2012），Excellence in Research Award（院级, 2007），and Annual Research Award（院级，2004）.

大会报告

Subgroup-learning for Treatment Effect and Covariance Structure

张寅

香港中文大学(深圳)

Abstract: Many great advances have been achieved in artificial intelligence through deep neural network learning, but our understandings on deep learning remain sorely limited. In this talk, we will discuss a number of optimization-related issues in deep learning, including model trainability, gradient stability, over-parameterization, quality of (globally optimal) solutions, generalization and extrapolation, though this discussion likely brings up more questions than answers. We will introduce a new neural-layer architecture using Householder weighting and absolute-value activating (thus called Han-layer). Compared to a standard fully-connected layer with d-neurons and d outputs, a Han-layer reduces the complexity order from d-squared to d, while guaranteeing gradient stability and 1-Lipschitz continuity. We will empirically evaluate the capacities of Han-layer and demonstrate its potential usefulness. In addition, we will share some interesting behaviors of Han-layers on a small stylized dataset.

报告人简介: 张寅教授是香港中文大学(深圳)数据科学学院校长讲座教授,和美国工业与应用数学学会会士(SIAM Fellow)。他于 1977 年毕业于重庆建筑工程学院(现重庆大学),并于 1987 年在美国纽约州立大学石溪分校获得应用数学博士学位。他曾长期任职美国莱斯大学计算与应用数学系终身教授。张寅教授的研究领域涵盖最优化算法设计、分析、实现,以及各类实际应用和相应的计算机软件开发。在内点算法领域,他的主要工作集中在缩小复杂性理论与实际计算的差距,引进和发展了超线性收敛理论和非可行点迭代收敛理论等。他开发的线性规划软件被权威科学与工程计算平台《MATLAB》购买版权并长期选为官方软件,受到国际上广泛应用。在图像与信号处理算法以及数据压缩感知算法方面,张寅教授和他的合作者也做出多项重要贡献。他的论文多次获得国际国内相关学术组织和期刊颁发的最佳论文奖。他曾担任多个国际学术期刊的常任编委,包括《SIAM Journal on Optimization》和《Mathematical Programming Computation》等著名期刊。

MARL = PPAD

邓小铁

北京大学

摘要: 马尔科夫博弈构成了多智能体强化学习和智能体顺序交互的研究基础。已有研究表明, 其传统解概念马尔科夫完美均衡 (Markov perfect equilibrium, MPE) 在无界马尔科夫博弈中的计算复杂性至少是 PPAD 困难的。据此难点, 我们导入了近似马尔科夫完美均衡作为无界多人广义和马尔科夫博弈求解问题的有限理性解概念, 并证明了其 PPAD 完备性。为多智能体学习算法由静态双人博弈成功扩展到动态多人马尔科夫博弈奠定了计算复杂度理论基础, 也为分布式人工智能、多智能体系统研究开辟了新思路、拓宽了求解路径。

报告人简介: 邓小铁教授于 1982 年在清华大学获得学士学位, 于 1984 年在中国科学院获得硕士学位, 于 1989 年在斯坦福大学获得博士学位。2017 年 12 月他入职北京大学, 任计算机学院前沿计算研究中心讲席教授。他曾任教于上海交通大学、利物浦大学、香港城市大学和约克大学。在此之前, 他还是西蒙菲莎大学的 NSERC 国际研究员。邓小铁教授的主要科研方向为算法博弈论、区块链、互联网经济、在线算法及并行计算。2008 年, 他因在算法博弈论领域的贡献当选 ACM Fellow;2019 年, 因在不完全信息计算和交互环境计算领域的贡献当选 IEEE fellow;2020 年当选欧洲科学院外籍院士 MAE;2021 年当选中国工业与应用数学学会会士 (CSIAM Fellow);2021 年被任命为博弈论学会 (GTS) 理事;2021 年被聘为中国运筹学会博弈论分会荣誉理事;2021 年获得 CCF 人工智能学会多智能体与多智能体系统研究成就奖;2022 年获得 ACM 计算经济学的"时间检验奖" (Test of Time Award)。

Nonsmooth Analysis and Sparse Optimization

孙德锋

香港理工大学

Abstract: In this talk, we shall explain why nonsmooth analysis plays a critical role in solving large scale sparse optimization problems. We start with introducing some basic concepts such as locally Lipschitz functions, Rademacher' theorem and the Moreau-Yosida regularization for convex functions. Then we talk about semismooth analysis including inverse and implicit functions theorems to demonstrate why nonsmooth systems are indispensable for solving constrained optimization problems and why smooth systems inevitably lead to singularity. Finally, we shall illustrate how we can employ nonsmooth analysis to design highly efficient sparse nonsmooth Newton methods for solving several important machine learning models including convex clustering, lasso, and exclusive lasso of sparse solutions and the nearest correlation matrix problems of low or high rank structures. Additionally, we shall point out several open questions in developing software packages for solving large scale conic optimization problems.

报告人简介：孙德锋，香港理工大学应用数学系系主任和应用优化与运筹学讲座教授，美国工业与应用数学学会会士，中国工业与应用数学学会会士，香港数学学会会长。荣获 2018 国际数学规划 Beale--Orchard-Hay 奖及新加坡国立大学科学学院首届杰出科学家奖。曾任《Asia-Pacific Journal of Operational Research（亚太运筹学杂志)》主编，现任国际顶级数学期刊《Mathematical Programming（数学规划)》编委，《SIAM Journal on Optimization》编委等。在 Mathematics of Operations Research, Mathematical Programming, SIAM Journal on Optimization 等国际权威刊物上发表学术论文百余篇。主要从事连续优化及机器学习的研究，包括基础理论、算法及应用。在半光滑和光滑化牛顿方法，以及线性和非线性矩阵优化等方面具有很深造诣。其在非对称矩阵优化问题方面取得的系列成果促成了矩阵优化这一新研究方向。2021 年凭借排产方面优化求解器的贡献，获得华为香港研究所和诺亚方舟实验室分别杰出合作奖。2022 年获香港研资局高级研究学者奖。

正则化辅助的统计学习

林华珍

西南财经大学

摘要：常用的统计建模方法可以分为两类：正则化方法和直接建模。正则化方法通过加入定性信息或专业知识来提高模型的精度和解释性。我们将介绍如何通过正则化方法，实现可估性或解的唯一性、找到重要的风险因子、识别风险因素的协同作用、识别同质样本、识别特定方案的敏感及不敏感人群。直接建模通常由问题驱动。 我们将以个体特征依赖的函数型数据的均值及协方差结构的学习来介绍正则化辅助下的直接建模方法、优化技术、理论性质及其应用。

报告人简介：林华珍，西南财经大学首席教授，统计研究中心主任，新基石研究员，国际数理统计学会 IMS-fellow，教育部长江学者特聘教授，国家杰出青年科学基金获得者。主要研究方向为非参数方法、函数型数据分析、因子模型、生存数据分析、转换模型等。研究成果发表在包括国际统计学四大顶级期刊 AoS、JASA、JRSSB、Biometrika 和计量经济学顶级期刊 JOE 及 JBES 上。先后是国际统计学权威期刊《Biometrics》、《Scandinavian Journal of Statistics》、《Journal of Business & Economic Statistics》、《Canadian Journal of Statistics》、《Statistics and Its Interface》、《Statistical Theory and Related Fields》的 Associate Editor，国内权威或核心学术期刊《数学学报》(英文) 、《应用概率统计》、《系统科学与数学》、《数理统计与管理》编委会编委。林华珍教授现任 ICSA 董事会成员，中国现场统计研究会副理事长，中国现场统计研究会数据科学与人工智能分会理事长，全国工业统计学教学研究会副会长。

数字集成电路布图规划、混合模块布局和总体布线的优化算法

朱文兴

福州大学

摘要：数字集成电路物理设计自动化主要包括布图规划、布局、时钟树综合和布线等环节，需要求解 NP 困难组合优化问题。本报告抛砖引玉，将介绍近期我们在数字集成电路的布图规划、布局和布线等基础性问题上的研究，包括：给出了模块不重叠的新条件，构建了固定边框布图规划的优化模型，设计了基于泊松方程的总体布图规划算法和基于约束图的布图合法化算法；设计了基于泊松方程解析解的混合模块集成电路总体布局的快速算法和宏模块合法化算法。与当前先进的 RePlace 相比，测试表明所设计的布局算法获得了 2 倍的加速比和 2.3%的线长提升；构建了集成电路总体布线的寻路模型，在拉格朗日松弛和 A*算法的基础上设计了拆线重布算法。与当前先进的 CUGR 相比，测试表明所设计的总体布线算法获得了 4.9 倍的加速比并减少了 5.1%的通孔，线长相当。

报告人简介：朱文兴，福州大学"嘉锡学者"特聘教授，主要从事数字集成电路物理设计自动化算法，及优化理论与算法的研究。主持承担了 7 项国家自然科学基金项目，作为骨干成员参与承担了 2 项国家"973"项目课题和 3 项国家自然科学基金重点项目，在 ACM、IEEE、INFORMS 和 SIAM 旗下期刊，以及集成电路设计自动化国际顶级学术会议 DAC 和 ICCAD 发表了系列研究论文，研发的数字集成电路布局器被纳入 IEEE 电子设计自动化参考学术流程，并被命名为 FZUplace。2020 年获中国运筹学会科学技术奖-运筹应用奖；2018 年获 ICCAD 最佳论文奖提名；2017 年获 DAC 最佳论文奖，系该会 54 年来中国大陆首次获此奖项；2017 年和 2018 年团队分别获 ICCAD'2017 和 ICCAD'2018 竞赛第一名，系中国大陆在国际权威集成电路设计竞赛中首次获得冠军；2013 年获福建省自然科学三等奖；2009 年获国家教学成果奖二等奖（排名第三）。

非凸优化的一些理解

夏勇

北京航空航天大学

摘要：报告通过一些典型非凸优化问题的理论和算法展示一些有趣的观点：非凸优化的困难可能来自其中"凸"的部分；非凸优化的局部解可能比全局解性质更好；将某些凸优化问题"非凸化"可能导出更快速算法；非凸连续优化的成功求解可能需要挖掘隐含的"离散结构"；等等。最后分享一些全局求解非凸优化的成功案例。

报告人简介：夏勇，北京航空航天大学教授，博士生导师，数学科学学院副院长。2002 年毕业于北京大学数学科学学院，2007 年毕业于中国科学院数学与系统科学研究院，师从袁亚湘院士。2013 年北京青年英才，2018 年国家优青。研究方向为非凸优化。在 Math Program、SIAM J Optim 等期刊发表论文 90 篇。任中国运筹学会理事、中国运筹学会数学规划分会理事、北京运筹学会理事，中国运筹学会会刊 JORSC 编委。代表性工作：针对经典二次指派问题提出新模型，被国际国内同行命名为 Xia-Yuan 线性化，其松弛被称为 Xia-Yuan bound；建立了等式型 S-引理；解决了领域内多个公开问题；部分成果被写进多部国际专著，包括被 Springer 专著第一章以完整定理的形式列为十个最重要的无约束优化方法之一的基础理论。

Multi-period locally-facet-based MIP formulations for unit commitment problems

杨林峰

广西大学

Abstract: A framework of systematic approach on unit commitment formulation is proposed in this paper. The framework is based on locally ideal conceptions to build strong valid inequalities for multi-period generation polytope subject to generation condition constraints. These inequalities define facets of the multiperiod polytope for the unit commitment problem. This approach uses more binary variables to represent the state of the generator to obtain the tightest upper bounds of the generation limits and ramping constraints within multiple periods of a single generator. Through this approach, we proposed a multi-period formulation based on sliding windows which may have different sizes for each generator in the system to solve the unit commitment problems. Furthermore, a multi-period model is obtained to consider historical unit commitment status. The proposed model is compared with five other commonly used unit commitment models over a 24-hour scheduling window with 75 instances. The case study results validated the accuracy and effectiveness with superior computational cost reduction.

Convergence of a partial Bregman ADMM for structured nonconvex and nonsmooth optimization

尹江华

广西民族大学

Abstract: In this talk, a partial Bregman alternating direction method of multipliers (ADMM) with a general relaxation factor $\alpha\in(0,\frac{1+\sqrt{5}}{2})$ is proposed for structured nonconvex and nonsmooth optimization, where the objective function is the sum of a nonsmooth convex function and a smooth nonconvex function without coupled variables. To the best of our knowledge, the nonconvex ADMM with a relaxation factor $\alpha\neq 1$ in the literature has never been studied for the problem under discussion. Under some mild conditions, the boundedness of the generated sequence, the global convergence and the iteration complexity are established. The numerical results verify the efficiency and robustness of the proposed method.

A two-stage distributionally robust CVaR-constrained framework and its approximations for self-scheduling microgrid

张晨

上海理工大学

Abstract: This work proposes a two-stage distributionally robust DR conditional value-at-risk (CVaR) constrained (TS-DR-CVaR) framework and its approximations for the economic self-scheduling of microgrid problem taking into account the uncertainty of renewable energy sources (RESs). First, Based on KL divergence and CVaR, the common distributionally robust constraint with CVaR (DRC-CVaR) is constructed to deal with the uncertainty of RESs, and then the TS-DR-CVaR model is established. The difficulty of solving mainly lies in the DRC-CVaR and the two-stage decision. For these two drawbacks, a more common and effective transformation approach of DRC-CVaR is designed by Jensen's inequality and Taylor approximation, which can enhance the universality of DR constraints. In addition, a continuous linear approximate transformation method of the two-stage model is innovatively designed through the Dual-Relax and McCormick relaxation method, which is convenient for the solver to calculate directly. By controlling the risk value and confidence in the approximate TS-DR-CVaR model constructed by the two methods designed, improving the consumption of RESs, and the economic operation and optimal scheduling of the system can be realized. Compared with the conventional operation methods, the uncertainty of RESs is fully addressed, and the scheduling scheme is both economical and robust. Simulations of the distribution system are conducted to demonstrate the correctness and effectiveness of the proposed approximate TS-DR-CVaR models.

专题报告 A2　　张量优化及其应用-I

5 月 13 日 13:30-14:45　川汇楼二层 3 号会议室

Low multilinear rank approximations via random projection and approximate matrix multiplication

车茂林

西南财经大学

Abstract: The main work in this talk is devoted to developing fast and efficient algorithms for computing the low multilinear rank approximation of a tensor with a given multilinear rank. By combining random projection and the relationship between singular value decomposition and eigenvalue decomposition, we obtain two efficient algorithms. To reduce the complexities of these two algorithms, fast and efficient algorithms are designed by combining two algorithms and approximate matrix multiplication. The theoretical results are also achieved based on the bounds of singular values of standard Gaussian matrices

and the theoretical results for approximate matrix multiplication. Finally, the efficiency of these algorithms are illustrated via some test tensors from synthetic and real datasets.

Singular value decomposition of dual matrices and its application to traveling wave identification in the brain

丁维洋

复旦大学

Abstract: Matrix factorization in dual number algebra, a hypercomplex system, has been applied to kinematics, mechanisms, and other fields recently. We develop an approach to identify spatiotemporal patterns in the brain such as traveling waves using the singular value decomposition of dual matrices in this talk. Theoretically, we propose the compact dual singular value decomposition (CDSVD) of dual complex matrices with explicit expressions as well as a necessary and sufficient condition for its existence. Furthermore, based on the CDSVD, we report on the optimal solution to the best rank-k approximation under a newly defined Froubenius norm in dual complex number system. The CDSVD is also related to the dual Moore-Penrose generalized inverse. Numerically, comparisons with other available algorithms are conducted, which indicate the less computational cost of our proposed CDSVD. Next, we employ experiments on simulated time-series data and a road monitoring video to demonstrate the beneficial effect of infinitesimal parts of dual matrices in spatiotemporal pattern identification. Finally, we apply this approach to the large-scale brain fMRI data and then identify three kinds of traveling waves, and further validate the consistency between our analytical results and the current knowledge of cerebral cortex function.

Cyclic stationary probability distribution of second order Markov chains and its applications

刘冬冬

广东工业大学

Abstract: In this talk, we define a cyclic stationary probability distribution equation for a second order Markov chain process in case that all states are independent each other, which improves the existing equation. There are two applications for the new model. First, the proposed model can be seen as a rank-3 approximation of a second order Markov chain with non-independent states. Secondly, unlike the previous tensor model, if the fixed point algorithm for solving the new model is convergent, the second order Markov chain process in the independent state converges. Furthermore, we investigate properties of the solutions for the proposed stationary equation.

专题报告 A3 　　非光滑非凸优化理论和算法-I

Inexact variable metric proximal incremental aggregated gradient algorithm for nonconvex nonsmooth optimization problem

贾泽慧

南京信息工程大学

Abstract: This paper focuses on the problem that minimizing the sum of a nonconvex smooth function and a nonsmooth convex function, in which the smooth term is in the form of finite sum. In order to solve the problem efficiently, we introduce the idea of incremental aggregation and two different inexact criterions to the variable metric proximal gradient (VMPG) algorithms, and then propose the inexact variable metric proximal incremental aggregated gradient (iVMPIAG) algorithms, i.e., iVMPIAG-I, iVMPIAG-II. Under the Kurdyka-Łojasiewicz (KL) property, we show the global convergence of iVMPIAG-I and iVMPIAG -II. When the Łojasiewicz exponent is known, we can prove the convergence rate of iVMPIAG-I with respect to the objective function value and the convergence rate of iVMPIAG-II with respect to the iterative sequence. Note that, for the convergence analysis of iVMPIAG-I, a critical tool is introduced, i.e., the incremental aggregated forward-backward (FB) envelope, which is a continuously differential function and can cover the FB envelope as a special case. Based on this tool, we define a continuously differentiable surrogate function, which equals to the value of the objective function at the stationary point. Finally, we present the efficiency of the iVMPIAG method for large-scaled image restoration problem.

Solving saddle point problems: a landscape of primal-dual algorithm with larger stepsizes

姜帆

南京信息工程大学

Abstract: We consider a class of saddle point problems frequently arising in the areas of image processing and machine learning. In this paper, we propose a simple primal-dual algorithm, which embeds a general proximal term induced with a positive definite matrix into one subproblem. It is remarkable that our algorithm enjoys larger stepsizes than many existing state-of-the-art primal-dual-like algorithms due to our relaxed convergence-guaranteeing condition. Moreover, our algorithm includes the well-known primal-dual hybrid gradient method as its special case, while it is also of possible benefit to deriving partially linearized

primal-dual algorithms. Finally, we show that our algorithm is able to deal with multi-block separable saddle point problems. In particular, an application to a multi-block separable minimization problem with linear constraints yields a parallel algorithm. Some computational results sufficiently support the promising improvement brought by our relaxed requirement.

Improved prediction correction algorithms for solving optimization and stochastic optimization problems

李婷

南京师范大学

Abstract: Both the descent direction and the stepsize play important roles in numerical algorithms for solving large-scale optimization problems, especially for solving stochastic optimization problems. In this paper, we propose improved prediction correction algorithms, where the descent direction can be regarded as a correction to the gradient direction with a judiciously correction parameter, and the stepsize is selected in an adaptive way. We state that the proposed algorithms have a close connection to the improved Euler method for solving ordinary differential equations. Under suitable conditions, we prove that the sequence generated by the proposed algorithms converges globally to a stationary point, and the convergence rate is $O (1/k)$. We emphasize that for stochastic optimization problems where the gradient is difficult to calculate, we only use `partial' gradient information and get the same convergence results as for the deterministic case. We report some numerical results that show the effectiveness and advantages of the proposed algorithms.

专题报告 A4　　人工智能与机器学习中的优化-I

5 月 13 日 13:30-14:45 天府楼二层 6 号会议室

Gradient tracking with multiple local SGD for decentralized non-convex learning

张纵辉

香港中文大学(深圳)

Abstract: The Gradient Tracking (GT) method, which solves decentralized optimization problems over a multi-agent network, is known to be robust against the inter-client variance caused by data heterogeneity. However, the GT method can be communication-intensive, requiring a large number of communication rounds of message exchange for convergence. To address this challenge, this work proposes a new communication-efficient GT algorithm called the Local Stochastic GT (LSGT)algorithm, which integrates

the local stochastic gradient descent (local SGD) technique into the GT method. With LSGT, each agent can perform multiple SGD updates locally within each communication round. Theoretically, we establish the conditions under which our proposed LSGT algorithm enjoys the linear speedup brought by local SGD. Compared with the existing work, our analysis requires less restrictive conditions on the mixing matrix and algorithm stepsize. Moreover, it reveals that the local SGD not only reserves the resilience of the GT method against the data heterogeneity but also speeds up reducing the tracking error in the optimization process. The experimental results demonstrate that the proposed LSGT exhibits improved convergence speed and robust performance in various heterogeneous environments.

Order matters: boosting mathematical programming solver via machine learning techniques

李希君

华为诺亚方舟实验室

Abstract: The trend of using machine learning techniques to improve the mathematical programming solvers has recently drawn lots of attention. In this talk, we present our recent works using machine learning techniques to enhance solvers, which are published on top venues (ICLR and AAAI). We will first restate an easily overlooked problem that the order determination leads to performance variability of solvers, which was proposed in decades ago but was not solved well. Then we will present a general solution that utilizes machine learning techniques to find better order for key decision-making component such as reformulation, cut selection, presolving, etc. in mathematical solvers, which boosts the performance of solvers by a large margin. We hope this talk can inspire the future research to better exploit the performance variability via machine learning to improve the solvers.

Asymptotic network independence in distributed stochastic gradient methods

濮实

香港中文大学(深圳)

Abstract: We provide a discussion of several recent results which, in certain scenarios, are able to overcome a barrier in distributed stochastic optimization for machine learning (ML). Our focus is the so-called asymptotic network independence property, which is achieved whenever a distributed method executed over a network of n nodes asymptotically converges to the optimal solution at a comparable rate to a centralized method with the same computational power as the entire network; it is as if the network is not even there! We explain this property through an example involving the training of ML models and present a short mathematical analysis for comparing the performance of distributed stochastic gradient descent (DSGD)

with centralized SGD. We also discuss the transient times for distributed stochastic gradient methods to achieve network independent convergence rates. Finally, we introduce some recent works on distributed random reshuffling (RR) methods.

专题报告 A5　　近似算法与机制设计

5 月 13 日 13:30-14:45　中苑迎晖厅会议室

Approximation algorithms for integer programming

陈婳

浙江大学

Abstract: Many classical combinatorial optimization problems can be modeled as integer linear programs. Solving an integer program is, however, difficult in general. The hardness of an integer program is mainly determined by the size and the structure of its constraint matrix. It is well-known that the problem can be solved in pseudo-polynomial time if the number of variables is fixed owing to the seminal work of Papadimitriou (1981). To move forward, one needs to seek the specific structure of the constraint matrix. In recent years, integer programming with special block structures attracts a lot of attention. All existing FPT algorithms for block-structured IP so far have a running time that is polynomial or even exponential in $\triangle$, which is the largest absolute value among all entries of the constraint matrix. This is unavoidable assuming P$\neq$NP. Thus, can we expect a trade-off between the accuracy and running time? That is, for any $\varepsilon > 0$, does there exist an algorithm that runs in f (k,ε) poly (n, log$\triangle$), where k is a parameter, and returns a near-feasible solution which violates the constraints by O ($\varepsilon\triangle$) but preserves the optimality? In this talk we will present new results towards this problem.

一些双设施选址博弈的防策略机制设计与分析

盖玲

东华大学

Abstract: We consider the games of locating two facilities in the interval [0, 1]. The facilities may be homogenous or heterogenous. There are n agents in the interval, who have some private information on their location or preference. They could misreport the information to improve their utility. We will talk about the game of locating two facilities with distance requirement, the game with candidate locations and the game with different agent type. We design the strategy-proof mechanisms for these problems and analyze the approximation ratios.

Two methods for regularized non-monotone submodular maximization

孙鑫

中国科学院大学

Abstract: In the paper, we study Regularized Non-monotone Submodular Maximization subject to a down-closed family of sets, where the objective function is constructed by a submodular term plus a linear regularizer. Different from existing results, we apply a novel technique of Lyapunov function method, which systematically shows how to design an approximation algorithm framework and naturally yields the guarantee for this NP-hard problem. With a proper choice of the coefficients in the framework, we obtain a $(1/e, \frac{\gamma-\gamma/e-1}{\gamma-1})$-approximation algorithm in continuous-time, where $\gamma\in[0,1)\cup (1,+\infty)$ is a parameter reflecting the relative dominance of the positive and negative parts of the linear optimal value. By discretization, an implemented algorithm could be presented in $\mathcal{O}\left (\frac{n^3}{\epsilon}\right)$ with almost the same approximation guarantee. Moreover, this two-phase method can also deal with Regularized Monotone Submodular Maximization with $(1-1/e, 1)$-approximation performance and the same complexity, which coincides with the results given by Feldman \yrcite{Feldman21}. Besides, we generalize the potential method used in the above work to the non-monotone case and get the same conclusions. This observation implies that the presented algorithm is only one of the concrete representations of the designed framework. At the end, we also give an analysis from the harness side to the problem we consider and prove that there exists no polynomial algorithm whose output satisfies a $(0.478,\lambda)$-approximation with $\lambda\in[0,1]$.

专题报告 A6　　网络与博弈

5 月 13 日 13:30-14:45 中苑西侧会议室

T-perfect graphs: known and unknown

操宜新

香港理工大学

Abstract: Perfect graphs have been pivotal in graph theory. Although the definition is purely graph-theoretical, Chvátal noticed that they can be characterized by their independent set polytopes. This motivated him to propose a similar polytope that comprises nonnegativity, edge, and odd-cycle constraints. A graph is t-perfect if this polytope is the independent set polytope of the graph. We start with briefly surveying known results, including minimally t-imperfect graphs and characterizations of t-perfect that are claw-free, P_5-free, or fork-free. We then discuss several conjectures that may lead to the final understanding of t-perfect graphs.

设施选址中的孔多塞稳定性

王晨豪

北京师范大学 (珠海)

摘要：设施选址问题是一类重要组合优化问题。近年来，除传统的优化目标外，越来越多的研究从消费者自主决策的角度关注其解的稳定性。在一个稳定解中，消费者群体不会过于偏好其他的候选设施。提出一种新的解概念——孔多塞稳定解：如果一个解内部的任意设施都比解外部任一候选设施受更多消费者支持，则称这个解是孔多塞稳定的。该解概念是对投票选举中孔多塞赢家概念的延申和拓展。在不同的网络结构上探索了孔多塞稳定解的存在性、可近似性和有效性，刻画了保证孔多塞稳定解存在的网络结构特征，设计了高效算法求解。

Arboricity games: the core and the nucleolus

肖汉

中国海洋大学

Abstract: The arboricity of a graph is the minimum number of forests required to cover all its edges. In this paper, we examine arboricity from a game-theoretic perspective and investigate cost-sharing in the minimum forest cover problem. We introduce the arboricity game as a cooperative cost game defined on a graph. The players are edges, and the cost of each coalition is the arboricity of the subgraph induced by the coalition. We study the properties of the core and propose an efficient algorithm for computing the nucleolus when the core is not empty. In order to compute the nucleolus in the core, we introduce the prime partition which is built on the densest subgraph lattice. The prime partition decomposes the edge set of a graph into a partially ordered set defined from minimal densest minors and their invariant precedence relation. Moreover, edges from the same partition always have the same value in a core allocation. Consequently, when the core is not empty, the prime partition significantly reduces the number of variables and constraints required in the linear programs of Maschler's scheme and allows us to compute the nucleolus in polynomial time. Besides, the prime partition provides a graph decomposition analogous to the celebrated core decomposition and the density-friendly decomposition, which may be of independent interest.

专题报告 A7   最优化及其在金融中的应用

5 月 13 日 13:30-14:45 天府楼一层 10 号会议室

A two stage dynamic scheduling of e-sports tournaments with integer programming

董志龙

西安交通大学

Abstract: Electronic sports tournaments are well adapted to dynamic scheduling. A dynamic approach for scheduling e-sports tournaments based on a modification of the Swiss system design is proposed. We use Colley's method to update all competitors' ratings at every round. The ratings are used for maximizing game fairness and viewers' utility in the integer programming formulation of the team pairing and game scheduling problem solved at each round. The approach was validated using real-life data from the 2020 Honor of Kings World Champion Cup group stage and further evaluated using randomly generated test problems with up to 80 competitors, illustrating the approach's applicability. In this talk, we will introduce the two stage scheduling procedure using integer programming models and show the situation which is suitable for the models.

International portfolio optimization with chance constraints

刘嘉

西安交通大学

Abstract: In this talk, we study an international portfolio selection problem, which allocates wealth in different security markets. We built an international portfolio selection model with a chance constraint to guarantee the portfolio performance over a benchmark in a large probability. We use some market factors to explain the return rates of risky securities. We use a copula model to capture the nonlinear dependence structure of the factors and exchange rates. We design a new efficient algorithm based on partial sampling approximation and sequence convex approximation to solve the chance constrained international portfolio selection problem. Numerical tests in a practical international portfolio management problem illustrate the reasonability and superior out-of-sample performance of the proposed model.

Robust enhanced indexation optimization with sparse industry layout constraint

赵志华

西安电子科技大学

Abstract: In this paper, we investigate an enhanced indexation methodology using robust Conditional Value-at-Risk (CVaR) and group-sparse optimization. A featured difference from the existing literatures is to describe the tail risk using the worst-case CVaR of excess returns (WCVaR-ER), and the process of industry selection using a weighted $\ell_{\infty,1}$-norm constraint. We develop an accelerated alternating minimization algorithm (AMA) for solving this problem. At each iteration, this method usually alternately

solves a convex cone program, which admits a closed-form solution via convex duality theory, and a projection problem onto a weighted infinity-to-one-ball, where a fixed-point iteration projection method is developed, terminating in finite number of iterations. The global convergence rates in terms of the primal and dual residuals are also provided. Empirical tests on actual data sets are presented to demonstrate the superior out-of-sample performance of our proposed strategy.

专题报告 A8　　微分变分不等式的理论、方法与应用

5 月 13 日 13:30-14:45 天府楼二层 7 号会议室

Differential variational inequalities: from finite to infinite dimensions

曾生达

玉林师范学院

Abstract: The notion of differential variational inequalities (DVIs) was initially introduced and systematically studied by Pang and Stewart in 2008. In this talk, we shall give a detailed review to the cutting-edge research program of (DVIs) from finite dimensions to infinite dimensions.

An optimal control problem with terminal stochastic linear complementarity constraints

罗建锋

香港理工大学深圳研究院

Abstract: In this talk, we introduce and study an optimal control problem with terminal stochastic linear complementarity constraints (SLCC), and its discrete approximation using the relaxation, the sample average approximation (SAA) and the implicit Euler time-stepping scheme. We show the existence of feasible solutions and optimal solutions to the optimal control problem and its discrete approximation under the conditions that the expectation of the stochastic matrix in the SLCC is a Z-matrix or an adequate matrix. Moreover, we prove that the solution sequence generated by the discrete approximation converges to a solution of the original optimal control problem with probability 1 as $\epsilon \downarrow 0$, $\nu\to\infty$ and $h\downarrow 0$, where ϵ is the relaxation parameter, ν is the sample size and h is the mesh size. We also provide asymptotics of the SAA optimal value and error bounds of the time-stepping method. A numerical example is used to illustrate the existence of optimal solutions, the discretization scheme, and error estimation.

On a new system of fractional delay differential equations coupled with

fuzzy variational inequalities

吴增宝

洛阳师范学院

Abstract: Fuzzy variational inequalities (FVIs) are modeling tools used to characterize a variety of fuzzy decision making problems arising in mathematical optimization, control theory, operations research, and game theory. Fractional order delay differential equations are also finding applications in all disciplines including chemistry, physics, and finance. The aim of this talk is to introduce and study a new dynamical fuzzy system, named the fractional differential fuzzy variational inequality (FDFVI) with delay, which bridges these two areas of research and broadens the class of problems amenable to be studied under the fuzzy environments. By using the KKM theorem and monotonicity arguments, we show that the solution set of the FVI is nonempty, convex and compact. We also establish the upper semicontinuity of the solution mapping U of the FVI involved in the FDFVI with delay. Moreover, we obtain an existence of the mild solution for the FDFVI with delay by employing Bohnenblust-Karlin's fixed point theorem. In addition, we provide an approximating algorithm to find a solution of the FDFVI with delay. Finally, we give two numerical examples to illustrate our main results.

专题报告 A9　　多项式优化与张量计算-I

5 月 13 日 13:30-14:45 中苑贵宾厅会议室

A complete solution to Saad's open problem

胡胜龙

杭州电子科技大学

Abstract: In 2009, von Neumann prize-winner Yousef Saad proposed the open problem on characterizing the convergence rate of the classical alternating polar decomposition method for low rank orthogonal tensor approximation problem. Actually, this problem was initiated by Gene Golub in 2001 for the rank one case, and received considerable study in the past twenty years. In 2015, Wolfgang Hackbusch presented concrete examples showing that the convergence rate may be sublinear, linear and superlinear. In this talk, we show that for a generic tensor, the algorithm converges linearly without any further assumption.

Globally solving concave quadratic program via doubly nonnegative relaxation

瞿铮

Abstract: We consider the problem of maximizing a convex quadratic function over a bounded polyhedral set. We design a new framework based on SDP relaxation and cutting plane method for solving the associated reference value problem. The major novelty is a new way to generate valid cut through the doubly nonnegative (DNN) relaxation. We establish various theoretical properties of the DNN relaxation. This includes its equivalence with the Shor relaxation of the equivalent quadratically constrained problem, the strong duality and generation of valid cut from an approximate solution of the DNN relaxation returned by an arbitrary SDP solver. Computational results on both real and synthetic data demonstrate the efficiency of the proposed new method and its ability to solve high dimensional problems with dense data. In particular, our new algorithm successfully solved in 3 days the reference value problem arising from computational biology for a dataset containing more than 300,000 instances of dimension 100. In contrast, CPLEX or Gurobi is estimated to need years of computational time for the same dataset on the same computing platform.

多项式广义纳什均衡问题

唐新东

香港理工大学

摘要：我们考虑由多项式函数给出的广义纳什均衡问题 (generalized Nash equilibrium problem)。首先，我们基于有理拉格朗日乘子 (rational Lagrange multiplier expressions)以及 Karush-Kuhn-Tucker 最优性条件将广义纳什均衡问题转换成多项式优化问题，并使用矩-平方和半定松弛 (Moment-SOS semidefinite relaxations)对其进行求解。然后，我们引入可行延拓 (feasible extension)来缩小候选解集，直至找到该广义纳什均衡问题的解或者判断解的不存在性，并且对该方法的有效性做理论分析。我们得出，在一般性条件下，该方法总能在有限多步内找到广义纳什均衡问题的一个解或者判定解不存在。最后，我们考虑广义纳什均衡问题的复 Fritz-John 条件的维数及代数次数 (algebraic degree)等性质。

专题报告 A10　统计中的优化-I

5 月 13 日 13:30-14:45　川汇楼二层 2 号会议室

低秩子空间聚类中非凸稀疏基函数的合理性

李海洋

广州大学

摘要：首先，我们简要回顾谱聚类、稀疏子空间聚类、低秩子空间聚类的原理、模型以及算法；其次，

引入稀疏基函数的概念，并证明使用稀疏基函数作为矩阵秩的替代函数是合理的，即就是，如果无噪声数据点来源与独立的线性子空间，则该模型的最优解在重排的意义下具有块对角结构；进一步，我们讨论了具有噪声 (高斯噪声和异常点)的低秩子空间聚类的模型和算法，最后，我们以特殊的稀疏基函数—分式函数为例，给出了该模型的求解算法。

稀疏非线性规划的精确罚问题

潘丽丽

山东理工大学

摘要： 本报告主要考虑带有稀疏约束的非线性规划问题的两类精确罚问题，研究罚问题与原问题的稳定点、局部极小点和全局极小点的关系。设计求解罚问题的牛顿算法，并证明收敛性。

稀疏典型相关分析：从矩阵到张量

修贤超

上海大学

摘要： 稀疏典型相关分析是最优化、统计、控制等共同关心的一类前沿研究课题。它是指给定两组或多组观测数据，通过求解稀疏典型相关分析优化模型，探索变量相互依存的关系，揭示整体的相关性，其应用十分广泛，渗透到工程、医学、经济、计算机等领域。本报告从矩阵到张量介绍几种稀疏典型相关分析模型，并探讨求解对应的优化算法，最终将其用于工业过程控制与图像处理等实际问题中。

专题报告 A11　随机优化及其应用-I

5 月 13 日 13:30-14:45 东苑七层会议室

Spherical designs for approximations on the hemisphere

李超

太原师范学院

Abstract: A spherical t-design is a set of points on the unit sphere, which provides an equal weight quadrature rule integrating exactly all spherical polynomials of degree at most t and has a sharp error

bound for approximations on the sphere. This paper introduces a set of points called a hemispherical t-subdesign on the unit hemisphere induced by the spherical t-design. We show that the hemispherical t-subdesign provides an equal weight quadrature rule integrating exactly all zonal hemispherical polynomials of degree at most t and all functions expanded by hemispherical orthonormal functions which are defined by shifted Legendre polynomials of degree at most t. Moreover, we apply the hemispherical t-subdesign and the hemispherical orthonormal basis functions to hyperinterpolation approximation of continuous functions on the hemisphere and present a theoretical approximation error bound. We also apply hemispherical t-subdesigns to sparse signal recovery on the hemisphere. Our theoretical and numerical results show that the hemispherical t-subdesign can provide good approximation on the hemisphere.

A Riemannian smoothing steepest descent method for non-Lipschitz optimization on Riemannian manifolds

张超

北京交通大学

Abstract: In this paper, we study the generalized subdifferentials and the Riemannian gradient sub-consistency that are basis for non-Lipschitz optimization on Riemannian manifolds. We then propose a Riemannian smoothing steepest descent method for non-Lipschitz optimization on complete Riemannian manifolds. We prove that any accumulation point of the sequence generated by the Riemannian smoothing steepest descent method isa stationary point associated with the smoothing function employed in the method, which is necessary for the local optimality of the original non-Lipschitz problem. We also prove that any accumulation point of the sequence generated by our method that satisfies the Riemannian gradient sub-consistency is a limiting stationary point of the original non-Lipschitz problem. Numerical experiments are conducted to demonstrate the advantages of Riemannian $\ell_{p} (0 < p < 1)$ optimization over Riemannian ℓ_{1} optimization for finding sparse solutions and the effectiveness of the proposed method.

Variance-based stochastic projection gradient method for two-stage co-coercive stochastic variational inequalities

周斌

南京师范大学

Abstract: The stochastic approximation (SA) type method for two-stage stochastic variational inequalities (SVIs) are limited. The existing SA-type algorithms are based on the uniqueness of the second stage solution. In this paper, we propose dynamic sampling stochastic projection gradient method (DS-SPGM) for solving a class of two-stage SVIs with co-coercive property. With the co-coercive property and variance reduction

technique, we can handle the multiple solutions case of the second stage problems and achieve O (1/sqrt (K)) rate of convergence. Moreover, numerical experiments show the efficiency of DS-SPGM.

专题报告 B1　　全局优化-I

5 月 13 日 14:50-15:40　川汇楼二层 1 号会议室

Effective algorithms for separable nonconvex quadratic programming with one quadratic and box constraints

罗和治

浙江理工大学

Abstract: We consider in this paper a separable and nonconvex quadratic program (QP) with a quadratic constraint and a box constraint that arises from application in optimal portfolio deleveraging (OPD) in finance and is known to be NP-hard. We first propose an improved Lagrangian breakpoint search algorithm based on the secant approach (called ILBSSA) for this nonconvex QP, and show that it converges to either a suboptimal solution or a global solution of the problem. We then develop a successive convex optimization (SCO) algorithm to improve the quality of suboptimal solutions derived from ILBSSA, and show that it converges to a KKT point of the problem. Second, we develop a new global algorithm (called ILBSSA-SCO-BB), which integrates the ILBSSA and SCO methods, convex relaxation and branch-and-bound framework, to find a globally optimal solution to the underlying QP within a pre-specified ϵ-tolerance. We establish the convergence of the ILBSSA-SCO-BB algorithm and its complexity. Preliminary numerical results are reported to demonstrate the effectiveness of the ILBSSA-SCO-BB algorithm in finding a globally optimal solution to large-scale OPD instances.

Design an effective blood distribution network with minimal impacts on the environment and blood supply assurance

郑小金

同济大学

Abstract: As the world's population grows, resulting in the aggravating trend of aging population, it brings with it an increase in the demand for blood. Nowadays, in most cities, the blood distribution network is based on a single distribution center pattern, with the blood center acting as distribution center for

one-to-one distribution. However, despite its convenience, this pattern has a high frequency of delivery, increased risk of blood shortage, and generates high carbon emissions. This paper aims to understand the real-life problems of the current blood distribution network and to design a more rational blood distribution network by taking the characteristics of the blood supply chain into account. Two blood distribution network patterns are considered, the current single distribution center pattern and the proposed multiple distribution center pattern. In order to minimise environmental impacts, we introduce open vehicle routing problem for blood delivery routes planning, using mixed integer programming for modelling, to compare the carbon emissions between the two blood distribution network patterns. Numerical experimental results demonstrate that applying the proposed BDN can reduce carbon emissions by an average of 25.84% and up to 29.59%, and the delivery time in emergency situations is significantly reduced by an average of 33.15%. Such studies are essential for both reducing carbon emissions and safeguarding patients' lives.

专题报告 B2　　张量优化及其应用-II

5 月 13 日 14:50-16:05　川汇楼二层 3 号会议室

Robust low-rank tensor completion via new regularized model with approximate SVD

李朝迁

云南大学

Abstract: We in this talk introduce a new low-rank tensor completion model with the robust form by minimizing the reconstruction error of approximate SVD and the γ nuclear norm of the lower triangular tensor, and then give their equivalent forms with the tensor slices in the Fourier domain. The efficient iterative algorithm is developed to solve the minimization problem, and the convergence of the algorithm is discussed. Experimental results on real-world visual data and the internet traffic data show that the proposed approaches outperform the state-of-the-art algorithms in both (robust) recovery accuracy and computing time.

Convergence of gradient-based block coordinate descent algorithms for non-orthogonal joint approximate diagonalization of matrices

李建泽

深圳市大数据研究院

Abstract: In this paper, we propose a gradient-based block coordinate descent (BCD-G) framework to solve the joint approximate diagonalization of matrices defined on the product of the complex Stiefel manifold

and the special linear group. Instead of the cyclic fashion, we choose a block optimization based on the Riemannian gradient. To update the first block variable in the complex Stiefel manifold, we use the well-known line search descent method. To update the second block variable in the special linear group, based on four kinds of different elementary transformations, we construct three classes: GLU, GQU and GU, and then get three BCD-G algorithms: BCD-GLU, BCD-GQU and BCD-GU. We establish the global and weak convergence of these three algorithms using the Łojasiewicz gradient inequality under the assumption that the iterates are bounded. We also propose a gradient-based Jacobi-type framework to solve the joint approximate diagonalization of matrices defined on the special linear group. As in the BCD-G case, using the GLU and GQU classes of elementary transformations, we focus on the Jacobi-GLU and Jacobi-GQU algorithms and establish their global and weak convergence. All the algorithms and convergence results described in this paper also apply to the real case. This is a joint work with Konstantin Usevich and Pierre Comon.

Least element of a nonnegative solution set of a class of polynomial inequalities

李昱帆

中山大学

Abstract: In this talk, we consider the least element problem of a nonnegative solution set of a system of inequalities defined by a homogeneous polynomial mapping and a vector. In the set under consideration, the homogeneous polynomial mapping is defined by a tensor. Under the assumption that the considered set is nonempty and the tensor involved is a generalized Z-tensor, we propose an iterative method for finding the least element of the considered set. Specifically, by recognizing the position indices of positive components in the least element continuously, we solve a series of lower-dimensional system of tensor equations corresponding to these indices and prove that the least element of the set can be obtained within finite step iterations. When the tensor involved is square, the set under consideration is just the feasible region of the tensor complementarity problem (TCP), and the least element obtained is also a solution of the TCP. Compared with the existing methods for finding the least-element solution of the TCP with a Z-tensor, our method does not require any additional assumptions and has lower computational cost. Preliminary numerical experiments show that the proposed method is effective.

专题报告 **B3** 非光滑非凸优化理论和算法**-II**

5 月 13 日 14:50-16:05 天府楼二层 5 号会议室

Understanding the convergence of the preconditioned PDHG method: a view of indefinite proximal ADMM.

马玉敏

南京财经大学

Abstract: The primal-dual hybrid gradient (PDHG) algorithm is popular in solving min-max problems which are being widely used in a variety of areas. To improve the applicability and efficiency of PDHG for different application scenarios, we focus on the preconditioned PDHG (PrePDHG) algorithm, which is a framework covering PDHG, alternating direction method of multipliers (ADMM), and other methods. We give the optimal convergence condition of PrePDHG in the sense that the key parameters in the condition can not be further improved, which fills the theoretical gap in the-state-of-art convergence results of PrePDHG, and obtain the ergodic and non-ergodic sublinear convergence rates of PrePDHG. The theoretical analysis is achieved by establishing the equivalence between PrePDHG and indefinite proximal ADMM. Besides, we discuss various choices of the proximal matrices in PrePDHG and derive some interesting results. For example, the convergence condition of diagonal PrePDHG is improved to be tight, the dual stepsize of the balanced augmented Lagrangian method can be enlarged to 4/3 from 1, and a balanced augmented Lagrangian method with symmetric Gauss-Seidel iterations is also explored. Numerical results on the matrix game, projection onto the Birkhoff polytope, earth mover's distance, and CT reconstruction verify the effectiveness and superiority of PrePDHG.

A Bregman proximal stochastic gradient method with extrapolation for nonconvex problems

王青松

北京航空航天大学

Abstract: This paper investigates a particular type of optimization problem, characterized by the composition of a differentiable and a non-differentiable function, where the differentiable component does not possess a global Lipschitz continuous gradient. To solve this problem, we employ a Bregman proximal stochastic gradient method with extrapolation (BPSGE). We establish the subsequential convergence of this algorithm under certain suitable conditions. Moreover, we demonstrate that the subgradient of the objective function exhibits a sublinear convergence rate. Additionally, we also establish global convergence of the sequence. The results of the numerical experiments on several nonconvex image processing problems demonstrate the robustness and effectiveness of the proposed algorithm.

On adaptive heavy-ball momentum for solving linear systems

谢家新

北京航空航天大学

摘要: 本报告将把线性方程组等价地转化为一个随机优化问题, 并利用随机梯度算法对问题进行求解。该随机梯度法可使用目标函数梯度的有偏或无偏估计, 并采用自适应步长。重球动量加速技术也被引入该算法, 不同于已往的重球加速使用固定的动量参数, 我们将采取自适应策略选取动量参数, 从而提出了求解线性方程组的自适应重球动量随机梯度法。几何上, 该自适应重球动量随机梯度法可以等价为某种正交投影算法。理论上, 我们证明了该算法具有线性收敛性。特别地, 当使用全梯度时, 该算法等价于某种 Krylov 子空间方法或共轭梯度法, 此时算法将具有有限步收敛性。我们的算法框架包含了如随机 Kaczmarz 算法, 随机块 Kaczmarz 算法等当前的一些热点算法。

专题报告 B4　　人工智能与机器学习中的优化-II

5 月 13 日 14:50-16:05　天府楼二层 6 号会议室

Proximal gradient/semismooth newton methods for projection onto a polyhedron via the duality-gap-active-set strategy

沈春根

上海理工大学

Abstract: In this work, we develop proximal gradient/semismooth Newton methods for the polyhedral projection problem. To efficiently solve the dual problem, one of crucial issues is to safely identify zero-elements as well as the signs of nonzero elements at the optimal solution. In this paper, relying on its nonsmooth dual problem and active set techniques, we first propose a Duality-Gap-Active-Set strategy (DGASS) to effectively identify the indices of zero-elements and the signs of nonzero entries of the optimal solution. Serving as an efficient acceleration strategy, DGASS can be embedded into certain iterative methods. In particular, by applying DGASS to both the proximal gradient algorithm (PGA) and the proximal semismooth Newton algorithm (PSNA), we propose the methods of PGA-DGASS and PSNA-DGASS, respectively. Global convergence and local quadratic convergence rate are discussed. We report on numerical results over both synthetic and real data sets to demonstrate the high efficiency of the two DGASS-accelerated methods.

Jacobi-type algorithms for homogeneous polynomial optimization on Stiefel manifolds with applications to tensor approximations

盛洲

安徽工业大学

Abstract: This talk mainly studies the gradient-based Jacobi-type algorithms to maximize two classes of homogeneous polynomials with orthogonality constraints, and establish their convergence properties. For

the first class of homogeneous polynomials subject to a constraint on a Stiefel manifold, we reformulate it as an optimization problem on a unitary group, which makes it possible to apply the gradient-based Jacobi-type (Jacobi-G) algorithm. Then, if the subproblem can always be represented as a quadratic form, we establish the global convergence of Jacobi-G under any one of three conditions. The convergence result for the first condition is an easy extension of the result in [Usevich et al. SIOPT 2020], while other two conditions are new ones. This algorithm and the convergence properties apply to the well-known joint approximate symmetric tensor diagonalization. For the second class of homogeneous polynomials subject to constraints on the product of Stiefel manifolds, we reformulate it as an optimization problem on the product of unitary groups, and then develop a new gradient-based multi-block Jacobi-type (Jacobi-MG) algorithm to solve it. We establish the global convergence of Jacobi-MG under any one of the above three conditions, if the subproblem can always be represented as a quadratic form. This algorithm and the convergence properties are suitable to the well-known joint approximate tensor diagonalization. As the proximal variants of Jacobi-G and Jacobi-MG, we also propose the Jacobi-GP and Jacobi-MGP algorithms, and establish their global convergence without any further condition.

A semismooth Newton-type method for the nearest doubly stochastic matrix problem

李欣欣

吉林大学

Abstract: We study a semismooth Newton-type method for the nearest doubly stochastic matrix problem where the nonsingularity of the Jacobian can fail. The optimality conditions for this problem are formulated as a system of strongly semismooth functions. We show that the non-singularity of the Jacobian does not hold for this system. By exploiting the problem structure, we construct a modified two step semismooth Newton method that guarantees a nonsingular Jacobian matrix at each iteration, and that converges to the nearest doubly stochastic matrix quadratically.

专题报告 **B5** 排序优化与椭球覆盖

5 月 13 日 14:50-16:05　中苑迎晖厅会议室

Time-of-use scheduling problem with equal-length jobs

Chau Vincent

东南大学

Abstract: We study the scheduling problem recently introduced by Wan and Qi [NRL'2010]. We are given

a set of jobs to be scheduled on a single machine, in which the cost of scheduling a job depends on when it is scheduled. This model is also known as Time-of-Use tariff. Each job is defined by its release time, its deadline and its processing time. The goal is to schedule the maximum number of jobs such that the total cost does not exceed a given budget. The problem is NP-hard when jobs have arbitrary processing time. However, when jobs have the same processing time, we show that the problem can be solved in polynomial time via dynamic programming techniques. In addition, we consider the case in which jobs have agreeable deadline, and we provide a faster algorithm.

带批运输与双目的地的单机调度问题研究

王银玲

郑州大学

摘要： 本文研究了工件在单机上加工然后运输到两类目的地的模型，每个工件除了有自己的体积之外还有属于自己的目的地，优化目标为运输机完成运输且返回机器时间最短。Chang 和 Lee 首次提出该问题模型并给出 2-近似算法。本文分析了现有 2-近似算法优缺点，改进了算法中的工件分批方式，使得本文算法的运输时间与最优调度需要的运输时间的比值从前期算法的 7/4 下降到 3/2 + ε。最终证明新的算法的近似比为 (11/6 + ε)。

Frank-Wolfe 算法与椭球覆盖问题

张威

华南理工大学

摘要： 最小体积覆盖椭球问题是一个经典的凸优化问题，除了内点算法之外，Frank-Wolfe 算法也经常被用于求解该问题。我们分析了 Frank-Wolfe 算法的结构，从而提出一种坐标轴下降算法来计算最小体积覆盖椭球，从理论和数值实验两方面说明了它的优势。

专题报告 B6　　组合优化

5 月 13 日 14:50-16:05　中苑西侧会议室

Altruism, collectivism and egalitarianism: on a variety of prosocial behaviors in binary networked public goods games

程郁琨

Abstract: Binary Networked public goods (BNPG) game consists of a network G= (V, E) with n players residing as nodes in a network and making a YES/NO decision to invest a public project. Examples of such public projects include face mask wearing during a pandemic, crime reporting and vaccination, etc. Most of the conventional modes of BNPG games solely posit egoism as the motivation of players: they only care about their own benefits. However, a series of real-world examples show that people have a wide range of prosocial behaviors in making decisions. To address this property, we introduce a novel extension of BNPG games to account for three kinds of prosocial motivations: altruism, collectivism, and egalitarianism. We revise utility functions to reflect different prosocial motivations with respect to the welfare of others, mediated by a prosocial graph.

We develop computational complexity results to decide the existence of pure strategy Nash equilibrium in these models, for cases where the prosocial graph is a tree, a clique or a general network. We further discuss the Prosocial Network Modification (PNM) problem, in which a principal can change the network structure within a budget constraint, to induce a given strategy profile with respect to an equilibrium. For all three types of PNM problems, we completely characterize their corresponding computational complexity results.

The power of multiple choices in online stochastic matching

黄志毅

香港大学

Abstract: We study the power of multiple choices in online stochastic matching. Despite a long line of research，existing algorithms still only consider two choices of offline neighbors for each online vertex because of the technical challenge in analyzing multiple choices. This paper introduces two approaches for designing and analyzing algorithms that use multiple choices. For unweighted and vertex-weighted matching，we adopt the online correlated selection (OCS) technique into the stochastic setting，and improve the competitive ratios to 0.716，from 0.711 and 0.7 respectively. For edge-weighted matching with free disposal，we propose the Top Half Sampling algorithm. We directly characterize the progress of the whole matching instead of individual vertices，through a differential inequality. This improves the competitive ratio to 0.706，breaking the $1-1/e$ barrier in this setting for the first time in the literature. Finally，for the harder edge-weighted problem without free disposal，we prove that no algorithms can be 0.703 competitive，separating this setting from the aforementioned three.

Approximation algorithms for capacitated vehicle routing problems

肖鸣宇

电子科技大学

Abstract: The Capacitated Vehicle Routing Problem (CVRP) is one of the most extensively studied combinatorial optimization problems. The k-CVRP problem has a fixed capacity k for each vehicle. According to the property of the demand of customers, we distinguish three variants of CVRP: unit-demand, splittable and unsplittable. It is well known that k-CVRP in general metrics with fixed $k \geq 3$ is APX-hard. We will consider approximation algorithms for k-CVRP. The ITP algorithm based on a given Hamiltonian cycle is a classic method to solve k-CVRP. It gives an $(\alpha + 1 - \Theta(\alpha/k))$-approximate solution for splittable and unit-demand k-CVRP and an $(\alpha + 2 - \Theta(\alpha/k))$-approximate solution for unsplittable k-CVRP, where $\alpha \approx 3/2$ is the approximation ratio for metric TSP. In this paper, we introduce a new technique EX-ITP. Based on this and other combinatorial methods, we can significantly improve the approximation ratio for k-CVRP with simple algorithms.

专题报告 B7　　非光滑优化

5 月 13 日 14:50-16:05　天府楼一层 10 号会议室

An efficient proximal difference-of-convex approach for fitting the sparse envelope model

陈亮

湖南大学

Abstract: The sparse envelope model (SEM) is an efficient tool for the parameter estimation and the response variable selection in the multivariate linear regression. However, compared with the nice statistical properties that have been well established for the SEM, the corresponding algorithmic study is not sufficiently developed. In fact, the computational efficiency of solving the nonsmooth and nonconvex optimization problem arising from the SEM is crucial to the applicability of the SEM, since such a problem should be solved for many times, with different parameters for cross validation, even for fitting only a single instance. In this paper, we propose a highly efficient difference-of-convex (DC) approach for fitting the SEM. We first show how to construct the DC decomposition of the nonconvex optimization problem in the SEM, and then we incorporate the DC programming, together with the accelerated proximal gradient method (APG), to solve the problem. Numerical experiments are conducted, and the corresponding numerical results suggest that the proposed method is far superior to the existing block-wise coordinate descent approach.

An efficient symmetric primal-dual algorithmic framework for saddle point problems

何洪津

Abstract: In this talk, we will introduce a new primal-dual algorithmic framework for a class of convex-concave saddle point problems frequently arising from image processing and machine learning. Our algorithmic framework updates the primal variable between the twice calculations of the dual variable, thereby appearing a symmetric iterative scheme, which is accordingly called the symmetric primal-dual algorithm (SPIDA). It is noteworthy that the subproblems of our SPIDA are equipped with Bregman proximal regularization terms, which make SPIDA versatile in the sense that it enjoys an algorithmic framework covering some existing algorithms such as the classical augmented Lagrangian method (ALM), linearized ALM, and Jacobian splitting algorithm for linearly constrained optimization problems. Besides, our algorithmic framework allows us to derive some customized versions so that SPIDA works as efficiently as possible for structured optimization problems. Theoretically, under some mild conditions, we prove the global convergence of SPIDA and estimate the linear convergence rate under a generalized error bound condition defined by Bregman distance. Finally, a series of numerical experiments on the matrix game, basis pursuit, robust principal component analysis, and image restoration demonstrate that our SPIDA works well on synthetic and real-world datasets.

A novel nonconvex relaxation approach to low-rank matrix completion of inexact observed data

张立平

清华大学

Abstract: In recent years, matrix completion has become one of the main concepts in data science. In the process of data acquisition in real applications, in addition to missing data, observed data may be inaccurate. This talk concerns with such matrix completion of inexact observed data which can be modeled as a rank minimization problem. We adopt the difference of nuclear norm and Frobenius norm as an approximation of the rank function, and we use Tikhonov regularization to control oscillation generated by inexact observed data. Then, we establish a new nonsmooth and nonconvex relaxation model for such low-rank matrix completion. Optimality condition for this model is described and a proximal gradient (PG) method is proposed to show robustness and recovery efficiency of our model. Furthermore, we design a new accelerated PG-type method for this nonconvex problem. We show that the sequence generated by our two methods is bounded and globally converges to a critical point of our model. For our accelerated PG-type method, the rate of convergence is given via the KL property. Numerical experiments demonstrate that our methods outperform some state-of-art popular methods in robustness and recovery effect.

专题报告 B8　　稀疏优化算法与应用

5 月 13 日 14:50-16:05　天府楼二层 7 号会议室

A new hybrid l_p-l_2 model for sparse solutions with applications to image processing

高雪瑞

上海工程技术大学

Abstract: Finding sparse solutions to a linear system has many real-world applications. In this paper, we study a new hybrid of the l_p quasi-norm (0<p<1) and l_2 norm to approximate the l_0 norm and propose a new model for sparse optimization. The optimality conditions of the proposed model are carefully analyzed for constructing a partial linear approximation fixed-point algorithm. A convergence proof of the algorithm is provided. Computational experiments on image recovery and deblurring problems clearly confirm the superiority of the proposed model over several state-of-the-art models in terms of the signal-to-noise ratio and computational time.

A sparsity-driven solution method for the cardinality constrained mean-variance portfolio selection problem

姜珊

厦门大学

Abstract: Cardinality constrained mean-variance (CCMV) portfolio selection problem is commonly formulated as a mixed integer quadratic program (MIQP) that can be solved by a branch-and-bound scheme or meta-heuristics. Yet, computational efficiency remains to be a major issue. In this study, we propose a novel solution method based on the concepts of sparse recovery for solving large-size problems. Using the relationship between investment risk and portfolio sparsity, we develop a "sparsity-driven" binary search framework for solving the CCMV portfolio selection problem through a sequence of quadratically constrained sparse recovery problems. For computational efficiency, a sub-one quasi-norm lq minimization model is adopted to find high-quality approximate solutions of each sparse recovery problem using a specially designed gradient-descent based algorithm. A final solution to the original CCMV portfolio selection problem is obtained by incorporating the approximate solution information to the binary search framework to solve one MIQP problem in a much more reduced size.

稀疏投资组合模型及其加速算法

李倩

上海工程技术大学

摘要：随着经济、发展市场壮大，考虑稀疏约束的投资组合问题是一个十分有意义的研究课题。报告主要介绍稀疏非凸分段二次正则化模型理论及其加速梯度算法。首先引入加权非凸分段二次函数作为稀疏优化的正则项，建立了稀疏非凸分段二次正则投资组合模型。证明当模型的正则化参数满足一定条件时，其稳定点和局部最优解等价，并对模型的稀疏性进行理论分析。其次，分析问题的结构特征，根据最优性条件给出问题加速梯度算法迭代序列的表达式，获得了加速梯度算法求解带单纯形约束非凸二次优化问题较未加速算法更优的收敛率，并得到加速邻近梯度算法固定步长下的最优加速因子。最后，将加速梯度算法应用到求解实际稀疏投资组合模型，实证分析也验证了算法的理论结果和高效性。

专题报告 B9　　多项式优化与张量计算-II

5 月 13 日 14:50-16:05　中苑贵宾厅会议室

多项式优化：理论与实践

王杰

中国科学院数学与系统科学研究院

摘要：多项式优化是一类重要的非线性非凸优化问题，在最优电力流、计算机视觉、组合优化、神经网络、信号处理、量子信息等许多领域有广泛的应用。本报告将介绍全局求解多项式优化问题的基本工具——Moment-SOS 半定松弛分层。为求解大规模问题，报告还会讨论如何利用系统的结构降低半定松弛问题的复杂度。

Certifying nonnegative functions on finite sets via Fourier SOS

叶科

中国科学院数学与系统科学研究院

Abstract: This talk consists of two parts. In the first part, we introduce a framework of certifying the non-negativity of a function on a finite set, which is equivalent to certifying the nonnegativity of tensors. Via the Fourier sum of squares (FSOS), we are able to discuss both the theoretical and algorithmic aspects of this problem. The second part is concerned with applications of our framework to MAX-SAT. We will discuss how to find low degree FSOS certificates and estimate the lower bound for MAX-SAT problems.

专题报告 B10　统计中的优化-II

An oracle gradient regularized newton method for quadratic measurements regression

樊军

河北工业大学

Abstract: Recently, recovering an unknown signal from quadratic measurements has gained popularity because it includes many interesting applications as special cases such as phase retrieval, fusion frame phase retrieval and positive operator valued measure. In this paper, by employing the least squares approach to reconstruct the signal, we establish the non-asymptotic statistical property showing that the gap between the estimator and the true signal is vanished in the noiseless case and is bounded in the noisy case by an error rate of O (pp log (1 + 2n)/n), where n and p are the number of measurements and the dimension of the signal, respectively. We develop a gradient regularized Newton method (GRNM) to solve the least squares problem and prove that it converges to a unique local minimum at a superlinear rate under certain mild conditions. In addition to the deterministic results, GRNM can reconstruct the true signal exactly for the noiseless case and achieve the above error rate with a high probability for the noisy case. Numerical experiments demonstrate the GRNM performs nicely in terms of high order of recovery accuracy, faster computational speed, and strong recovery capability.

A global two-stage algorithm for non-convex penalized high-dimensional linear regression problems

李培丽

河南大学

Abstract: By the asymptotic oracle property, non-convex penalties represented by minimax concave penalty (MCP) and smoothly clipped absolute deviation (SCAD) have attracted much attentions in high-dimensional data analysis, and have been widely used in signal processing, image restoration, matrix estimation, etc. However, in view of their non-convex and non-smooth characteristics, they are computationally challenging. Almost all existing algorithms converge locally, and the proper selection of initial values is crucial. In this paper, based on the DC (difference of convex functions) property of MCP and SCAD penalties, we aim to design a global two-stage algorithm for the high-dimensional least squares linear regression problems. A key idea for making the proposed algorithm to be efficient is to use the primal dual active set with continuation (PDASC) method to solve the corresponding sub-problems. Theoretically, we not only prove the global

convergence of the proposed algorithm, but also verify that the generated iterative sequence converges to a d-stationary point. In terms of computational performance, the abundant research of simulation and real data show that the algorithm in this paper is superior to the latest SSN method and the classic coordinate descent (CD) algorithm for solving non-convex penalized high-dimensional linear regression problems.

0/1 optimization solving sample average approximation for chance constrained programming

周声龙

北京交通大学

Abstract: Sample average approximation (SAA) is a tractable approach to deal with the chance constrained programming, a challenging issue in stochastic programming. The constraint is usually characterized by the 0/1 loss function which results in enormous difficulties in designing numerical algorithms. Most current methods have been created based on the SAA reformulation, such as binary integer programming or the relaxation. However, no viable algorithms have been developed to tackle SAA directly, not to mention theoretical guarantees. In this paper, we investigate a novel 0/1 constrained optimization problem, which provides a new way to address SAA. Specifically, by deriving the Bouligand tangent and Frechet normal cones of the 0/1 constraint, we establish several optimality conditions including the one that can be equivalently expressed by a system of equations, thereby allowing us to design a smoothing Newton type method. We show that the proposed algorithm has a locally quadratic convergence rate and high numerical performance.

专题报告 B11　随机优化及其应用-II

5 月 13 日 14:50-16:05　东苑七层会议室

Tight error bounds for nonnegative orthogonality constraints and exact penalties

贺一凡

香港理工大学

Abstract: For the intersection of the Stiefel manifold and the set of nonnegative matrices in $\mathbb{R}^{n\times r}$, we present global and local error bounds with easily computable residual functions and explicit coefficients. Moreover, we show that the error bounds cannot be improved except for the coefficients, which explains why two square-root terms are necessary in the bounds when $1 < r < n$ for the nonnegativity and orthogonality, respectively. The error bounds are applied to penalty methods for

minimizing a Lipschitz continuous function with nonnegative orthogonality constraints. Under only the Lipschitz continuity of the objective function, we prove the exactness of penalty problems that penalize the nonnegativity constraint, or the orthogonality constraint, or both constraints. Our results cover both global and local minimizers. Joint work with Prof. Xiaojun Chen and Dr. Zaikun Zhang.

A quasi-Newton subspace trust region algorithm for least-square problems in min-max optimization

邱子程

香港理工大学

Abstract: The first-order optimality conditions of convexly constrained nonconvex-nonconcave min-max optimization problems formulate variational inequality problems, which are equivalent to a system of nonsmooth equations. In this paper, we propose a quasi-Newton subspace trust region (QNSTR) algorithm for the least-square problem defined by the smoothing approximation of the nonsmooth equation. Based on the structure of the least-square problem, we use an adaptive quasi-Newton formula to approximate the Hessian matrix and solve a low-dimensional strongly convex quadratic program with ellipse constraints in a subspace at each step of QNSTR algorithm. According to the structure of the adaptive quasi-Newton formula and the subspace technique, the strongly convex quadratic program at each step can be solved efficiently. We prove the global convergence of QNSTR algorithm to an ϵ-first-order stationary point of the min-max optimization problem. Moreover, we present numerical results of QNSTR algorithm for the mixed generative adversarial networks with real data of blood vessel segmentation in eye image. Preliminary numerical results show that QNSTR outperforms some traditional deep learning methods in training accuracy and promising for solving large scale min-max optimization problems in practices. Joint work with Jie Jiang and Xiaojun Chen.

Error bounds for time series forecasting with recurrent neural networks

王悦

香港理工大学

Abstract: In this talk, we present an estimation error bound for Elman RNNs based on the Probably Approximately Correct (PAC) learning framework without independent and identically distributed (i.i.d) and stationary assumptions. Furthermore, we propose an augmented Lagrangian optimization algorithm to train the Elman RNN model, in which we first utilize auxiliary variables to deal with composite hidden layers in RNNs and regularization terms to ensure the boundedness and convergence of the sequence generated by the algorithm. Numerical results show that our error bound is efficient, and our algorithm for Elman ALM outperforms commonly used SGD-based algorithms for the volatility of S$\&$P index prediction.

An improved approximation algorithm for maximizing DR-submodular function over general convex set

周洋

山东师范大学

Abstract: Maximizing a DR-submodular function subject to a general convex set P is an NP-hard problem arising from many applications in combinatorial optimization and machine learning. Vondr{\'a}k showed that such a problem admits no constant approximation ratio under the value oracle model. To overcome this inapproximability, extant research assumes monotonicity on either the objective function or the feasible set, with the exception of the recent work of D{\"u}rr et. al., who, without any monotonicity assumption, proposed a sub-exponential time algorithm with an approximation ratio depending on the ℓ_∞-norm. The main contribution of this work is to present a new algorithm that improves both their approximation guarantee from $\frac{1}{3\sqrt{3}} (1-\min\limits_{x\in P}\|x\|_{\infty})$ to $\frac{1}{4} (1-\min\limits_{x \in P}\|x\|_{\infty})$ and their time complexity from sub-exponential to polynomial. In the process, we also introduce a couple of new ideas of independent interests, including the exponential integrator method to discretize the ordinary differential equation (ODE) in the continuous-time Frank-Wolfe algorithm, and the Lyapunov function approach to streamline the analysis of the approximation ratio and/or the time complexity.

分组报告 C1　　线性与非线性规划

5 月 13 日 16:20-17:35　川汇楼二层 3 号会议室

非凸函数的误差界理论及在下降算法收敛率中的应用

李明华

重庆文理学院

摘要： 本报告主要介绍非凸函数的各类误差界不等式的关系及在下降算法收敛率中的应用。首先介绍三类误差界之间的关系，然后分别介绍误差界在复合优化问题和低阶正则化问题中的应用，最后介绍应用一类误差界到 Bregman 临近梯度算法收敛性中。

一般非线性约束不可分优化问题的模松弛分裂序列二次规划算法

马国栋

广西民族大学

摘要：分裂序列二次规划 (SSQP)算法瞄准交替方向乘子法和 SQP 型算法的优势，开拓大规模优化问题的高效新型算法。本报告针对一般非线性约束不可分优化问题，以模松弛 SQP 可行方向法为主线，借鉴 Jacobian 分裂思想和近似积极集技术，将模松弛二次规划子问题分解为两个可独立并行求解的小规模二次规划子问题，以产生可行下降的搜索方向。以增广 Lagrange 函数作为效益函数，通过 Armijo 线搜索获得步长。在合适的条件下，论证了算法的全局收敛性和迭代复杂性。最后，通过数值试验验证了所提算法的有效性。

Mixed contingent coderivative and relative Lipschitz-like property in reflexive Banach spaces

吴朋程

香港理工大学

Abstract: The paper concerns foundations of sensitivity and stability analysis, being primarily addressed constrained systems. We consider general models, which are described by multifunctions between Banach spaces and concentrate on characterizing their well-posedness properties that revolve around Lipschitz stability and metric regularity relative to sets. The enhanced relative well-posedness concepts allow us, in contrast to their standard counterparts, encompassing various classes of constrained systems. Invoking tools of variational analysis and generalized differentiation, we introduce new robust notions of relative coderivatives. The novel machinery of variational analysis leads us to establishing complete characterizations of the relative well-posedness properties with further applications to stability of affine variational inequalities.

A revisit of solving the convex clustering model

袁雁城

香港理工大学

Abstract: Convex clustering is a relaxation of the k-means model with attractive properties. However, solving the convex clustering model for a collection of large-scale and high-dimensional data is still very challenging. In this talk, we will present some recent progress in solving this model. In particular, we will discuss some dimension reduction techniques which can exploit the structure of the model in an appropriate way. Some numerical experiment results will be shown to demonstrate the efficiency of the proposed dimension reduction techniques.

Developing derivative-free optimization software: why, how, and what

张在坤

香港理工大学

Abstract: Derivative-free optimization (DFO) methods solve optimization problems based on function values of the objective function and the constraints, without using first-order information such as derivatives. They are motivated by applications where it is impossible or prohibitively expensive to obtain or approximate the first-order information, as happens frequently in industrial and engineering problems. Challenges of this kind keep emerging from data science and artificial intelligence. This talk will focus the development of DFO software. We will explain why this is particularly important for DFO, and what are the major challenges. We will also introduce some recent advances we have made in this direction. In particular, we will present three packages developed by us to solve general nonlinear optimization problems without using derivatives, namely PDFO (www.pdfo.net), PRIMA (www.libprima.net), and COBYQA (www.cobyqa.com), which are used not only by researchers but also by industrial practitioners.

分组报告 **C2**　　线性与非线性规划

5 月 13 日 16:20-17:35 天府楼二层 5 号会议室

A dual approach for projection onto nonconvex ℓ_p ball

陈彤

北京航空航天大学

Abstract: This report focuses on designing a dual approach for computing the projection onto the nonconvex ℓ_p ball, which is a core building block in statistics machine learning and sparse signal estimation involving the ℓ_p norm with $p\in (0,1)$. The solution of the dual problem is a root of a generalized equation. We explore the properties for the subdifferential operator of the Lagrangian dual function and propose a search method incorporated with bisection and Newton methods to find the root of the generalized equation. The effectiveness and efficiency of the proposed algorithm is demonstrated on synthetic data. The numerical experiments reveal that the proposed algorithm achieves better performance than existing approaches when the root is not a piecewise point. We show that embedded with our efficient projection operator, projection-based algorithms can solve matrix completion and compressed sensing problems on large-scale datasets.

Proximal decomposition of convex optimization via an alternating linearization algorithm with inexact oracles

何玥

大连海事大学

Abstract: In this paper, we consider the optimization problem of minimizing the sum of two con-vex functions where one objective function φ is assumed general and its exact first-order information (function values and subgradients) may be difficult to obtain, while the other function ϕ is assumed relatively "simple", and an alternating linearization algorithm with inexact information is proposed. In the algorithm, two relatively simple subproblems need to be solved in each iteration, and one of the subproblems is solved by replacing the exact solution with the approximate optimal solution. We also prove that the generated sequence of iteration points converges to the solution of the original problem.

两分块非凸优化的惯性邻近 Peaceman-Rachford 分裂 SQP 算法

晋家晨

广西民族大学

摘要：本文结合 PR 分裂算法和 SQP 算法，引入惯性思想及邻近项，建立了两分块非凸优化问题的惯性邻近 PR 分裂 SQP 算法。首先，借鉴 ADMM-SQP 算法思想，将问题转换为 QP 子问题，并分解成两个小规模的 QP 子问题。其次，在子问题中嵌入惯性外推步和邻近项。再次，借助线搜索更新原始变量。最后，结合 PR 分裂算法，在每个子问题求解后立即对乘子采取正梯度方向更新。在适当条件下，获得了算法的全局收敛性。进一步的，在相关函数满足 KL 性质时，论证了算法的强收敛性及收敛率。通过初步数值实验验证了算法的有效性和稳定性。

A Bregman-style partially symmetric alternating direction method of multipliers for nonconvex multi-block optimization

刘鹏杰

中国矿业大学

Abstract: The alternating direction method of multipliers (ADMM) is one of the most successful and powerful methods for separable minimization optimization. Based on the idea of symmetric ADMM in two-block optimization, we add a updating formula for the Lagrange multiplier without restricting its position for multi-block one. Then, combining with the Bregman distance, in this work, a Bregman-style partially symmetric ADMM is presented for nonconvex multi-block optimization with linear constraints, and the Lagrange multiplier is updated twice with different relation factors in the iteration scheme. Under the suitable conditions, the global convergence, strong convergence and convergence rate of the presented method are analyzed and obtained. Finally, some preliminary numerical results are reported to support the

correctness of the theoretical assertions, and these show that the presented method is numerically effective.

分组报告 C3 　　非光滑优化

An inexact primal-dual method with correction step for a saddle point problem in image debluring

方长杰

重庆邮电大学

Abstract: In this talk, we present an inexact primal-dual method with correction step for a saddle point problem by introducing the notations of inexact extended proximal operators with symmetric positive defifinite matrix D. Relaxing requirement on primal-dual step sizes, we prove the convergence of the proposed method. We also establish the O(1/N) convergence rate of our method in the ergodic sense. Moreover, we apply our method to solve TV-L1 image deblurring problems. Numerical simulation results illustrate the efficiency of our method.

Convergence results of a new monotone inertial forward-backward splitting algorithms based on the local Holder error bound condition

王婷

西安邮电大学

Abstract: In this talk, we introduce a new monotone inertial forward-backward splitting algorithm (newMIFBS) for the convex minimization of the sum of a non-smooth function and a smooth differentiable function. Under the local H{\"o}lder error bound condition, we study the improved convergence rates for the iterates and the sequence of objective function values. We show that the monotonicity can effectively improve the convergence rates of the iterates and the sequences of function values, and the convergence results extend the results for IFBS under the local error bound condition. Finally, we conduct the numerical experiments to illustrate our results.

A class of new modulus-based matrix splitting methods for linear complementarity problem

吴世良

云南师范大学

Abstract: In this talk, to economically and fast solve the linear complementarity problem, based on a new equivalent fixed-point form of the linear complementarity problem, we establish a class of new modulus-based matrix splitting methods, which is different from the previously published works. Some sufficient conditions to guarantee the convergence of this new iteration method are presented. Numerical examples are offered to show the efficiency of this new iteration method. Moreover, the comparisons on numerical results show the computational efficiency of this new iteration method advantages over the corresponding modulus method, the modified modulus method and the modulus-based Gauss–Seidel method.

The convergence of relaxed inexact progressive hedging algorithm for multi-stage stochastic variational inequalities

张海森

四川师范大学

Abstract: In this talk, we shall discuss two relaxed inexact progressive hedging algorithms for multi-stage stochastic variational inequalities in a general probability space. First, based on the inexact calculation of the subproblems, a relaxed inexact progressive hedging algorithm (RIPHA) is proposed. Then, inspired by the idea of Halpern-type relaxed inexact proximal point algorithm, we propose a Halpern-type relaxed inexact progressive hedging algorithm (HRIPHA). The weak convergence of RIPHA and the strong convergence of HRIPHA are obtained under appropriate conditions. It is found that the over-relaxed parameter can speed up the convergence of those two algorithms.

分组报告 C4　　组合优化与算法

5 月 13 日 16:20-17:35　中苑迎晖厅会议室

大数据环境下基数约束近似次模最大化问题研究

崔敏

北京工业大学

摘要：次模性广泛存在于生活、生产、社会管理甚至是感情中，小可到日常饮食、大可至国家政策出台。我们身处各行各业疯狂产出数据的时代，海量数据的获取、挖掘及整合，使之展现自有价值是这个时代的一大重要课题。大数据环境下，次模优化的主要研究模型有：并行、分布式、流模型和在线等。近似次模函数是次模函数的推广，次模函数是近似次模函数的一种特殊形式。本次报告主要介绍基数约束近似次模最大化问题的并行算法和流模型。

单位加工时间下最小化加权误工工件数的调度问题

黄宏宇

江西财经大学

摘要：本文考虑在单机和 m 台平行机环境下，给定 n 个工件，每个工件的释放时间，工期均为非负整数，权重为正数，加工时间为单位时间，需要研究的目标为最小化加权误工工件数。针对这个问题，我们首先进行理论分析，提出了链式替换和循环操作的概念，并给出了排序最优时等价的 CL-条件，随后在单机环境下提出了基于链式替换的算法，并进一步对算法进行了优化，在解决了此问题的基础上，降低了算法的时间复杂度，优化后的算法时间复杂度为 O (n^2)。同时，我们将问题拓展到 m 台平行机中，得出时间复杂度为 O[(n^2)/m]。最后，为评估本文对于单机问题提出的三个算法，我们生成问题实例进行计算机仿真，实验结果表明了优化后的算法降低了运行时间。关键词：调度问题，误工工件数，链式替换，CL-条件，多项式时间算法

A generalization of the maximum weight t-sparse set problem

林宇权

东南大学

Abstract: Let t be a nonnegative integer and $G= (V (G),E (G))$ be a graph. For $v \in V (G)$, let $N_{G} (v)=\{u \in V (G) \setminus \{v\}: uv \in E (G)\}$. And for $S\subseteq V (G)$, we define $d_{S} (G;v)= \left|N_{G} (v)\cap S \right|$ for $v\in S$ and $d_{S} (G;v)=-1$ for $v\in V (G)\setminus S$. A subset $S\subseteq V (G)$ is called a t-sparse set of G if the maximum degree of the induced subgraph $G[S]$ does not exceed t. In particular, a 0-sparse set is precisely an independent set. A vector-weighted graph $ (G,\vec{w},t)$ is a graph G with a vector weight function $\vec{w}: V (G) \to \mathbb{R}^{t+2}$, where $\vec{w} (v)= (w (v;-1),w (v;0),\ldots,w (v;t))$ for each $v\in V (G)$. The weight of a t-sparse set S in $ (G,\vec{w},t)$ is defined as $\vec{w} (S,G)=\sum_{v\in V (G)} w (v;d_{S} (G;v))$. And a t-sparse set S is a maximum weight t-sparse set of $ (G,\vec{w},t)$ if there is no t-sparse set of larger weight in $ (G,\vec{w},t)$. In this paper, we propose the maximum weight t-sparse set problem on vector-weighted graphs, which is to find a maximum weight t-sparse set of $ (G,\vec{w},t)$ for fixed t. We design a dynamic programming algorithm to find a maximum weight t-sparse set of an outerplane graph $ (G,\vec{w},t)$ which takes $O (n (t+2)^{4})$ time, where $n=\left|V (G)\right|$.

数据骡调度问题的近似和多项式时间算法研究

刘敏琴

华东理工大学

摘要：随着移动网络的广泛应用，数据骡调度问题越来越受到人们的关注。数据骡是一种移动设备，通过收集数据或充电/更换电池在网络中移动来维护节点。我们希望以最优的方式来调度数据骡的轨迹，以实现特定的目标，即在能够完成目标传感器所需服务的条件下，尽量减少数据骡的数量。我们提出了在特殊网络如线、圈、树上的近似和多项式时间算法，其中有许多变形，如目标传感器处理时间一致，不一致以及单仓库和多仓库的情形。给出了线上 2 仓库处理时间一致的 $O\left (n^{4}\right)$ 的多项式时间算法，多仓库处理时间一致的 $O\left (mn^{5}\right)$ 的动态规划算法，以及线上处理时间不一致的 2-近似算法；对于圈上，我们首先给出 2 仓库处理时间一致的 $O\left (n^{6}\right)$ 的多项式时间算法，并推广到多仓库，得到 $O\left (mn^{7}\right)$ 的多项式时间算法，同样还得到圈上处理时间不一致的 2-近似算法；在树形网络，给出了 2 仓库处理时间不一致的 4-近似算法以及 3 仓库的 6-近似算法。

算法优化技术在装备试验鉴定中的应用

王凤敏

中国航天科工三院

摘要：从充分利用现有装备试验计算资源、节约试验成本的角度，提高装备试验软硬件中的算法执行效率，不仅能大大降低装备试验鉴定经费开销，还能明显推进装备试验鉴定执行进度，提升装备试验鉴定的效率，有助于真正形成并加速装备试验需求-设计/改进-验证的全程闭环。从装备试验鉴定、算法与算法优化的概念入手，介绍了有限装备试验计算资源约束下，将算法优化技术应用到装备试验鉴定的必要性和可行性，结合低成本国产化计算资源约束下，采用算法优化技术提升装备算法效率的工程应用实践，梳理算法优化方法及算法程序设计中需要注意的事项，提出优化武器装备试验鉴定的对策，为有效提高装备试验鉴定实施效率效益提供参考。

分组报告 C5　　博弈论

5 月 13 日 16:20-17:35　中苑西侧会议室

Based on reputation consistent strategy times promotes cooperation in spatial prisoner's dilemma game

毕艳

贵州大学

Abstract: As we all know, the reputation has important influence on individual's decision-making. How to effectively and objectively measure reputation is very important in based-reputation evolutionary game theory. In this paper, a novel evolutionary mechanism for based on reputation consistent strategy times is

proposed, in which the reputation income of each player is positive or negative related to its consistent strategy times for cooperation or defection at the initial moment of the current time step. The reward or punishment scheme of the proposed evolutionary mechanism is relatively consistent with the real world understanding of reputation. It's especially worth pointing out that, when the player's strategy state changes, the player can get reasonable and timely reward or punishment, which can better promote cooperation compared to existing reputation-based evolutionary mechanisms. Specifically, the proposed evolutionary mechanism has the following two advantages in the evolutionary systems. First, the player who has insisted on cooperation for a long time is not inclined to adopt defection, mainly because the cost of reputation is too high. In addition, the player who has long insisted on defection tends to adopt cooperation. This is mainly because the reputation of the player is easily restored from notoriety to general. Obviously, the above two points can effectively promote cooperation. Based on prisoner's dilemma game (PDG) model, simulation and analysis also show that the proposed evolutionary mechanism can better promote cooperation compared to the traditional evolutionary mechanism, and can also speed up the evolutionary process, especially when the reputation factor is large. Furthermore, we also find that the cooperation level enhances when consistent strategy times upper bound becomes larger.

Network characterizations for excluding informational Braess's paradox

敬新奇

中国科学院数学与系统科学研究院

Abstract: In this talk, we discuss the network structures for charactering occurrences of the informational Braess's Paradox (IBP). The paradox refers to the counter-intuitive phenomenon that adding information worsens traffic congestion. Under the nonatomic selfish routing model, we characterize the topologies of k-commodity undirected network in which IBP never occurs. Our results strengthen the series linearly independent characterization of Acemoglu et al for single-commodity networks (Operations Research 66 (4), 893-917 2018). This work is joint with Xujin Chen, Xiaodong Hu.

具有模糊支付的多主多从博弈的 Nash 平衡存在性

刘珍丽

贵州大学

摘要： 本文在领导者的支付为模糊值函数的情况下，主要研究多主多从模糊博弈的 Nash 平衡存在性。首先，引入模糊数及他们之间的偏序关系、欧式空间中连续模糊值函数及其保不等式性、最值性等性质。其次，建立模糊值函数对应的极大值定理。最后，利用这一极大值定理及 Kakutani 不动点定理证明了多主多从模糊博弈 Nash 平衡的存在性，并通过举例说明了该 Nash 平衡的存在性结果是有效的。

原子拥堵博弈的均衡算法研究

任春莹

北京工业大学

摘要：拥堵博弈是刻画交通出行和通讯网络路由的数学模型，具有重要的理论和实际应用价值。拥堵博弈作为一种典型的非合作博弈，每位玩家均想通过选择策略极小化自己的成本。因此，纳什均衡相较于最优解，具有重要的研究价值。纳什均衡代表玩家自发形成的一种稳定状态，在该状态下没有玩家会单方面的改变自己的策略。在拥堵博弈的研究领域，探索纳什均衡的存在性以及可计算性是至关重要的。基于最佳反应动态 (best response dynamic)，本论文以辅助势博弈作为研究工具，设计有效算法：辅助最佳反应动态，可在多项式时间内计算多项式原子加权拥堵博弈的近似纳什均衡。

Several progress of fashion game on graphs

王琦

东南大学

Abstract: This paper studies an optimization problem of the fashion game on graphs. There are two kinds of players in a graph G, one is the conformist and the other is the rebel. All players choose their actions from an identical set of k symmetric actions Act, say {1,2,...,k}. A conformist (resp. rebel) likes neighbors with the same (resp. different) action while dislikes neighbors with the different (resp. same) actions. An action profile of G is a mapping $\pi : V (G) \to$ Act. The utility u (v,π) if a player v under an action profile π is the number of neighbors it likes minus the number of neighbors it dislikes. For a mapping $\varphi : V (G) \to Z$, the φ−satisfiability problem is to determine whether a graph has a action profile π with u (v, π) $\geq \varphi$ (v). For a fixed integer t, the t−satisfiability problem is the specialized φ−satisfiability problem when φ (v) = t for every v $\in$ V (G). The utility of a graph G, u (G), is defined as the maximum t for which G is t−satisfiable. For t−satisfiability problem with 2 actions, we prove all graph is ($-\Delta$ (G) + 1)−satisfiable and characterize all subcubic graph with u (G) = −2 with simple features. The t−satisfiability problem for plannar graphs with 3 actions is NP-complete if t $\in$ {3, 4, 5} and is polynomial time solvable otherwise. For any integer k $\geq$ 3, we provide simple characterizations to determine the utilities of complete graphs.

分组报告 C6　　组合优化与图论

5 月 13 日 16:20-17:35　天府楼一层 10 号会议室

带收益下界和惩罚费用的能量覆盖问题

刘晓非

云南大学

摘要： 给定一个传感器集合、一个边缘服务器集合和一个收益下界 B，其中每个边缘服务器均可以通过提供能量产生一个覆盖区域， 覆盖区域的半径 r 与提供能量 p 满足 p=r^{\alpha} (\alpha 被称为衰减系数)；传感器若在某个边缘服务器的覆盖区域内，则称该传感器被覆盖并产生一个收益，否则产生一个惩罚费用。带收益下界和惩罚费用的能量覆盖问题要寻找边缘服务器的一个能量供应方案， 使得覆盖传感器的收益至少为 B 且总能量与未覆盖用户的惩罚费用之和达到最小。利用拉格朗日松弛技术和原始对偶框架，对于任意\epsilon，本文设计了一个近似比为 (4\cdot3^{\alpha-1}+\epsilon)的多项式时间近似算法。

Characterizing 3-uniform linear extremal hypergraphs on feedback vertex number

唐中正

北京邮电大学

Abstract: Let $H= (V,E)$ be a hypergraph with vertex set V and edge set E. $S\subseteq V$ is a feedback vertex set (FVS) of H if $H\setminus S$ has no cycle and $\tau_c (H)$ denote the minimum cardinality of a FVS of H. Chen et al. [IWOCA,2016] has proven if H is a linear 3-uniform hypergraph with m edges, then $\tau_c (H)\le m/3$. In this paper, we furthermore characterize all the extremal hypergraphs with $\tau_c (H)= m/3$ holds. This result has a direct application to Tuza's conjecture.

具有整除加工时间和拒绝费用的平行机排序问题

谢润陶

云南大学

摘要： 排序问题研究是运筹学的一个重要分支，其目标是按时间合理地安排稀缺资源，最有效的完成给定的任务。本文主要研究的是具有整除加工时间和拒绝费用的平行机排序问题 (简记为 PS-DPP 问题)，即给定 m 台平行机和 n 个工件，每个工件有一个加工时间和一个拒绝费用，并且加工时间为整数且满足整除性质，要求一个排序，将工件集分为接受集和拒绝集，把接受集的所有工件放到 m 台机器上加工，对拒绝集中的工件拒绝加工并支付拒绝费用。本文考虑了该问题在三种情形下的多项式时间可解性。第一个情形 (PS-DPMP 问题)描述为：要求一个排序满足上述规定，目标是使得接受集

中工件的最大完工时间和拒绝集中工件的最大拒绝费用之和最小。第二个情形 (PS-DPBP 问题)描述为：要求一个排序满足上述规定，且拒绝集中工件的总拒绝费用不超过给定界限，目标是使得接受集中工件的最大完工时间最小。第三个情形 (PS-DPTP 问题)描述为：要求一个排序满足上述规定，目标是使得接受集中工件的最大完工时间和拒绝集中工件的总拒绝费用之和最小。针对以上三个问题，结合具有整除加工时间的经典平行机排序问题的多项式时间算法和可分物品大小的多背包问题的多项式时间算法，我们对于 PS-DPMP 问题、PS-DPBP 问题和 PS-DPTP 问题分别设计了一个组合算法，时间复杂度分别为 O (n^2 logn)，O ((nlogn+nm)logC)和 O ((nlogn+nm)C)，这里 C 是具有整除加工时间的经典平行机排序问题的最优值，并给出了算法最优性的严格证明。

Approximation algorithms for the maximum-weight cycle/path packing problems

余炜

华东理工大学

Abstract: Given an undirected complete graph G= (V,E) on kn vertices with a non-negative weight function on E, the maximum-weight k-cycle (k-path) packing problem aims to compute a set of n vertex-disjoint cycles (paths) in G containing k vertices so that the total weight of the edges in these n cycles (paths) is maximized. For the maximum-weight k-cycle packing problem, we develop an algorithm achieving an approximation ratio of A ((k-1)/k})^2, where A is the approximation ratio for the maximum traveling salesman problem. For the case k=4, we design a better 2/3-approximation algorithm. When the weights of edges obey the triangle inequality, we propose a 3/4-approximation algorithm and a 3/5-approximation algorithm for the maximum-weight k-cycle packing problem with k=4 and k=5, respectively. For the maximum-weight k-path packing problem with k=3 (or k=5) with the triangle inequality, we devise an algorithm with approximation ratio 3/4 and give a tight example.

Online scheduling of two flowshop with lookahead and incompatible job families

张新功

重庆师范大学

Abstract: This paper considers online scheduling on two unit flowshop machines, which there exist unbounded parallel-batch processing of incompatible job families and lookahead intervals. The unit flowshop means that the processing time of any job on each machine is unit processing time. Based on overtime case, the objective is to minimize the maximum completion time. The lookahead model means that an online algorithm can foresee the information of all jobs arriving in time interval $ (t,t+\beta]$ at time t.

There exist incompatible job families, that is, jobs belonging to different families cannot be processed in the same batch. In this paper, we firstly give the lower bound of the proposed problem, and provide a best possible online algorithm of competitive ratio $1+\alpha_f$ for $0\leq\beta<1$, where α_f is the positive root of the equation ${(f+1)} \alpha^{2}+ (\beta+2) \alpha+\beta-f=0$ and f is the number of incompatible job families which is known in advance.

分组报告 C7　　变分不等式与互补问题

5 月 13 日 16:20-17:35　天府楼二层 7 号会议室

A fast stochastic approximation-based subgradient extragradient algorithm with variance reduction for solving stochastic variational inequality problems

贺月红

重庆工商大学

Abstract: In this paper, we introduce a new variance-based proximal backward-forward algorithm with line search for stochastic mixed variational inequalities, which only needs to compute one proximal operator per iteration. Particularly, the proposed algorithm only requires the mapping F to be g-pseudomonotone and does not need to know any information of the Lipschitz constant of the mapping while other similar methods require the monotonicity and the information of the Lipschitz constant. Moreover, we analyse some properties of the proposed algorithm related to the asymptotic convergence, the linear convergence rate with finite computational budget and the optimal oracle complexity under some moderate conditions. Finally, some numerical experiments are given to show the efficiency and advantages of the algorithm.

The approximation technique for the solving of hemivariational inequality

侯金闰

中南大学

Abstract: Friction contact phenomena occur in various industrial processes and engineering applications, and there is no analytical solution formula for hemivariational inequalities that arise in applications. Therefore, developing effective numerical methods to solve them is of great significance in practice. The frictional contact mechanics problem can be transformed into a hemivariational inequality problem through standardization, then a kind of nonconvex optimization is established with the help of finite element discretization. In this talk, the numerical methods based on approximation technique are presented to solve

the nonconvex optimization problem for hemivariational inequality deriving from frictional contact mechanics problem. They are the smooth quadratic regularization method, first order and second order approximation approaches for the nonconvex functions. Evaluation and discussion on the presented methods are also reported by conducting numerical experiments at the end.

Distributed stochastic algorithm for Cartesian stochastic variational inequality problems with applications

刘丽亚

西南大学

Abstract: Motivated by numerous applications of large-scale noncooperative Nash games and multiuser decision-making systems in stochastic regimes, we consider a stochastic variational inequality problem with a Cartesian structure. We develop a new distributed algorithm for addressing this problem governed by pseudomonotone and Lipschitz continuous mappings, based on the forward backward-forward iterative method. In the procedure, the expected value of the involved operator can be estimated by using the stochastic approximation method and the variance reduction method. A stochastic approximation version of Armijo-type line search rule is adopted to define the stepsize sequence, which addresses the unavailability of Lipschitz constants. The almost sure convergence, optimal rate statement and oracle complexity bound of the proposed algorithm are established, under appropriate assumptions. Finally, preliminary numerical results are presented to illustrate the validity and advantage of the proposed algorithm in comparison with existing methods.

Solving two-stage stochastic second-order cone programming by progressive hedging method

王迪

北京交通大学

Abstract: Second-order cone programming problems are a class of convex optimization problems. Stochastic second-order cone programming with recourse is a class of optimization problems that defined to handle uncertainty in data defining deterministic second-order cone programming. In this work, a two-stage stochastic second-order cone programming is transformed into a two-stage stochastic variational inequality model equivalently, which can be solved by using the progressive hedging method quickly. As an application, we show how the two-stage Markowitz's mean-variance model can be transformed from a two-stage stochastic second-order cone programming problem to a two-stage stochastic variational inequality, and how to solve it, using the progressive hedging method and the primal interior decomposition method.

The mini-batch stochastic conjugate algorithms with the new variance reduction

高菲菲

北京邮电大学, 浙江工商大学

Abstract: Stochastic gradient descent methods are popular for large scale optimization but has slow convergence asymptotically due to the inherent variance. To remedy this problem, we develop a new stochastic gradient estimate of unbiasedness with minimized variance. Besides, we present two stochastic conjugate gradient algorithms with the new stochastic gradient estimate. The convergence theory can be established with smooth and strongly convex functions and experiments show the new algorithms have satisfactory numerical performance.

Generalized robust duality in constrained nonconvex optimization

王杰

重庆交通大学

Abstract: In this talk, the general dual problems in robust optimization without any convexity or concavity assumptions are investigated by using the image space analysis. A generalized Lagrange function is proposed by the class of regular weak separation functions. Then, two types of generalized robust dual problems are established. Under the appropriate assumption, the equivalent assertions of the zero duality gap property are characterized between the robust counterpart of an uncertain constrained optimization problem and the optimistic counterpart of its uncertain generalized Lagrange dual. Similarly, these theories and results can be extended to the deterministic dual pair of the robust counterpart and its Lagrange dual.

An Improved spectral conjugate gradient algorithm based on a modified Wolfe line search

伍浩

南京航空航天大学

Abstract: In this paper, we combine the mth-order Taylor expansion of the objective function with cubic

Hermite interpolation conditions and then derive a series of modified secant equations with higher accuracy in approximation of the Hessian matrix of the objective function. A modified Wolfe line search is also developed. It overcomes the weakness of the typical restriction imposed on modified secant equations and keeps the curvature condition met. Therefore, based on the modified secant equation and Wolfe line search, an improved spectral conjugate gradient algorithm is proposed. Under some mild assumptions, the algorithm is showed to be globally convergent for general nonconvex functions. Numerical results are also reported for verifying the effectiveness.

Adaptive three-term PRP algorithms without gradient Lipschitz continuity condition for nonconvex functions

杨贺舒

广西大学

Abstract: In unconstrained optimization, gradient Lipschitz continuity is an important condition. For gradient non-Lipschitz continuous problems, this report introduces two algorithms, based on MPRP algorithm for further research, Algorithm 1 and Algorithm 2 can obtain global convergence without gradient Lipschitz continuous condition. First, this report introduces that Algorithm 1 retains sufficient descent property independent of line search technology in MPRP algorithm, and the global convergence of Algorithm 1 is obtained in combination with the trust region property and the weak Wolfe-Powell line search technique. Second, Algorithm 2 is further improved which global convergence can be obtained independently of line search technique based on Algorithm 1. Finally, according to numerical experiments, the proposed algorithms perform competitively with other similar algorithms.

带重启步的共轭梯度投影法及其在图像恢复中的应用

杨慧慧

广西民族大学

摘要： 本文提出了一个带重启步的改进三项 PRP 型搜索方向，同时给出一个修正的自适应线搜索准则，从而建立了一个带重启步的三项共轭梯度投影法。在不依赖线搜索的情况下，由新算法产生的搜索方向满足充分下降条件和信赖域性质;在不使用目标映射 Lipschitz 连续性的情况下，该算法是全局收敛的。此外，在一般假设条件与使用目标映射 Lipschitz 连续性的情况下，该算法具有 R-线性收敛速度。最后，对凸约束非线性单调方程组和图像恢复问题进行中大规模数值实验，数值试验结果表明该算法是有效的。

分组报告 C9　整数规划

考虑混合整数线性规划问题对称特性的学习优化算法

陈乾

香港中文大学(深圳)

摘要：对称性广泛存在于混合整数线性规划 (MILP) 问题中，是在经典优化算法设计中常被考虑的重要特性。近几年，基于机器学习的 MILP 算法愈发流行，然而由于忽略了对称性，这些算法在具有该特性的 MILP 问题上表现不佳。在本工作中，我们基于端到端学习框架，通过引入对称信息，提出了一种新颖的损失函数设计，以此提升机器学习模型在具有对称性的 MILP 问题上的性能。在公共数据集上的大量数值实验结果表明，我们提出的方法求解性能优于现有方法。

A polyhedral study of a mixed 0-1 set arising in PLO problems

黄诗语

北京邮电大学

Abstract: We study a mixed 0-1 set appearing as a common substructure of piecewise linear optimization problems. We derive an exponential family of valid inequalities and give a necessary and sufficient condition for them to be facet-defining. These inequalities dominate known valid inequalities in the literature. We show that together with the trivial inequalities, the derived inequalities are sufficient to describe the convex hull of the considered set. Moreover, we identify a strongly polynomial-time algorithm to separate these inequalities, which makes them efficient to be embedded in a branch-and-cut solver. Numerical results demonstrate the effectiveness of using the derived inequalities as cutting planes to solve piecewise linear multicommodity network flow problems. This is a joint work with Dr. Wei-Kun Chen, Prof. Cai-Xia Kou and Prof. Yu-Hong Dai.

Benders decomposition for probabilistic set-covering problems

梁洁

北京理工大学

Abstract：In this talk, we consider a probabilistic set covering problem (PSCP) in which the constraint matrix is a random matrix, and the objective is to minimize the total cost set such that each covering

constraint is satisfied with a prespecified probability. We formulate the PSCP as a deterministic 0-1 integer programming (IP) formulation, and develop an efficient Benders decomposition (BD) approach for it. We enhance the BD approach by using initial cuts to initialize the relaxed master problem, adding mixed integer rounding inequalities to strengthen the problem formulation, implementing an effective heuristic procedure to find high-quality solutions. Numerical experiments carried out on Benchmark PSCP instances demonstrate the efficiency of the proposed BD approach. This is a joint work with Prof. Yu-Hong Dai, Dr. Wei-Kun Chen, Wei Lv, Cheng-Yang Yu.

A branch and bound algorithm for a class of multiobjective integer linear fractional programming problems

刘霞

北方民族大学

Abstract: The multiobjective fractional programming problem is researched. For a class of multiobjective integer fractional programming problems with each objective is the sum of linear fraction and linear form, auxiliary variables are introduced for each fraction of the objective function, and a series of relaxed linear programs are obtained using the convex and concave envelopes. In accordance with the requirements of multi-objectivity and integer solution in the solved problem, the branch and bound algorithm is proposed to solve all efficient solutions by the bounding, selection, deletion and termination rules of the algorithm. Meanwhile, the termination of the algorithm is analyzed, and numerical experiments illustrate the feasibility of the algorithm.

混合整数线性优化问题上基于图神经网络的"预测-搜索"算法框架

杨林鑫

香港中文大学(深圳)，深圳市大数据研究院

摘要：混合整数线性规划 (Mixed-Integer Linear Programming，MILP)被广泛应用于组合优化问题的建模当中。在现实生产生活中，来自相同问题集的相似 MILP 问题会被大量求解，但是这些 MILP 问题之间存在的通性却常常被忽略。机器学习方法可以帮助我们从求解这些相似问题的过程中发掘并总结出规律。在此工作中，我们将机器学习中常见的图神经网络与传统优化算法相结合并提出了一种新颖的"预测-搜索" (Predict-and-Search)算法框架以高效寻找 MILP 问题的高质量可行解。具体来说，我们首先通过图神经网络预测解的分布，然后基于此分布，在一个适当定义的空间上搜索可行解。我们展示了该算法框架优于已有的同类型工作；同时我们也在四个真实世界 MILP 数据集上进行了大量数值实验，并且在与 SOTA 优化求解器 SCIP 和 Gurobi 的对比中获得了 51%和 9%的性能提升。 (本文已发表于 ICLR2022)

分组报告 C10　非光滑优化

Modified gradient sampling algorithm for nonsmooth semi-infinite programming

尚天佑

河北大学

Abstract： In this paper, we construct a modified gradient sampling method to solve a type of nonsmooth semi-infinite optimization problem. The algorithm is grounded in the modified ideal direction, a subgradient computed in the convex hull of some sampling points. In addition, we discretize the semi-infinite optimization problem as finite problem based on the modified adaptive discretization method, ensure the convergence of the algorithm with respect to the discretization problem, and diminish the number of evaluating the constraint function. Moreover, we establish the theoretical convergence of the algorithm under some suitable assumptions. Finally, numerical results are obtained by applying algorithms and demonstrating that the new algorithm has advantages.

A restricted memory quasi-Newton bundle method for nonsmooth optimization on Riemannian manifolds

省沙杰

广西大学

Abstract: In this talk, a restricted memory quasi-Newton bundle method for minimizing a locally Lipschitz function over a Riemannian manifold is proposed, which extends the classical ones in Euclidean space to the manifold setting. The potential second order information of the objective function is approximated by applying the Riemannian versions of the quasi-Newton updating formulas. The subgradient aggregation technique is used to avoid solving the time-consuming quadratic programming subproblem when calculating the candidate descent direction. Moreover, a new Riemannian line search procedure is proposed to generate the stepsizes. Global convergence of the proposed method is established: if the serious iteration steps are finite, then the last serious iteration is stationary; otherwise, every accumulation point of the serious iteration sequence is stationary. Finally, some preliminary numerical results show that the proposed method is promising.

Generalized regularized Newton methods for nonsmooth optimization

problems with nonisolated solutions

史子剑

广西大学

Abstract: We propose a family of coderivative-based generalized regularized Newton methods to solve $C^{1,1}$ optimization problems. Our approach features global convergence and fast local convergence rate even for problems with non-isolated solutions. To this end, we introduce the p-order semismooth* property which plays the same role in our analysis as the Lipschitz continuity of the Hessian does in the C^2 case. Imposing only the metric q-subregularity of the gradient, we establish global convergence of the proposed algorithm as well as its local convergence rate, which can be superlinear, quadratic, or even higher than quadratic, depending on an algorithmic parameter \rho and the regularity parameters p and q. Specifically, choosing \rho to be one, we achieve quadratic local convergence rate under metric subregularity and the strong semismooth* property. The algorithm is applied to a class of nonsmooth convex composite minimization problems through the machinery of forward-backward envelope. Numerical experiments on the Lasso problem suggest that our algorithm is competitive with state-of-the-art Lasso solvers and particularly efficient when the number of samples is no less than the number of features.

Momentum schemes with Riemannian stochastic proximal gradient methods for nonsmooth optimization

卫阳

北京交通大学

Abstract: Two new stochastic proximal gradient algorithms on Riemannian manifold named R-ProxSGD and R-ProxSPB have been recently proposed, which have been shown to achieve their incremental first-order oracle (IFO) complexity for nonsmooth. Riemannian optimization. To improve further the solving efficiency, momentum technique can be a good candidate to improve the performance of R-ProxSGD and R-ProxSPB. In this paper, we propose the Riemannian Stochastic Proximal Gradient Methods with momentum technique to solve non-smooth function without geodesically convex or geodesically strongly convex over the Stiefel manifold. The two methods, named R-ProxSGM and R-ProxSPM, are generalizations of R-ProxSGD and R-ProxSPB. The incremental first-order oracle (IFO) complexity of the proposed algorithms is provided is the same as R-ProxSGD and R-ProxSPB. Experimental results on sparse PCA show that the computational speed of our methods is obviously faster than that of the existing methods using Riemann subgradient information, R-ProxSGD and R-ProxSPB.

A regularized Newton method for ℓ_q-norm composite optimization problems

吴育洽

香港理工大学

Abstract: This paper is concerned with $\ell_q (0<q<1)$-norm regularized minimization problems with a twice continuously differentiable loss function. For this class of nonconvex and nonsmooth composite problems, many algorithms have been proposed to solve them and most of which are of the first-order type. In this work, we propose a hybrid of proximal gradient method and subspace regularized Newton method, named HpgSRN. The whole iterate sequence produced by HpgSRN is proved to have a finite length and converge to an L-type stationary point under a mild curve-ratio condition and the Kurdyka-{\L}ojasiewicz property of the cost function, which does linearly if further a Kurdyka-{\L}ojasiewicz property of exponent $1/2$ holds. Moreover, a superlinear convergence rate for the iterate sequence is also achieved under an additional local error bound condition. Our convergence results do not require the isolatedness and strict local minimality properties of the L-stationary point. Numerical comparisons with ZeroFPR, a hybrid of proximal gradient method and quasi-Newton method for the forward-backward envelope of the cost function, proposed in [A. Themelis, L. Stella, and P. Patrinos, SIAM J. Optim., 28 (2018), pp. 2274-2303] for the ℓ_q-norm regularized linear and logistic regressions on real data indicate that HpgSRN not only requires much less computing time but also yields comparable even better sparsities and objective function values.

专题报告 D1　　全局优化-II

5 月 14 日 13:30-14:45　川汇楼二层 1 号会议室

Benders decomposition for large-scale p-median problems with a coverage constraint

陈伟坤

北京理工大学

Abstract: We study the p-median problem with the addition of a coverage constraint which requires the total customer demand, covered at a distance greater than a pre-defined coverage distance, to be smaller than a given threshold. The considered problem can be formulated as a mixed integer programming (MIP) formulation. However, due to the huge number of allocation variables and constraints, the MIP formulation cannot be efficiently solved by state-of-the-art MIP solvers, especially for large-scale cases. In this talk, we propose an effective branch-and-Benders-cut decomposition approach for solving large-scale problems. We show that both Benders feasibility and optimality cuts can be separated in polynomial-time. Moreover, we enhance the decomposition approach by including tight initial cuts, valid inequalities, and effective heuristic procedure. Computational experiments carried on benchmark and real-world instances (with up to 29514 customers and facilities) demonstrate the effectiveness of the proposed Benders decomposition approach. In particular, the proposed approach outperforms the state-of-the-art general-purpose MIP solver's

branch-and-cut and automatic Benders decomposition algorithms by orders of magnitude.

Global optimization for a class of multiplicative programming problems

邓亚萍

华北水利水电大学

Abstract: We consider a class of linear multiplicative programming problems, which have numerous applications in many fields of bargaining problem, financial optimization and so on. Firstly, based on branch-and-bound framework, we give relaxation methods by combining convex relaxation and the second-order cone relaxation to provide lower bounds of the optimal value to the problem, respectively. Furthermore, we use adaptive branching rule to replace classical midpoint subdivision and consider region reduction technique to improve the algorithm. Also, the theoretical convergence and computational complexity are given. Finally, numerical experiment evidences the efficiency of the proposed methods.

Global algorithms for nonconvex separable quadratic optimization with symmetric structures

邓智斌

中国科学院大学

Abstract: In real-world applications, optimization models often have symmetric structures, i.e., the model is invariant under some permutation. Most existing global algorithms are designed to address the symmetric structures in linear mixed integer optimization. In this talk, we will propose a new method based on the so-called aggregate function to solve two types of nonconvex separable quadratic problems with symmetric structures. The convex envelope for the aggregate function is obtained and used as the relaxation in the proposed branch-and-bound algorithms. Numerical results are presented to show the effectiveness of our proposed algorithms by considering the symmetric structure in the model. Possible future research directions will be discussed at the end of this talk.

专题报告 D2 　　张量优化及其应用-III

5 月 14 日 13:30-14:45 川汇楼二层 3 号会议室

Multilinear equations for scattered data interpolation

陈艳男

华南师范大学

Abstract: The scattered data interpolation aims to reconstruct a (typically smooth) function s (x) that approximates the underlying function and particularly satisfies s (xi) = fi for all i = 1,...,N. Here, "scattered" means that the data sites x1,...,xN have no structure or order between their relative locations. Xu and Ye (2019) developed the mathematical model of multilinear equations for the scattered data interpolation. In this talk, we propose a scalable optimization approach for solving the multilinear equations arising from the scattered data interpolation.

Vacuum stability conditions of the general two-Higgs-doublet potential

宋义生

重庆师范大学

Abstract: In this report, we present the novel analytical expressions for the bounded-from-below or the vacuum stability conditions of scalar potential for a general two-Higgs-doublet model by using the concepts of co-positivity and the gauge orbit spaces. More precisely, several analyticial sufficient conditions and necessary conditions are established for the vacuum stability of the general 2HDM potential, respectively. We also give an equivalent condition of the vacuum stability of the general 2HDM potential in theory, and then, apply it to derive the analyticial necessary conditions of the general 2HDM potential. Meanwhile, the semi-positive definiteness is proved for a class of 4th-order 2-dimensional complex tensor.

The evolution of tensor network decompositions

赵熙乐

电子科技大学

Abstract: Recently, tensor network decompositions are emerging for capturing the intrinsic structures of multi-dimensional data, especially for high-order data. The topology design of tensor network decompositions is the key problem in the development of tensor network decompositions. In this talk, I will first review the recent progress of tensor network decompositions. Then, I will discuss how to design fast algorithms for tensor network decompositions from a unified framework. Finally, we will also discuss the limitation and future possibilities of tensor network decompositions.

专题报告 D3　　非线性规划

5 月 14 日 13:30-14:45 天府楼二层 5 号会议室

Riemannian preconditioned algorithms for tensor completion

高斌

中国科学院数学与系统科学研究院

Abstract: We propose Riemannian preconditioned algorithms for low-rank tensor completion via polyadic decomposition and tensor ring decomposition. These algorithms exploit a non-Euclidean metric on the product space of the factor matrices of the low-rank tensor in tensor decomposition forms. This new metric is designed using an approximation of the diagonal blocks of the Hessian of the tensor completion cost function, thus having a preconditioning effect on these algorithms. We prove that the proposed Riemannian gradient descent algorithm globally converges to a stationary point of the tensor completion problem, with convergence rate estimates using the Lojasiewicz property. Numerical results on synthetic and real-world data suggest that the proposed algorithms are more efficient in memory and time compared to state-of-the-art algorithms. Moreover, the proposed algorithms display a greater tolerance for overestimated rank parameters in terms of the tensor recovery performance, thus enabling a flexible choice of the rank parameter.

Error analysis of Crank-Nicolson approximation for an optimal control problem with a time-fractional diffusion equation

田文义

天津大学

Abstract: An optimal control problem governed by a time-fractional diffusion equation is meticulously approximated based on Crank-Nicolson scheme in time. With the finite element discretization in space, we derive the optimality conditions of the discretized systems and rigorously analyze the temporal error estimates with respect to the regularity property of the data. Further an inexact ADMM algorithm is applied for solving the discrete optimization system.

Averaged method of multipliers for bi-level optimization without lower-level strong convexity

尧伟

南方科技大学

Abstract: Gradient methods have become mainstream techniques for Bi-Level Optimization (BLO) in learning fields. The validity of existing works heavily rely on either a restrictive Lower-Level Strong Convexity (LLSC) condition or on solving a series of approximation subproblems with high accuracy or both. In this work, by averaging the upper and lower level objectives, we propose a single loop Bi-level Averaged Method of Multipliers (sl-BAMM) for BLO that is simple yet efficient for large-scale BLO and gets rid of the limited LLSC restriction. We further provide non-asymptotic convergence analysis of sl-BAMM towards KKT stationary points, and the comparative advantage of our analysis lies in the absence of strong gradient boundedness assumption, which is always required by others. Thus our theory safely captures a wider variety of applications in deep learning, especially where the upper-level objective is quadratic w.r.t. the lower-level variable. Experimental results demonstrate the superiority of our method.

专题报告 D4　　人工智能与机器学习中的优化-III

5 月 14 日 13:30-14:45　天府楼二层 6 号会议室

On the rank of the optimal matrix of a general Toeplitz matrix completion problem

闫喜红

太原师范学院

Abstract: We consider symmetric and general Toeplitz matrix completion problems. They have wide applications in diverse areas and are well-known to be computationally NP-hard. This note presents an upper bound on the objective of minimizing the rank of the Toeplitz matrix in the completion problem, based on conclusions from the trigonometric moment problem and the semi-infinite problem. We prove that the upper bound is less than twice the number of the active constraints of the associated semi-infinite problem. Moreover, it is less than twice the number of linear constraints of the problem.

两类 PDE 最优控制问题中的优化算法设计

乐航睿

南开大学

摘要：偏微分方程 (PDE)的最优控制旨在最优地控制 PDE 描述的系统或过程来达到特定的目的。这类问题在离散后通常是一个大规模且病态的问题，可能包含非光滑、非线性以及非凸性质，是科学计算中最复杂的问题之一。此报告关注如何用优化算法求解两类 PDE 最优控制，即对流-扩散-反应方程的双线性控制以及热对流控制。我们将会以这两类问题为例，对 PDE 最优控制问题做简单介绍，探讨 PDE 最优控制的优化算法设计可能遇到的问题，并提出一些有效的数值方法。

专题报告 D5　　组合优化反问题及其应用

5 月 14 日 13:30-14:45　中苑迎晖厅会议室

A framework of the generalized inverse combinatorial optimization problems

关秀翠

东南大学

Abstract: In this talk, we built a uniform framework of Generalized Inverse Combinatorial Optimization Problems (GICOP) to integrate all classes of problems including the classical ICOPs, reverse COPs, the inverse optimal value COPs, the partial inverse COPs, the network improvement problems, the network interdiction problems and adjustment problems. We untangle the intricate relationships among these problems. We consider some classical polynomial time solvable COPs including shortest path, minimum spanning tree, center/median location, maximum flow and minimum cut, etc. We propose a uniform format for a concrete GICOP to describe its multiple characteristics. We further list a table to specify each characteristic in the uniform format. Series of open problems for the GICOPs have been proposed through the unified framework. We introduce some useful methods to solve GICOPs under different norms.

The sum of root-leaf distance interdiction problem with cardinality constraint by upgrading critical edges on trees

李霄

东南大学

Abstract: A network for the transportation of supplies can be described as a rooted tree with a weight of a degree of congestion for each edge. We take the sum of root-leaf distance (SRD) on a rooted tree as the whole degree of congestion of the tree. Hence, we consider the SRD interdiction problem on trees with cardinality constraint by upgrading edges (denoted by (\textbf{SDIPTC})) in brief). It aims to maximize the SRD by upgrading the weights of N critical edges such that the total upgrade cost under some measurement is upper-bounded by a given value. The relevant minimum cost problem (\textbf{MCSDIPTC}) aims to minimize the total upgrade cost on the premise that the SRD is lower-bounded by a given value. We develop two different norms including weighted l_∞ norm and weighted bottleneck Hamming distance to measure the upgrade cost. We propose two binary search algorithms within O ($n\log n$) time for the problems (\textbf{SDIPTC}) under the two norms, respectively. For problems (\textbf{MCSDIPTC}),we propose two binary search algorithms within O ($N n^2$) and O ($n \log n$) under weighted l_∞ norm and weighted bottleneck Hamming distance, respectively. These problems are solved through their subproblems (\textbf{SDIPT}) and (\textbf{MCSDIPT}), in which we ignore the cardinality constraint on the number of upgraded edges. Finally, we design numerical experiments to show the effectiveness of these algorithms.

求解赋权l_1模下的线性规划逆问题的通用算法

张昀蔚

东南大学

摘要： 本文研究的是赋权l_1模下的线性规划逆问题，线性规划逆问题是指给定标准型线性规划问

题的可行但非最优解x^0, 调整价值系数向量c到$\tilde c$要求x^0成为调整后新线性规划问题的最优解, 使得调整量$\|\tilde c-c\|$在赋权l_1模的意义下最小。本文首先基于该问题最优解的性质, 给出了其数学模型, 基于列生成算法的思想给出了一般求解算法的框架, 每次迭代需要更新对偶算子, 然后设计了三个不同的方法来计算该对偶算子; 接着, 通过最优性条件给出了该问题的另一给等价数学模型, 并基于原始-对偶算法的思想给出了两个通用算法, 分别将该逆问题看成原问题或者对偶问题。最后, 将上述通用算法应用到指派问题上。

专题报告 D6　　随机优化理论与方法-I

5 月 14 日 13:30-14:45　中苑西侧会议室

Delayed stochastic algorithms for distributed weakly convex optimization

邓琪

上海财经大学

Abstract: This paper studies delayed stochastic algorithms for weakly convex optimization in a distributed network with workers connected to a master node. More specifically, we consider a structured stochastic weakly convex objective function which is the composition of a convex function and a smooth nonconvex function. Recently, Xu et al. 2022 showed that an inertial stochastic subgradient method converges at a rate of $\mathcal{O} (\tau/\sqrt{K})$, which suffers a significant penalty from the maximum information delay τ. To alleviate this issue, we propose a new delayed stochastic prox-linear ($\texttt{DSPL}$) method in which the master performs the proximal update of the parameters and the workers only need to linearly approximate the inner smooth function. Somewhat surprisingly, we show that the delays only affect the high order term in the complexity rate and hence, are negligible after a certain number of $\texttt{DSPL}$　iterations. Moreover, to further improve the empirical performance, we propose a delayed extrapolated prox-linear ($\texttt{DSEPL}$) method which employs Polyak-type momentum to speed up the algorithm convergence.　Building on the tools for analyzing $\texttt{DSPL}$, we also develop an improved analysis of the delayed stochastic subgradient method ($\texttt{DSGD}$). In particular, for general weakly convex problems, we show that convergence of $\texttt{DSGD}$ only depends on the expected delay.

Several stochastic first-order splitting methods

白建超

西北工业大学

Abstract: In this talk, several stochastic versions on the alternating direction method of multipliers and the Peaceman-Rachford splitting method are presented for structured convex optimization problems whose

objective function is the sum of a possibly nonsmooth convex function and an average function of many smooth convex functions. We show the main convergence results of these methods and their performance on testing the popular graph-guided fused lasso problem in supervised learning and the 3D CT reconstruction problem in medical imaging, respectively. Finally, several interesting questions are shared and discussed.

Robbins-Monro augmented Lagrangian method for stochastic convex optimization

丁超

中国科学院数学与系统科学研究院

Abstract: In this talk, we introduce a Robbins-Monro augmented Lagrangian method (RMALM) to solve a class of constrained stochastic convex optimization, which can be regarded as a hybrid of the Robbins–Monro type stochastic approximation method and the augmented Lagrangian method of convex optimizations. Under mild conditions, we show that the proposed algorithm exhibits a linear convergence rate. Moreover, instead of verifying a computationally intractable stopping criteria, we show that the RMALM with the increasing subproblem iteration number has a global complexity. Numerical results on synthetic and real data demonstrate that the proposed algorithm outperforms the existing algorithms.

专题报告 D7 数据驱动的管理优化-I

5 月 14 日 13:30-14:45 天府楼一层 10 号会议室

基于分布鲁棒优化的产品组合优化问题

金庆伟

浙江大学

摘要： 本文研究了基于分布鲁棒优化的产品组合优化问题。传统基于 MNL 模型的产品组合优化问题对选择模型的假设过强，需要假设产品效用的随机项服从 IID 的 Gumbel 分布。在本研究中，我们对其分布建立了分布鲁棒优化模型，松弛了对选择模型随机项的假设。在此基础上，我们提出了两个产品组合优化模型——鲁棒收益优化与鲁棒收益满足模型。我们证明了在无约束条件下最优产品组合满足按收益排序的性质，在数量约束下设计了相应的算法对最优产品组合进行求解。

考虑机会约束的分布式鲁棒单机调度问题研究

陆海旻

浙江工业大学

摘要： 本文研究了需灵活调整作业排程方案的单机调度问题，考虑每个作业同时具有释放时间和期限时间，且加工时间具有不确定性。假设加工时间的真实分布存在于经验分布的 Wasserstein 球不确定集中，并提出了传统期望目标函数与机会约束结合的分布式鲁棒优化模型，称为数据驱动的分布式鲁棒期望机会约束模型。由于调度问题本身的复杂性，该模型的目标函数和机会约束中均包含了优化问题，极大程度增加了求解难度，为此提出了等价的模型转换。在一般性假设下，得到了该模型的等价混合整数线性规划模型和混合整数二阶锥规划模型。数值实验部分，通过交叉验证方法获取最佳的半径，并通过与随机规划模型和基于矩信息的分布式鲁棒优化比较，探究数据驱动模型的效能表现和鲁棒性。

基于顾客个人 no-show 概率预测的酒店超售问题

翟倩茹

西南财经大学

摘要： 本文提出了一种新的数据驱动超售模型。与该领域的传统模型不同，我们的新模型首先应用一些机器学习方法对客户进行分类，以预测每个客户的"no-show"概率，然后利用这些个人信息来确定最佳超售水平。在没有任何先验假设的情况下，构建一个更好的超售框架，根据每个客户准确的"no-show"概率，从而获得更高的利润。此外，针对酒店预订中的不平衡数据，引入了过采样处理方法。本文所提出的模型被表述为一个预期收益最大化问题，以高效地获得最优超售解。最后，应用现实生活中的面板数据集证明了我们提出的模型在数值实验中的优势。

专题报告 D8   向量与集值优化-1

5 月 14 日 13:30-14:45　天府楼二层 7 号会议室

First- and second-order optimality conditions for sparse nonsmooth multiobjective optimization

陈加伟

西南大学

Abstract: Sparsity and multiobjective are important characterizations of many practical problems such as image processing, compression sensing, recommendation system and big data. In this talk, we focus on optimality conditions of nonsmooth sparsity multiobjective optimization problem (shortly, SMOP). The variational analysis characterizations, such as tangent cones, normal cones, dual cones and second-order tangent set, of the sparse set are presented as well as the relationships among the sparse set and its tangent cones, recession cone, asymptotic cone and second-order tangent set. The first-/second- order necessary conditions for local weakly Pareto efficient solution of SMOP are established under some suitable

conditions.

Some characterizations of a nonlinear scalarizing function via oriented distance function

韩瑜

江西财经大学

Abstract: In this talk, we talk about some properties concerned with a nonlinear scalarizing function via oriented distance function. The convexity, continuity and Lipschitz continuity of the nonlinear scalarizing function are showed under some suitable conditions. As an application, we establish Lipschitz continuity of strongly approximate solution mapping for l-type order relation to parametric set optimization problems by using convexity and Lipschitz continuity of the nonlinear scalarizing function.

A proximal gradient method for multi-objective optimization with applications

徐阳栋

重庆邮电大学

Abstract: This report proposes a novel variant of the proximal gradient method for an unconstrained multi-objective optimization problem, in which each objective function is the sum of a smoothly convex function and a convex function (not necessarily differentiable). At each iteration, the descent direction of the differentiable part is calculated by solving a quadratic subproblem, and the nondifferentiable part draws on the idea of the multi-objective proximal point method. Under some mild assumptions, it is proved that the sequence generated by the algorithm converges to a Pareto critical point. In addition, an application to a binary classification problem in supervised machine learning is given to validate the effectiveness of the proposed method. Finally, performance experiments suggest that the proposed algorithm can robustly generate Pareto fronts of multiple synthesis test problems compared with existing ones.

专题报告 D9　　多项式优化与张量计算-III

5 月 14 日 13:30-14:45　中苑贵宾厅会议室

Solving polynomial variational inequality problems via Lagrange

multiplier expressions and moment-SOS relaxations

张敏

中国科学院新疆生态与地理研究所

Abstract: In this paper, we study variational inequality problems (VIPs) with involved mappings and feasible sets characterized by polynomial functions (namely, polynomial VIPs). We propose a numerical algorithm for computing solutions to polynomial VIPs based on Lagrange multiplier expressions and the Moment-SOS hierarchy of semidefinite relaxations. We also extend our approach to finding more or even all solutions to polynomial VIPs. We show that the method proposed in this paper can find solutions or detect the nonexistence of solutions within finitely many steps, under some general assumptions. In addition, we show that if the VIP is given by generic polynomials, then it has finitely many Karush-Kuhn-Tucker points, and our method can solve it within finitely many steps. Numerical experiments are conducted to illustrate the efficiency of the proposed methods.

T-product factorization based method for matrix and tensor completion problems

张新珍

天津大学

Abstract: Low rank matrix and tensor completion problems are to recover the incomplete two and higher order data of low rank structures. The essential problem in the matrix and tensor completion problems is how to improve the efficiency. For a matrix completion problem, we establish a relationship between matrix rank and tensor tubal rank, and reformulate matrix completion problem as a third order tensor completion problem. For the reformulated tensor completion problem, we adopt a two-stage strategy based on tensor factorization algorithm. In this way, a matrix completion problem of big size can be solved via some matrix computations of smaller sizes. For a third order tensor completion problem, to fully exploit the low rank structures, we introduce the double tubal rank which combines the tubal rank of two tensors, original tensor and the reshaped tensor of the mode-3 unfolding matrix of original tensor. Based on this, we propose a reweighted tensor factorization algorithm for third order tensor completion. Extensive numerical experiments demonstrate that the proposed methods outperform state-of-the-art methods in terms of both accuracy and running time.

Semidefinite relaxation methods for tensor absolute value equations

周安娃

上海大学

Abstract: In this talk, we consider the tensor absolute value equations (TAVEs). When one tensor is row diagonal with odd order, we show that the TAVEs can be reduced to an algebraic equation; when it is row diagonal and nonsingular with even order, we prove that the TAVEs is equivalent to a polynomial complementary problem. When no tensor is row diagonal, we formulate the TAVEs equivalently as polynomial optimization problems in two different ways. Each of them can be solved by Lasserre's hierarchy of semidefinite relaxations. The finite convergence properties are also discussed. Numerical experiments show the efficiency of our proposed methods.

专题报告 D10　统计中的优化-III

5 月 14 日 13:30-14:45　川汇楼二层 2 号会议室

An alternating direction method with continuation for a double nonconvex relaxation model of background subtraction problems

彭定涛

贵州大学

Abstract: Background subtraction is used to detect moving parts of a video stream by subtracting them from the established background, which is a fundamental and critical step for many high level computer vision tasks. Low-rank sparse decomposition (LRSD) model provides a suitable framework for background subtraction. In this paper, we consider a double nonconvex continuous relaxation model for LRSD model, in which the rank function is relaxed by the composition of capped-ℓ_1 function and singular values, and the sparse function is relaxed by a class of special non-Lipschitz function. An alternating direction method with continuation (ADMC) of the penalty parameter in the augmented Lagrangian function is proposed to solve the resulted nonconvex and non-Lipschitz matrix optimization problem. Although the objective function is the sum of two nonconvex functions, the convergence of ADMC algorithm is proved under some mild conditions. Numerical results of simulation data and real data show that the proposed ADMC algorithm is very efficient and competitive with several state-of-the-art algorithms.

A proximal iteratively reweighted approach for efficient network sparsification

杨翔宇

河南大学

Abstract: The huge size of deep neural networks makes it diffificult to deploy on the embedded platforms with limited computation resources directly. In this talk, we present a novel trimming approach to determine the redundant parameters of the trained deep neural network in a layer-wise manner to produce a compact neural network. This is achieved by minimizing a nonconvex sparsity-inducing term of the network

parameters while maintaining the response close to the original one. We present a proximal iteratively reweighted method to resolve the resulting nonconvex model, which approximates the nonconvex objective by a weighted L1 norm of the network parameters. Moreover, to alleviate the computational burden, we develop a novel termination criterion during the subproblem solution, significantly reducing the total pruning time. Global convergence analysis and a worst-case O (1/k) ergodic convergence rate for our proposed algorithm is established. Numerical experiments demonstrate the proposed approach is effficient and reliable.

0/1 deep neural networks via block coordinate descent

张辉

北京交通大学

Abstract: The step function is one of the simplest and most natural activation functions for deep neural networks (DNNs). As it counts 1 for positive variables and 0 for others, its intrinsic characteristics (e.g., discontinuity and no viable information of subgradients) impede its development for several decades. Even if there is an impressive body of work on designing DNNs with continuous activation functions that can be deemed as surrogates of the step function, it is still in the possession of some advantageous properties, such as complete robustness to outliers and being capable of attaining the best learning-theoretic guarantee of predictive accuracy. Hence, in this paper, we aim to train DNNs with the step function used as an activation function (dubbed as 0/1 DNNs). We first reformulate 0/1 DNNs as an unconstrained optimization problem and then solve it by a block coordinate descend (BCD) method. Moreover, we acquire closed-form solutions for sub-problems of BCD as well as its convergence properties. Furthermore, we also integrate $l\_\{2,0\}$-regularization into 0/1 DNN to accelerate the training process and compress the network scale. As a result, the proposed algorithm has a high performance on classifying MNIST and Fashion-MNIST datasets.

Solving constrained nonsmooth group sparse optimization via group capped-l1 relaxation and group smoothing proximal gradient algorithm

张弦

贵州大学

Abstract: In this report, we study the constrained group sparse regularization optimization problem, where the loss function is convex but nonsmooth, and the penalty term is the group sparsity which is then proposed to be relaxed by the group Capped-l1 for the convenience of computation. Firstly, we introduce three kinds of stationary points for the continuous relaxation problem and describe the relationship of the three kinds of stationary points. We give the optimality conditions for the group Capped-l1 problem and the original group sparse regularization problem, and investigate the link between the relaxation problem and the original problem in terms of global and local optimal solutions. The results reveal the equivalence of the original

problem and the relaxation problem in some sense. Secondly, we propose a group smoothing proximal gradient (GSPG) algorithm for the constrained group sparse optimization, and prove that the proposed GSPG algorithm globally converges to a lifted stationary point of the relaxation problem. Finally, we present some numerical results on recovery of the simulated group sparse signals and the real group sparse images to illustrate the efciency of the continuous relaxation model and the proposed algorithm.

专题报告 D11　随机优化及其应用-III

5 月 14 日 13:30-14:45　东苑七层会议室

Distributionally robust multiproduct pricing problems with pure characteristics demand

蒋杰

重庆大学

Abstract: In the seminal work by Pang et al. [Oper. Res., 63 (2015), pp. 639–659], a constructive and effective approach is proposed to estimate pure characteristics demand models with pricing, which lays a numerical foundation to the application of pure characteristics demand models. Mainly inspired by this work, we consider in this paper an extended multiproduct pricing problem with pure characteristics demand under the uncertainty of the true probability distribution. Specifically, we employ the distributionally robust approach, distortion function and regularization term to formulate our extended multiproduct pricing problem. By rewriting our model as a dynamic form, some continuity properties are given. We then show that our model is well-defined strictly. After that, we investigate the data-driven analysis. The convergence assertion is made when the data size tends to infinity. Moreover, considering the contamination of driven data, the quantitative statistical robustness is analyzed. Further, we study the tractable reformulation of the distributionally robust multiproduct pricing problem and use the augmented Lagrangian method to solve the reformulation problem with the convergence guarantee. Finally, in our computational experiments, we compare the distributionally robust multiproduct pricing problem with the non-robust one. These numerical results show the effectiveness of our methods.

DC algorithms for sparse group L0 regularized optimization problems

李汶静

哈尔滨工业大学

Abstract: In this talk, we consider a class of sparse group L0 regularized optimization problems. First, we give a continuous relaxation model of the considered problem and define a class of stationary points of the relaxation problem. Then, we establish the equivalence of these two problems in the sense of global

minimizers, and prove that the defined stationary point is equivalent to the local minimizer of the considered sparse group L0 regularized problem with a desirable bound from its global minimizers. Further, based on the difference-of-convex (DC) structure of the relaxation problem, we design two DC algorithms to solve the relaxation problem. We prove that any accumulation point of the iterates generated by them is a local minimizer with a desirable bound for the considered sparse group L0 problem. In particular, all accumulation points have a common support set and their zero entries can be attained within finite iterations. Moreover, we give the global convergence analysis of the proposed algorithms. Finally, we perform some numerical experiments to show the efficiency of the proposed algorithms.

Proximal stochastic recursive momentum algorithm for a class of nonsmooth nonconvex optimization problems

温博

河北工业大学

Abstract: In this paper, we mainly consider a class of nonconvex nonsmooth optimization problems, whose objective function is the sum of a smooth function with a Lipschitz continuous gradient and a convex nonsmooth function. We first propose a proximal stochastic recursive momentum algorithm (ProxSTORM) with mini-batch for solving the optimization problems and consider its convergence behaviour. Then, based on the Polyak–Łojasiewicz inequality, we establish the global linear convergence rate of ProxSTORM. Finally, some numerical experiments have been conducted to illustrate the efficiency of our method.

专题报告 E1　　全局优化-III

5 月 14 日 14:50-16:05　川汇楼二层 1 号会议室

多核心集的全局分布鲁棒优化模型及其应用

李玥瑶

清华大学

摘要： 本报告介绍的全局分布鲁棒优化模型是通过建立核心集对数据的结构性质进行刻画，如对于具有多峰分布特点的数据，可以建立多个核心集来描述多峰这一结构。在目标函数分段线性的假设以及合适的核心集、样本空间、距离函数的选取下，多核心集的全局分布鲁棒优化模型可以等价地改写为半定规划模型。我们将这一模型应用到多产品报童问题上，通过数值实验验证了在数据服从多峰分布的情况下，多核心集和全局分布鲁棒优化模型优于一般的全局分布鲁棒优化模型和传统的分布鲁棒优化模型。

A matrix optimization problem over an uncertain linear system and its

semidefinite programming approximations

徐瑾涛

清华大学

Abstract: In this talk, we discuss a matrix optimization problem over an uncertain finite-horizon linear system that regards the unknown state transition matrix as a decision variable. The problem is in general NP-hard and its polynomial-timesolvable semidefinite programming approximation models are presented. Additionally, we discuss the quality of SDP approximation solutions in terms of feasibility and optimality theoretically and numerically.

Interval partition and linearization algorithm for minimax linear fractional program

张博

宁夏大学

Abstract: This paper constructs an interval partition linearization algorithm for solving minimax linear fractional programming (MLFP) problem. In this algorithm, MLFP is converted and decomposed into a series of linear programs by dividing the outer 1-dimensional space of the equivalent problem (EP) into polynomially countable intervals. To improve the computational efficiency of the algorithm, two new acceleration techniques are introduced, in which the regions in outer space where the optimal solution of EP does not exist are largely deleted. In addition, the global convergence of the proposed algorithm is summarized and its computational complexity is illustrated to reveal that it is a fully polynomial time approximation scheme. Finally, the numerical results demonstrate that the proposed algorithm is feasible and effective.

专题报告 E2   优化前沿算法及其应用

5 月 14 日 14:50-16:05 川汇楼二层 3 号会议室

A gradient method exploiting the two dimensional quadratic termination property

黄亚魁

河北工业大学

Abstract: The quadratic termination property is important to the efficiency of gradient methods. We consider equipping a family of gradient methods, where the stepsize is given by the ratio of two norms, with

two dimensional quadratic termination. Such a desired property is achieved by cooperating with a new stepsize which is derived by maximizing the stepsize of the considered family in the next iteration. We show that the new stepsize converges to the reciprocal of the largest eigenvalue of the Hessian. Furthermore, by adaptively taking the long Barzilai-Borwein stepsize and reusing the new stepsize with retard, we propose an efficient gradient method for unconstrained quadratic optimization. We prove that the new method is R-linearly convergent with a rate of $1-1/\rho$, where ρ is the condition number of Hessian. Numerical experiments show the efficiency of our proposed method.

Gradient methods with approximately optimal stepsizes

刘泽显

贵州大学

Abstract: By viewing the well-known BB method from the angle of approximate model, a new type of stepsize called approximately optimal stepsize is introduced for gradient method.   A lot of stepsizes for gradient method can be regarded as approximately optimal stepsizes. We first present an efficient gradient method with approximately optimal stepsize for strictly convex quadratic minimization problems and establish its linear convergence rate. By exploiting some approximate models including quadratic models, tensor models, conic models and regularization models, we extend approximately optimal stepsize to general unconstrained optimization and present some efficient gradient methods with approximately optimal stepsizes. Extensive numerical experiments indicated the proposed methods are surprisingly efficient and are competitive to some famous conjugate gradient software packages. Due to the surprising efficiency, we believe that gradient methods with approximately optimal stepsizes can become strong candidates for large-scale unconstrained optimization. The talk is based on joint works with professor Hongwei Liu in Xidian University.

Frank-Wolfe type methods for a class of nonconvex inequality-constrained problems

曾燎原

浙江工业大学

Abstract: The Frank-Wolfe method and its variants, which implement efficient linear oracles for minimizing smooth functions over compact convex sets, form a prominent class of projection-free first-order methods. In this talk, we extend the Frank-Wolfe method and its away-step variant for minimizing a smooth function over a possibly nonconvex compact set, based on our new generalized linear oracles. We discuss convergence and present numerical performance of our nonconvex Frank-Wolfe type methods for solving matrix completion problems.

A golden ratio Bregman proximal gradient algorithm for nonconvex optimization problems

高雪

河北工业大学

Abstract: This paper focuses on solving the nonconvex nonsmooth minimization problem over abstract set, whose objective function is the sum of a proper lower semicontinuous convex function and a smooth nonconvex function, and the differentiable part is freed from the restrictive assumption of global Lipschitz gradient continuity. By combining the proximal regularization and extrapolation strategies, we propose a golden ratio Bregman proximal gradient algorithm (GBPG for short), where the geometry of the abstract set and the function is captured by employing generalized Legendre function. In theory, we prove that each bounded sequence generated by GBPG globally converges to the critical point of the considered problem, under the assumption that the underlying function satisfies the Kurdyka-Łojasiewicz property. Finally, to illustrate computational effectiveness of our algorithm GBPG, we apply it to solve the standard phase retrieval and the Poisson linear inverse problems and make comparisons with some existing methods.

A highly efficient adaptive-sieving-based algorithm for the high-dimensional rank lasso problem

李庆娜

北京理工大学

Abstract: The high-dimensional rank lasso (hdr lasso) model is an efficient approach to deal with high-dimensional data analysis. It was proposed as a tuning-free robust approach for the high-dimensional regression and was demonstrated to enjoy several statistical advantages over other approaches. The hdr lasso problem is essentially an L1-regularized optimization problem whose loss function is Jaeckel's dispersion function with Wilcoxon scores. Due to the nondifferentiability of the above loss function, many classical algorithms for lasso-type problems are unable to solve this model. In this paper, inspired by the adaptive sieving strategy for the exclusive lasso problem in Lin et al. (2021), we propose an adaptive-sieving-based algorithm to solve the hdr lasso problem. The proposed algorithm makes full use of the sparsity of the solution. In each iteration, a subproblem with the same form as the original model is solved, but in a much smaller size. We apply the proximal point algorithm to solve the subproblem, which fully takes advantage of the two nonsmooth terms. Extensive numerical results demonstrate that the proposed algorithm (AS-PPA) is

robust for different types of noises, which verifies the attractive statistical property. Moreover, AS-PPA is also highly efficient, especially for the case of high-dimensional features, compared with other methods.

An efficient algorithm for the ℓ_{p} norm based metric nearness problem

王承竞

西南交通大学

Abstract: Given a dissimilarity matrix, the metric nearness problem is to find the nearest matrix of distances that satisfy the triangle inequalities. This problem has wide applications, such as sensor networks, image processing, and so on. But it is of great challenge even to obtain a moderately accurate solution due to the $O(n^{3})$ metric constraints and the nonsmooth objective function which is usually a weighted ℓ_{p} norm based distance. In this paper, we propose a delayed constraint generation method with each subproblem solved by the semismooth Newton based proximal augmented Lagrangian method (PALM) for the metric nearness problem. Due to the high memory requirement for the storage of the matrix related to the metric constraints, we take advantage of the special structure of the matrix and do not need to store the corresponding constraint matrix. A pleasing aspect of our algorithm is that we can solve these problems involving up to 10^{8} variables and 10^{13} constraints. Numerical experiments demonstrate the efficiency of our algorithm. In theory, firstly, under a mild condition, we establish a primal-dual error bound condition which is very essential for the analysis of local convergence rate of PALM. Secondly, we prove the equivalence between the dual nondegeneracy condition and nonsingularity of the generalized Jacobian for the inner subproblem of PALM. Thirdly, when $q(\cdot)=\|\cdot\|_{1}$ or $\|\cdot\|_{\infty}$, without the strict complementarity condition, we also prove the equivalence between the dual nondegeneracy condition and the uniqueness of the primal solution.

专题报告 E4　　大规模机器学习-稀疏和分布式技术

5 月 14 日 14:50-16:05　天府楼二层 6 号会议室

分布式优化中的压缩方法

严明

香港中文大学(深圳)

摘要: 分布式优化是求解大规模问题和处理分布式数据的重要手段，而节点之间数据的传输是分布式优化的一个新瓶颈。对传输数据进行压缩可以有效地解决低带宽的问题，缩小总通信时间。然而数据压缩会引入新的误差，给算法设计带来新的挑战。在本报告中，我将介绍一些在分布式优化中减少压

缩误差影响的方法。这些方法可以有效地减少压缩误差甚至消除压缩误差，使算法能够在几乎不增加或者少量增加计算时间的情况下大量减少通信时间。

Snap-shot decentralized stochastic gradient tracking methods

叶海山

西安交通大学

Abstract: n decentralized optimization, m agents form a network and only communicate with their neighbors, which gives advantages in data ownership, privacy, and scalability. At the same time, decentralized stochastic gradient descent (\texttt{SGD}) methods, as popular decentralized algorithms for training large-scale machine learning models, have shown their superiority over centralized counterparts. Distributed stochastic gradient tracking (\dsgt)\citep{pu2021distributed} has been recognized as the popular and state-of-the-art decentralized \texttt{SGD} method due to its proper theoretical guarantees. However, the theoretical analysis of \dsgt\citep{koloskova2021improved} shows that its iteration complexity is $\tilde{\cO}\left (\frac{\bsig^2}{m\mu\varepsilon}+\frac{\sqrt{L}\bsig}{\mu (1 - \lambda_2 (W))^{1/2}C_W \sqrt{\varepsilon}}\right)$, where W is a double stochastic mixing matrix that presents the network topology and $ C_W $ is a parameter that depends on W. Thus, it indicates that the convergence property of \dsgt is heavily affected by the topology of the communication network. To overcome the weakness of \dsgt, we resort to the snap-shot gradient tracking skill and propose two novel algorithms. We further justify that the proposed two algorithms are more robust to the topology of communication networks under similar algorithmic structures and the same communication strategy to \dsgt. Compared with \dsgt, their iteration complexity are $\cO\left (\frac{\bsig^2}{m\mu\varepsilon} + \frac{\sqrt{L}\bsig}{\mu (1 - \lambda_2 (W))\sqrt{\varepsilon}} \right)$ and $\cO\left (\frac{\bsig^2}{m\mu \varepsilon} + \frac{\sqrt{L}\bsig}{\mu (1 - \lambda_2 (W))^{1/2}\sqrt{\varepsilon}} \right)$ which reduce the impact on network topology (no C_W).

Accelerating decentralized deep training with sparse and effective topologies

袁坤

北京大学

Abstract: Decentralized optimization algorithms save remarkable communication overheads in distributed deep learning since each node averages locally with neighbors. The network topology connecting all nodes determines communication efficiency and local averaging effectiveness. The key to making decentralized algorithms efficient is to seek sparse topologies that realize effective local averaging with little communication. However, exiting common topologies either suffer expensive per-iteration communication or slow consensus rates. In this talk, we will propose several sparse and effective topologies that endow

decentralized algorithms with state-of-the-art balance between communication efficiency and convergence. We will also discuss BlueFog, an open-source python library for straightforward, high-performance implementations of diverse topologies and decentralized algorithms.

专题报告 E5　　网络优化

5 月 14 日 14:50-16:05　中苑迎晖厅会议室

Algorithms for partial inverse min-max spanning tree problem under the weighted bottleneck Hamming distance

李宪越

兰州大学

Abstract: Min-max spanning tree problem is a classical problem in combinatorial optimization. Its purpose is to find a spanning tree to minimize its maximum edge in a given edge weighted graph. Given a connected graph G, an edge weight vector w and a forest F, the partial inverse min-max spanning tree problem (PIMMST) is to find a new weighted vector w^*, so that F can be extended into a min-max spanning tree with respect to w^* and the gap between w and w^* is minimized. In this talk, I will introduce some algorithms for this problem and its variant under the weighted bottleneck Hamming distance.

An LP-based approximation algorithm for generalized traveling salesman path problem

孙建

南开大学

Abstract: The traveling salesman problem (TSP) is one of the classic research topics in the field of operations research, graph theory and computer science. In this paper, we propose a generalized model of traveling salesman problem, denoted by generalized traveling salesman path problem. Let $G= (V,E,c)$ be a weighted complete graph, in which c is a nonnegative metric cost function on edge set E, i.e., $c:E\rightarrow \mathbb{R}^{+}$. The traveling salesman path problem aims to find a Hamiltonian path in G with minimum cost. Compared to the traveling salesman path problem, we are given extra vertex subset $V^{\prime}$ and edge subset $E^{\prime}$ in the problem proposed in this paper; its goal is to construct a path which traverses all the edges in $E^{\prime}$ while only needs to visit each vertex in $V^{\prime}$ exactly once. Based on integer programming, we give a mathematical model of the problem, and design a $\frac{1+\sqrt{5}}{2}$-approximation algorithm for the problem by combining linear programming rounding strategy and a special graph structure.

The restricted inverse optimal value problem on shortest path under l_∞ norm on trees

张巧

常州大学

Abstract: We consider the restricted inverse optimal value problem on shortest path under weighted l_∞ norm on trees (RIOVSPT$_\infty$). It aims at adjusting some edge weights to minimize the total cost under weighted l_∞ norm on the premise that the length of the shortest root-leaf path of the tree is lower-bounded by a given value D, which is just the restriction on the length of a given root-leaf path P0. If we ignore the restriction on the path P0, then we obtain the minimum cost shortest path interdiction problem on trees (MCSPIT$_\infty$). It can be solved by an $O (n \log n)$ time subalgorithm. We analyze some properties of the problem (RIOVSPT$_\infty$) and explore the relationship of the optimal solutions between (MCSPIT$_\infty$) and (RIOVSPT$_\infty$). Based on some subproblems, we finally propose a polynomial-time algorithm for the problem (RIOVSPT$_\infty$).

专题报告 E6　　随机优化理论与方法-II

5 月 14 日 14:50-16:05 中苑西侧会议室

A framework for analyzing variance reduced stochastic gradient methods and a new one for non-smooth non-convex optimization

梁经纬

上海交通大学

Abstract: Over the past years, stochastic optimization methods are becoming increasingly popular in traditional areas including inverse problems and signal/image processing. In this talk, I will introduce SPRING, a novel stochastic version of proximal alternating linearized minimization (PALM) algorithm for solving a class of non-smooth and non-convex optimization problems which arise in many statistical machine learning, computer vision and imaging applications. Theoretically, I will show that our proposed method with variance-reduced stochastic gradient estimators, such as SAGA and SARAH, achieves state-of-the-art oracle complexities. Numerical experiments on sparse non-negative matrix factorization, sparse principal component analysis and blind image deconvolution are also presented to demonstrate the efficiency of our algorithm.

Stochastic Bregman golden ratio algorithms for stochastic mixed variational inequalities beyond Lipschitz continuity

龙宪军

重庆工商大学

Abstract: In the study of stochastic mixed variational inequalities, the Lipschitz continuity is an indispensable assumption for the convergence analysis. However, this assumption may fail in many practice applications. In this paper, we propose a stochastic Bregman golden ratio algorithm for solving stochastic mixed variational inequalities involving the non-Lipschitz mapping. Since our algorithm only requires to calculate one stochastic approximation of the expected mapping per iteration, the computational load may be reduced. Under moderate conditions, we not only prove the almost surely convergence of the iteration sequence, but also derive the $\mathcal{O} (1/K)$ convergence rate and the probabilities of large deviation results for the proposed algorithm. Numerical experiments on Logistic regression problems and modified entropy regularized LP boosting problems show that our algorithm is competitive compared with some exiting algorithms. Finally, we apply our algorithm to solve a non-Lipschitz resource sharing problem.

Recent advances in randomized quasi-Newton methods

罗珞

复旦大学

Abstract: The classical quasi-Newton methods focus on minimizing convex function by constructing the Hessian estimator with Broyden family updates. We introduce randomized squared-quasi-Newton methods and randomized partial-quasi-Newton methods for solving nonlinear equations and minimax problems, achieving explicit superliner convergence rates without the positive-definiteness of Hessian. We also introduce randomized SR-k methods to show the block quasi-Newton methods provably converge faster than ordinary ones with rank-1 or rank-2 updates.

专题报告 **E7** 数据驱动的管理优化**-II**

5 月 14 日 14:50-16:05 天府楼一层 10 号会议室

基于树状考虑集的产品组合优化

王倩倩

浙江大学

摘要： 本文研究了树状结构考虑集的产品组合优化问题。我们考虑了两种树状结构的考虑集，一种是基于子树的考虑集，一种是基于生成路径的考虑集。在两种考虑集下我们分别研究了基于 nested logit 模型和 multinomial logit 选择模型的产品组合优化与定价问题。我们建立了动态规划方法并设计了相

应的 FPTAS 算法。

考虑选品优化的城市无人机配送调度问题研究

吴萌婷

浙江工业大学

摘要：本文研究了在无人机和人工快递合作交付下的城市多地点配送问题，将收益最大化作为优化目标，使用 Multinomial Logit 模型表征客户的购买行为。此外，我们综合考虑了无人机的负载能力以及无人机和快递员的投递距离限制。通过构建混合整数线性规划 (MILP) 与具有麦考密克不等式的二阶锥混合整数模型来解决该问题。数值研究证明，当容量相对较小时，二阶锥混合整数规划模型较 MILP 的计算时间表现更好。此外，我们还为零售商在面对不同类型的产品收入结构时对品类规划提供了一些管理启示，并为在线订购平台在无人机和人工快递合作下的配送范围设置提供了建议。

不含核的拉普拉斯二次曲面最优分布支持向量机及其在信用风险评估中的应用

周靖悦

西南财经大学

摘要：本文提出了一种用于半监督学习的拉普拉斯二次曲面最优分布 (LapQSODM)支持向量机。该模型通过流行正则项利用未标记样本嵌入的几何信息来克服标记样本不足的问题。与传统支持向量机基于最大化最小距离的思想不同，我们的模型优化了距离分布，并直接生成二次曲面实现了非线性分类。该模型不仅提高了泛化能力，而且避免了核函数搜索和调整核参数的困难。对于常规规模的数据集，我们为模型设计了经典的共轭梯度 (CG)算法进行求解，并设计了一种简单的迭代算法来计算其精确步长；对于大规模数据，我们利用一个或多个数据为 LapQSODM 的梯度设计了一个无偏估计，并为模型设计了高效且有效的随机梯度下降方差减小 (SVRG)算法进行求解。最后，我们将模型应用于人工和公共数据集，并将其应用于三个现实的风险评估问题，验证了模型的有效性。

专题报告 E8　　向量与集值优化-II

5 月 14 日 14:50-16:05　天府楼二层 7 号会议室

Abstract convexity frame for vector topical function

姚朝李

海南大学

Abstract: It is well known that convex analysis has been a powerful tool in the investigation of optimization. Many concepts and results from convex analysis play crucial roles in the research of lots of optimization problems. Due to these facts, a variety of generalizations for the classical convexity follow naturally. One of the most famous extensions is the theory known as abstract convexity. In this work, we focus on the so-called topical function, which is a typical example of abstract convex map. We introduce a new type of vector topical function. It contains some other categories of topical functions as special cases and can be interpreted as weak separation functions in image space analysis. We establish its envelope result and investigate its properties in the frame of abstract convexity. Then, we present the corresponding conjugation and subdifferential, and observe the relationships among these concepts. Finally, as applications, we obtain some dual results for some vector optimization, where the object is expressed as the difference of vector topical functions.

集优化问题的最优性理论及其应用

余国林

北方民族大学

摘要：介绍集优化问题理论及其应用方面的研究成果。

A nonmonotone projected gradient method for multiobjective optimization

赵晓芃

天津工业大学

Abstract: In this work, we consider a projected gradient method equipped with the nonmonotone line search procedure for constrained multiobjective optimization problems. We show that each accumulation point of the sequence generated by the algorithm, if exists, is Pareto stationary. The convergence of the full sequence generated by the algorithm to a weak Pareto optimal point is obtained when the multiobjective function is convex. Moreover, under some appropriate Lipschitz continuity assumption of the gradients of objective functions, a linear convergence result for this method is established.

专题报告 E9　　航空交通运筹与优化

5 月 14 日 14:50-16:05　中苑贵宾厅会议室

考虑停机位实时指派的不正常航班一体化恢复问题及基于 Benders 分解和列生成技术的算法设计

顾燕

南京航空航天大学

摘要： 不正常航班恢复是世界各航空公司普遍面临的难题，它不仅干扰了航空公司的实际运作，更会影响航空公司的经济效益和社会声誉。不正常航班恢复通常划分为航班计划、飞机排班、机组排班、旅客行程四个恢复阶段，在具体实践中按上述阶段顺序解决，但是顺序求解忽视了四者的内在联系，可能会导致次优解的产生甚至不可行。此外，不正常航班会导致停机位的预指派计划失效，因此有必要在不正常航班恢复中考虑停机位实时指派。本报告将在航班计划与飞机路径的恢复中考虑停机位实时指派，建立上述一体化恢复问题的数学模型，设计基于 Benders 分解和列生成技术的求解算法并结合问题的结构提出加速技术，最后由数值实验反映模型和方法的有效性。本报告的研究成果将极大降低航司在不正常航班恢复中产生的费用，提升资源利用率，具有重要的现实意义。

离场航班延误预测模型及算法研究

徐海文

中国民用航空飞行学院

摘要： 航班延误的产生由多方面复杂因素导致，目前航班延误预测缺少对航路网络结构等因素的考虑，以及传统多分类预测准确度不高。因此，本报告总结了航班延误预测的模型和不同类型模型，并且构建了考虑航路网络结构的离场航班延误预测模型，并针对离场航班延误预测模型设计了深度学习优化算法，旨在有效提高模型预测准确度，为民航各单位提供决策参考。

考虑时隙、机场容量和维修灵活性约束的鲁棒飞机路线恢复问题及基于 ADMM 的算法研究

张思佳

南京航空航天大学

摘要： 航班中断将导致大量不正常航班 (如延误航班和取消航班等)的产生，严重影响了航空公司的正常运营，也给旅客出行带来不便。因此一旦发生中断航空公司需尽快制定恢复方案。本报告针对飞机路线恢复问题进行优化建模，同时考虑了时隙约束、机场容量约束以及维修灵活性约束，并通过减少关键连接的方式增加恢复方案的鲁棒性。为解决模型具有大量变量和约束条件带来的求解困难，本报告提出两种基于交替方向乘子法 (ADMM)的高效算法，即线性化 ADMM-CG 和混合 ADMM-CG。在 ADMM 框架下原问题被转化为多个小规模子问题，应用模型特性和降阶方法可以将子问题线性化并通过列生成技术进行快速求解。数值实验表明本研究可以在短时间内得到比较好的恢复方案，可为

航空公司减少大量成本，提高旅客满意度，增强航空公司的市场竞争力。

专题报告 E10　非光滑变分不等式的最优化控制与算法

5 月 14 日 14:50-16:05　川汇楼二层 2 号会议室

Numerical analysis of a class of hemivariational inequalities governed by the coupled fluid-fluid flow

荆菲菲

西北工业大学

Abstract: In this work, we develop a comprehensive study on the numerical approaches for a hemivariational inequality of stationary coupled Navier-Stokes/Navier-Stokes equations. The nonsmooth and nonconvex slip interface condition of friction-type is proposed to models geophysical flows, such as the atmosphere-ocean interaction. First, solution existence and uniqueness are explored. Second, the convergence of the projection method (i.e., the Uzawa algorithm) is shown. A domain decomposition algorithm is proposed to decouple the system into two Navier-Stokes problems with the Dirichlet and friction-type slip boundary conditions on the interface, respectively. Last, we obtain the error estimates of the finite element approximation. Numerical results are reported to illustrate the optimal convergence order predicted by the error analysis.

Structure of solutions to a class of multistage stochastic linear complementarity problems

刘建勋

广西民族大学

Abstract: We consider a class of multistage stochastic linear complementarity problems (SLCPs) in this paper. We first propose the multistage SLCPs by giving the optimality conditions of a class of multistage stochastic linear program problems. Then, we investigate the existence and uniqueness of solutions to the multistage SLCPs under strongly monotonicity assumption. Moreover, we state the structure of the solutions to the multistage SLCPs.

Optimal control problems governed by variational inequalities of obstacle type

彭自嘉

广西民族大学

Abstract: This talk is concerned with optimal control of elliptic obstacle problems whose weak formulations are nonlinear variational inequalities. Under appropriate assumptions, existence of optimal solutions is proved. Moreover, the necessary conditions of optimality are derived by the Lagrange multiplier rule and approximation techniques.

A modified Tseng splitting method with double inertial steps for solving monotone inclusion problems

王中宝

西南交通大学

Abstract: Based on a double inertial extrapolation steps strategy and relaxation techniques, we introduce a modified Tseng splitting method with double inertial extrapolation steps and self-adaptive step sizes for solving monotone inclusion problems in real Hilbert spaces. Under mild and standard assumptions, we establish successively the weak convergence, nonasymptotic $O (\frac{1}{\sqrt{n}})$ convergence rate, strong convergence and linear convergence rate of the proposed algorithm. Finally, several numerical experiments are provided to illustrate the performance and theoretical outcomes of our algorithm.

专题报告 E11　　最优控制方法及其应用

5 月 14 日 14:50-16:05　东苑七层会议室

Optimal control computation for nonlinear fractional time-delay systems with state inequality constraints

刘重阳

山东工商学院

Abstract: In this talk, we develop a numerical method for solving a class of delay fractional optimal control problems involving nonlinear time-delay systems and subject to state inequality constraints. The fractional derivatives in this class of problems are described in the sense of Caputo, and they can be of different orders. First, we propose a numerical integration scheme for the fractional time-delay system and prove that the convergence rate of the numerical solution to the exact one is of 2nd-order based on Taylor expansion and linear interpolation. This gives rise to a discrete-time optimal control problem. Then, we derive the gradient formulas of the cost and constraint functions with respect to the decision variables and present a gradient computation procedure. On this basis, a gradient-based optimization algorithm is developed to solve the

resulting discrete-time optimal control problem. Finally, several example problems are solved to demonstrate the effectiveness of the developed solution approach.

基因表达调控尺度下的生物发酵过程最优控制

叶剑雄

福建师范大学

摘要： 现有的基因编辑等合成生物学技术为改造细胞工厂大量生产特定的有机物提供可能。在细胞改造过程中，如何在细胞生长和目标代谢物中寻求平横是一个关键问题。本报告以一类微生物发酵生产为背景，介绍一种利用最优控制模型刻画此类问题的数学方法。

Perimeter control with state-dependent delays: optimal control model and computational method

袁金龙

大连海事大学

Abstract: Perimeter control is to manipulate traffic flows indifferent regions through adjusting traffic signals at the border of the regions. Traditionally, the complete trips in a region are assumed to be dependent on the current accumulated vehicles in this region. This assumption is invalid because the vehicle needs time to complete its trip in a region. In order to solve this shortcoming, some recent studies have introduced a time-delay dynamical system to describe the dynamical behaviour of the accumulated vehicles in a region. However, in these studies, the perimeter control problem is formulated as a tracking problem with a given optimal reference point. In reality, such an optimal reference point is unavailable in advance. This paper will fill this gap through formulating perimeter control as an optimal control problem governed by a state-dependent time delay system. The control parametrization technique and an exact penalty method are introduced to solve such a challenging optimal control problem. Model predictive control is applied to obtain close-loop solution through solving a series of online optimal control problems. Some experiments are performed to demonstrate the effectiveness of our method.

分组报告 F1　　线性与非线性规划

5 月 14 日 16:20-17:30 川汇楼二层 1 号会议室

The contraction integral equation model with hybrid regularization for solving inverse scattering problems

刘玉凤

桂林电子科技大学

Abstract: In this paper, based on the contraction integral equation model which effectively reduces the nonlinearity of the inverse scattering problems (ISPs), and the hybrid regularization technique (modified Fourier bases-expansion (MFBE) regularization and $L_{1/2}$ regularization) which effectively alleviates the ill-posedness of ISPs, a new cost function is established. MFBE regularization is directly applied to modeling, and $L_{1/2}$ regularization is applied to unknowns to achieve more sparse solutions and better inversion efficiency. The new cost function is a non-convex, non-smooth, non-Lipschitz optimization problem. We propose an efficient contrast source inversion (CSI) type algorithm. Numerical experiments are performed on synthetic and experimental data to verify the ability of new method to recover high permittivity objects.

A new formulation of sparse multiple kernel k-means clustering and its applications

曲文涛

北京交通大学

Abstract: Multiple kernel k-means (MKKM) clustering has been an important research topic in statistical machine learning and data mining over the last few decades. MKKM combines a group of pre-specified base kernels to improve the clustering performance. Although many efforts have been made to improve the performance of MKKM further, the present works do not sufficiently consider the potential structure of the partition matrix. In this work, we propose a novel sparse multiple kernel k-means (SMKKM) clustering by introducing a ℓ_1-norm to induce the sparsity of the partition matrix. We then design an efficient alternating algorithm with curve search technology. More importantly, the convergence and complexity analysis of the designed algorithm are established based on the optimality conditions of the SMKKM. Finally, extensive numerical experiments on synthetic and benchmark datasets demonstrate that the proposed method outperforms the state-of-the-art methods in terms of clustering performance and robustness. This work was joint with Xianchao Xiu, Jun Sun, Lingchen Kong.

Proximal distance algorithms for sparse portfolio selections

赵弘欣

北京交通大学

Abstract: Machine Learning algorithms have been recently applied to portfolio selection problems due to their simplicity to implementation and solution efficiency. This paper introduces one type of such algorithms known as the proximal distance algorithm (PDA) for the sparsity-constrained portfolio optimization, which is challenging for many existing algorithms. While PDA enjoys nice convergence properties, we focus on the issue how the penalty parameter would influence the solution quality. In particular, we study the ϵ-optimality of the penalized problem and establish an exact penalty result for the long-only sparse portfolio under certain conditions. We further introduce a new variant of PDA that is based on the exact penalization making use of the distance function to the sparsity set. We circumvent the nondifferentiablity issue of the distance function by applying the majorization-minimization technique to develop the corresponding PDA. We also report extensive numerical results to validate the efficiency of the introduced PDAs. Specifically, the proposed portfolios demonstrate the superior out-of-sample performance by comparing with several state-of-the-art portfolio strategies.

分组报告 F2 线性与非线性规划

5 月 14 日 16:20-17:30 川汇楼二层 3 号会议室

两分块一般线性约束光滑优化的部分可行分布式 SQP 算法

陈文睿

广西大学

摘要： 本文讨论一般线性约束两分块光滑优化问题. 所讨论问题有广泛的应用背景，如电力系统经济调度、数据挖掘、信号处理等.针对问题的特殊结构研究高效的求解方法，具有重要的学术价值和实际意义. 本工作旨在建立问题的新型部分可行分布式 (PFD)序列二次规划 (SQP) 算法 (PFD-SQP 算法). 算法的设计以 SQP 算法思想为主线,借鉴交替方向乘子法 (ADMM)分裂思想，将二次规划 (QP) 子问题分解成两个可独立并行求解的小规模 QP. 在设计小规模 QP 时，对不等式约束引入了一个恰当的可调控的新型扰动收缩项，使其产生的搜索方向的可行性步长得以增大乃至达到 1. 以仅包含等式约束的部分增广拉格朗日函数作为效益函数，使用 Armijo 线搜索技术产生新迭代点. 迭代点始终满足问题的所有不等式约束. 分别在适当的假设条件下, 分析并获得了 PFD-SQP 算法的全局收敛性、迭代复杂性、线性收敛率、超线性收敛率和二次收敛率等良好的理论性质. 最后基于一类数学例子及电力系统经济调度模型，初步检验了算法的数值效果.

稀疏-低秩矩阵恢复问题的渐进凸差方法

丁明才

石河子大学

摘要： 考虑稀疏-低秩矩阵恢复模型的优化问题，它是一种带秩约束与势约束的最小二乘问题。我们采用 Moreau 光滑化技术将势约束或秩约束的指示函数转化成凸差 (DC)正则函数，而得到的子问题仍然是没有显式的 DC 分解的非凸非光滑问题。为了解决这个问题，我们借助 KyFan 范数将另一个约束转化为等价的 DC 等式约束，并采用罚方法将其罚到目标函数中，从而将原问题转化为标准 DC 规划。我们研究了该问题的全局、局部精确罚理论。采用渐近的策略更新 Moreau 光滑化参数和罚参数，从而提出了渐近 DC (ADC)方法来求解原问题。为了求解相应的 DC 规划，我们提出了一种高效的带筛选策略的非精确 DCA (siDCA)算法框架，证明了 siDCA 产生的迭代序列全局收敛到 DC 问题的稳定点，并采用基于对偶的半光滑牛顿方法 (SSN)求解 siDCA 的子问题，从而提出了基于 SSN 方法的 siDCA (siDCA-SSN)。为了验证 ADC-siDCA-SSN 求解稀疏-低秩矩阵恢复模型的高效性，我们将 ADC-siDCA-SSN 用于非负矩阵和半正定矩阵情形下的稀疏-低秩矩阵恢复，并与逐次 DC 近似方法以及罚邻近交替线性极小化方法进行对比。数值实验结果表明，ADC-siDCA-SSN 从求解效率与恢复误差两方面要优于其它两种方法。此外，我们将 ADC-siDCA-SSN 应用于稀疏相位恢复，实验结果表明，该算法对于求解稀疏-低秩的半正定 Hermite 矩阵恢复问题是有效的。

A moment-sos hierarchy for robust polynomial matrix inequality optimization with SOS-convexity

郭峰

大连理工大学

Abstract: We study a class of polynomial optimization problems with robust polynomial matrix inequality constraints and an uncertainty set defined also by a polynomial matrix inequality. We construct a hierarchy of moment-SOS relaxations for such a problem under some SOS-convexity assumptions. To this end, we apply the Positivstellensatz for polynomial matrices and its dual matrix-valued moment theory to a conic reformulation of the problem. The finite convergence of the relaxations can be certified if some flat extension condition holds. To extract the global optimal solutions in this case, we provide a linear algebra procedure to recover the representing matrix-valued measure of the corresponding truncated matrix-valued moment problem. The moment-SOS relaxations can be simplified when the considered problem is linear, which can be applied to the problem of minimizing the smallest eigenvalue of a polynomial matrix subject to a polynomial matrix inequality.

分组报告 F3　　线性与非线性规划

5 月 14 日 16:20-17:30 天府楼二层 5 号会议室

Structured joint sparse orthogonal nonnegative matrix factorization for fault detection

张茜

北京交通大学

Abstract: As modern industrial processes become complicated, and some faults are difficult to be detected due to noises and nonlinearity of data, data-driven fault detection has been extensively used to detect abnormal events in functional units. In order to obtain the better fault detection performance of nonnegative matrix factorization, this paper first proposes a fault detection method using the structured joint sparse orthogonal nonnegative matrix factorization. The core idea is to incorporate the graph regularization, sparsity and orthogonality constraints into the classical nonnegative matrix factorization, which enjoys stronger discriminative ability, removes redundancy of different basis vectors and improves the fault interpretability. More importantly, an optimization algorithm based on the proximal alternating nonnegative least squares is developed, which can guarantee and speed up the convergence. Finally, the effectiveness of the proposed method is demonstrated by the experiments on the benchmark Tennessee Eastman Process and two practical bearing datasets. Particularly, compared with the classical nonnegative matrix factorization, the T^{2} statistic has a gain of 33.13% for the fault IDV (16) on the Tennessee Eastman Process. The results show that the proposed model and algorithms are promising for the fault detection.

Microphone array placement design based on Bayesian optimization

张雨涵

中南大学

Abstract: Given a placement of microphone array, an optimization problem for beamformer design is to find a group of filter coefficients for the generation of desired beamforming response. Taking into consideration of the influence of array placement, a composite optimization problem with respect to filter coefficients and array placement has been raised. In general, the placement variables are nested in the transfer function (impulse response), it leads to a complex and non-convex optimization problem. In this talk, we propose a new microphone array placement design method by employing the Bayesian optimization technique. We first generate a Gaussian process as a surrogate model for the objective of array placement problem. Then the posterior probability distribution of array placement is estimated with the help of joint Gaussian distribution. And a new placement candidate can be captured by adopting proper acquisition function. We also report some experimental results to verify the performance of the proposed method.

An inertial Bregman Peaceman-Rachford splitting method for nonconvex optimization problems with linear constraints

赵永欣

北京交通大学

Abstract: In this paper, we propose an inertial Bregman Peaceman-Rachford splitting method (IBPRSM) for solving a class of nonconvex optimization problem. The method combines the proximal Peaceman-Rachford splitting method with its inertial variant, by using Bregman distance to replace Euclidean distance as proximal term. Under some assumptions, we prove that the iterative sequence generated by the proposed algorithm converges to a critical point of the considered problem. Under the assumption that the associated function satisfies the Kurdyka-Lojasiewicz property, we prove the strong convergence of the IBPRSM. Finally, we report some preliminary numerical results to verify the efficiency of the proposed method.

一个带重启步的有界约束共轭梯度法

朱亦晗

广西民族大学

摘要： 对于有界约束优化问题，根据 Facchinei，J\'{u}dice 和 Soares 提出的积极集识别技术对积极变量进行更新，利用带有重启步的共轭梯度法对非积极变量进行更新，从而求解有界约束优化问题。提出的算法在严格互补性条件成立的情况下，每次迭代产生可行点，且目标函数值序列单调递减。最后，通过数值实验表明新算法在求解有界约束优化问题的有效性。

分组报告 F4　　非光滑优化

5 月 14 日 16:20-17:30 天府楼二层 6 号会议室

非凸非光滑不可分优化的两个线性邻近 Peaceman-Rachford 分裂算法

蔡靖民

广西民族大学

摘要： 本文研究一类非凸非光滑不可分优化。基于 Peaceman-Rachford (PR)分裂算法，并结合 Armijo 线搜索技术及线性正则化技术，提出了两个线性邻近 PR 分裂算法。利用 PR 分裂算法思想，将增广拉格朗日法涉及的子问题分解成两个小规模子问题。为便于子问题的求解和使其具有良好的理论性质，对子问题的目标函数中的光滑项作线性化处理，并分别添加必要的正则项。在常规假设下，论证了算法的全局收敛性及迭代复杂性。最后，数值实验结果表明算法是有效的。

A descent method for nonsmooth multiobjective optimization problems on Riemannian manifolds

何毫

广西大学

Abstract: In this work, a descent method for nonsmooth multiobjective optimization problems on complete Riemannian manifolds is proposed. The objective functions are only assumed to be locally Lipschitz continuous instead of convexity used in other methods. The necessary condition for Pareto optimality in Euclidean space is generalized to the Riemannian setting. At every iteration, an acceptable descent direction is obtained by constructing a convex hull of some ε-subgradients. And then a Riemannian Armijo-type line search is executed to produce the next iterate. The convergence result is obtained under the assumption that at least one objective function is bounded below and the employed retraction and vector transport satisfy certain conditions. Finally, some preliminary numerical results are reported, which show that the proposed method is efficient.

A dual-based stochastic inexact algorithm for a class of stochastic nonsmooth convex composite problems

杨振平

嘉应学院

Abstract: In this paper, a dual-based stochastic inexact algorithm is developed to solve a class of stochastic nonsmooth convex problems with underlying structures. This algorithm can be regarded as an integration of a deterministic augmented Lagrangian method and some stochastic approximation techniques. By exploiting the second order sparsity, each subproblem is solved by a superlinearly convergent semismooth Newton method in an efficient way. We derive the almost surely convergence property and convergence rate in expectation of the objective value. Furthermore, we present some results related to convergence rate of the distance between iteration points and solution set under error bound conditions. Numerical results show that the proposed algorithm compares favorably with some existing methods.

Distributed scaled proximal ADMM algorithms for cooperative localization in WSNs

张美

四川大学

Abstract: Distributed cooperative localization in wireless networks is a challenging problem since it typically requires solving a large-scale nonconvex and nonsmooth optimization problem. In this report, we reformulate the classic cooperative localization problem as a smooth and constrained nonconvex minimization problem while its loss function is separable over nodes. By utilizing the structure of the

reformulation, we propose two novel scaled proximal alternating direction method of multipliers (SPADMM) algorithms, which can be implemented in a distributed parallel manner. Compared with the semi-definite programming relaxation technique, the proposed algorithms enjoy lower computation complexity. In addition, based on the established potential function, we showed that the proposed algorithms are able to converge to a stationary point of the original nonconvex and nonsmooth problem with a sublinear convergence rate of O (1/T), where T is the iteration counter. Numerical experiments on various benchmarks have consistently shown that the proposed SP-ADMM algorithms are superior to state-of-the-art methods in terms of localization accuracy and computational time.

分组报告 F5　　次模优化与聚类

5 月 14 日 16:20-17:30　中苑迎晖厅会议室

关于 DR 次模性质的研究

刘治成

北京工业大学

摘要： DR 次模函数被广泛的应用在组合优化，机器学习，经济学等问题中。本文中，我们研究 DR 次模函数的一些相关性质以及求解 DR 次模函数最大化的算法。

满足给定约束的 k-1 条不相交路径问题的存在性研究

孙悦

北京工业大学

摘要： 给定有向图 G= (V，E)，每条边有两个非负权值：权重 w (e)和长度 l (e)。针对不同的节点 s, t，带约束的 k 条不相交最短路径问题是指计算出 k 条不相交路径，使得 k 条路径总长度之和最小，总权重之和满足给定的上界约束 W。在带有权重约束的端到端视频传输、构建具有最小成本的时间敏感的可生存网络等网络问题中有广泛应用。本文基于 Guo (JOCO，2015)使用 LP-rounding 技巧得到的 (2，2)-双因子近似，通过分析分数边对应的图结构，证得分数边对应的图恰好是一个圈，还给出了满足上界约束 W 和 k 条不相交路径总费用 OPT 的 k-1 条不相交路径的存在性分析过程。

带异常点的公平聚类问题研究

田晓云

摘要：人工智能的发展为人们的生活提供诸多便利，一些重要决策正在算法的帮助下实现自动化，比如刑事判决、福利评估、简历筛选、犯罪预测、药物检测、广告推荐等。用理性的算法代替人类作出决策似乎会消除任何一种"偏见"，但是"大数据杀熟"、推荐系统结果误差大等现象普遍存在。公平聚类是探索数据"待遇"公平性的研究热点之一。所谓公平是指数据集合中数据本身固有的种族、性别、年龄或其他敏感属性等在聚类过程中不会产生偏见，聚类结果不对"弱势群体"造成更不利的影响。此外，当数据集合存在异常点时，会对聚类效果产生极大影响。为此，本报告将考虑带异常点的公平聚类问题，通过贪婪算法、匹配和搜索等技巧设计近似算法并给出理论分析过程。

单面光滑函数最大化问题的算法研究

张洪祥

北京工业大学

摘要：集合函数的多线性扩展的工作研究突破得到了集合次模函数最大化问题的 (1-1/e)-近似比。本文中我们通过探索一系列参数化函数 (单面光滑函数)及其相关应用，推广了连续 DR 次模函数最大化问题的研究。对于单面光滑函数最大化问题，Mehrdad 等 (SODA 2021)基于条件梯度法的思想提出了第一个连续积分贪婪近似算法。他们给出了离散和连续的算法分析过程，但这两种分析都有局限性。连续积分的证明需要无穷小的步长，这导致了较高的复杂性。离散分析过程需要一个有界的局部条件。我们克服了上述困难，给出了更一般的离散算法和较为通用的算法分析工具。此外还给出了单面光滑函数最大化问题的并行计算框架及其理论分析过程。

分组报告 F6　　博弈论、管理中的优化

5 月 14 日 16:20-17:35 中苑西侧会议室

Realization of Nash equilibrium in two-population games based on differential evolution algorithm

王国玲

贵州大学

Abstract: Until now, the majority of algorithms for solving and realizing Nash equilibria of games are based on multiplayer game models. However, most games in reality are played between populations, and the question about how the Nash equilibrium of the population game is realized remains to be solved. Two-population games as the most typical type of population games, therefore, this paper proposes an algorithm called PGDE to realize Nash equilibria of two-population games by combining Fudenberg's social

learning and Schlag's population imitation theory and using Differential Evolution algorithm as a tool. The algorithm obtains the following results through rigorous convergence theoretical analysis and simulation analysis: firstly, for the case where there is only one Nash equilibrium distributed at the endpoints of the simplex, when the initial social state is random, the final results converge completely to the Nash equilibrium; secondly, for the case where there is only one Nash equilibrium distributed in the interior of the simplex, when the initial social state is random, the experimental results fluctuate around the Nash equilibrium, and when the initial social state is the Nash equilibrium, experimental results remains unchanged; thirdly, for the case where there is more than one Nash equilibrium, when the initial social state is the Nash equilibrium distributed in the interior of the simplex, experimental results remains unchanged, otherwise, the final convergence result is the Nash equilibrium distributed at the endpoints of the simplex.

Generic stability of cooperative equilibria for mixed games

武文俊

贵州大学

Abstract: We present a new game model, multi-leader-population-follower mixed model, in which the leaders play the n-noncooperative games, and the population followers play the population game. In this mixed game we give an interesting game phenomenon: in leadership each agent will cooperate with others through forming a coalition, but in the meantime can be influenced by the agents outside the coalition and followers' population social state; in the followership different populations have cooperative behaviors, but in the meanwhile can be influenced by the leaders' decision and followers' population social state. So, we introduce the concept of cooperative equilibrium and provide the existence in mixed games. Finally, in the perturbation of the payoff functions, we verify that most of the set of cooperative equilibria for multi-leader-population-follower mixed games are stable.

Benders decomposition for the multiple gradual cover location problem

王彦儒

北京理工大学

Abstract: In this talk, we consider the multiple gradual cover location problem (MGCLP), which involves identifying a set of K open facilities that can maximizes the weighted sum of the joint partial coverage over all customers. We propose a compact mixed integer linear programming formulation, which compared with previous formulations, is much more compact in terms of smaller number of variables. We develop an efficient Benders decomposition (BD) algorithm for the MGCLP based on the newly proposed formulation. Computational results on 240 Benchmark instances show that our proposed BD algorithm outperforms the state-of-the-art algorithms by at least one order of magnitude on the hard instances. In particular, with the proposed BD algorithm, we are able to provide optimal solutions for 48 previously unsolved instances. This is a joint work with Yi-Long Chen, Wei-Yang Zhang, Dr. Wei-Kun Chen, and Prof. Yu-Hong Dai.

非线性鲁棒易逝品配送规划

魏彦姝

河北大学

摘要：冷链物流是维持最佳低温运输、确保食品质量和减少食品消耗的系统工程。由于易腐产品的特点，冷链物流的管理更具挑战性。我们提出一种考虑碳排放和产品新鲜度的基于不确定场景的易腐产品鲁棒配送规划模型，首先，分析易腐产品的经济成本和新鲜度，将碳排放水平转化为碳排放成本。其次，为了最小化总成本和最大化产品新鲜度，建立了一个非线性双目标规划模型。第三，考虑到客户需求和产品损失率的不确定性，使用鲁棒优化方法将确定性模型重新表述为可计算的鲁棒对等模型，然后提出基于线搜索技巧的信赖域 SQP 滤波方法以解决该问题。

不确定环境下可持续闭环供应链弹性问题的研究

赵冰

河北大学

摘要：近年来，闭环供应链的可持续管理已成为几乎每个企业战略的重要组成部分。供应链管理人员在设计和规划供应链时，希望能够通过整合经济、环境和社会等目标，实现企业的可持续发展。除此之外，有效的供应链网络设计还需要考虑模型中存在的固有不确定性，以及由重大事件和操作突发事件引起的中断风险。因此，研究如何设计一个不仅高效且富有弹性的闭环供应链，能够在中断情况下运行和满足需求的连续性是必要的。 本文在不确定环境下，建立了一种两阶段分布鲁棒优化模型，用于设计一个在面对中断风险时能够弹性执行的可持续闭环供应链网络。首先，该模型考虑了供应商和生产中心两类设施可能发生的随机中断，并旨在通过供应商强化、恢复、与备用供应商签约、横向转运等策略来应对。其次，针对中断场景发生的不确定性和可获取的有限历史数据，我们采取了具有Wasserstein 非精确集的分布鲁棒优化方法，来获取具有鲁棒性的解。在求解方面，利用对偶性和线性化技术，将所建立的鲁棒模型转化为混合整数线性规划形式，并借助于 Gurobi 求解器进行求解。最后对模型进行了实例应用和影响参数的灵敏度分析，数值结果表明：考虑弹性措施对缓解中断危害带来了显著影响；加入反向供应链的回收策略可有效降低生产成本；与随机和经典鲁棒模型相比，突出了本文模型的优点。

分组报告 F7　　管理中的优化

5 月 14 日 16:20-17:30 天府楼一层 10 号会议室

Privacy preserving decentralized learning

李梅

北京交通大学

Abstract: Decentralized learning has been hugely successful, which minimizes a finite sum of expected objective functions over a network of agents. Different from centralized learning, decentralized learning allows agents to collaboratively learn by communicating with their neighbors. Despite each node communicating with its neighbors by sending parameters instead of directly exchanging raw data, the risk of leaking private information still exists. To address this challenge, we propose a general differentially private (DP) learning framework for decentralized data based on the popular KM iteration method. We show that the proposed DP-KM algorithm retains the performance guarantee in terms of stability, generalization, and investigate the impact of local privacy-preserving computation on the DP guarantee. Further, we extend the discussion by adopting a new class of noise-adding DP mechanisms based on generalized Gaussian distributions to improve the utility-privacy trade-offs. Our numerical results demonstrate the effectiveness of our algorithm and DP mechanisms and its better performance over the state-of-the-art baseline methods in various decentralized settings.

Social welfare maximization for efficient resource sharing and allocation in fog-assisted IIoT systems

刘欢

燕山大学

Abstract: Empowered by the emerging fog computing technology, the Industrial Internet of Things (IIoT) characterizes a novel service-oriented mode, which can provide agile and reliable services residing in close proximity to the terminal environment of smart manufacturing. However, there are still critical challenges for fog-assisted IIoT systems in how to efficiently allocate the resources of fog servers with limited resource capacities to IIoT devices with diverse resource requirements. To resolve the above challenges, we firstly propose a fog-assisted IIoT resource sharing and allocation framework, which integrates the conventional three-layer fog computing architecture with software-defined network (SDN) technology, to facilitate the management of fog resources in industrial environments. Apart from describing the general framework, we formulate a parallel and distributed fog-assisted IIoT resource sharing and allocation problem for maximizing social welfare and achieving the desired trade-off optimization, which jointly takes the utility of IIoT devices and the cost of fog servers into account. Then we also design the ADMM-based algorithm for the purpose of appropriately decomposing the corresponding optimization problem to each IIoT device and fog server for distributed computing in both single fog server and multiple fog servers IIoT scenarios. Finally, we perform a series of theoretical and numerical analyses to manifest the effectiveness and reliability of the proposed mechanism compared with other related methods for the fog-assisted IIoT systems.

信息不对称视角下企业证券化融资的信号传递

张勇

吉首大学

摘要： 从信息不对称视角出发，利用实物期权信号传递模型，以及信号博弈分离均衡理论，研究多企业证券化融资中的企业质量识别问题。具体地，我们根据多企业 ICC 条件建立数理模型，得到了多企业下的分离均衡条件、最佳投资时机、分离最小质量差以及最低逆向选择成本，通过数值模拟分析，验证了有效投资时机及其影响因素，达到了识别和筛选资产池中的企业质量的目的。研究结果表明：第一，当所有分离企业与其它剩余企业的质量差大于分离最小质量差时，多企业分离均衡才确定存在，而且分离最小质量差与运营总成本、波动率呈负相关关系。第二，多企业 ICC 下的投资时机是反映企业质量的有效信号，并且企业质量越好，其投资时间越早。第三，在好企业与差企业质量相差足够大的多企业市场中，随着中企业质量的逐渐增加，好企业与其分离的成本依次经过无成本分离、分离成本增加、分离成本减小、不能分离四个阶段。以上结论还为企业合理制定投资和融资策略提供了理论基础和实践支持。

分组报告 F8　　通信中的优化、变分不等式与互补问题

5 月 14 日 16:20-17:30 天府楼二层 7 号会议室

Accelerating coordinate descent for covariance-based activity detection in cooperative multi-cell massive MIMO

王子岳

中国科学院数学与系统科学研究院

Abstract: We consider the device activity detection problem in the multi-cell massive multi-input multi-output (MIMO) system, where the active devices transmit their signature sequences to multiple base stations (BSs) in multiple cells and all the BSs cooperate to detect the active devices. The device activity detection problem has been formulated as a maximum likelihood maximization (MLE) problem in the literature. The coordinate descent (CD) algorithm that iteratively updates the variable associated with each device is the state-of-the-art algorithm for solving the problem. However, there are two drawbacks of the CD algorithm: first the algorithm fails to exploit the special sparse structure of the solution of the MLE problem and second the computational cost of updating one variable is high. In this talk, we propose two strategies to overcome the above two drawbacks and accelerate the CD algorithm. Numerical results show that the proposed acceleration strategies can significantly improve the computational efficiency of the CD algorithm.

A novel negative l1 penalty approach for one-bit precoding

武哲宇

中国科学院数学与系统科学研究院

Abstract: One-bit precoding is a popular problem in 5G wireless communications. Mathematically, the problem can be formulated as an optimization problem with piece-wise linear objective and discrete one-bit constraint. This talk will introduce a negative $\ell 1$ penalty approach for solving the problem. Specifically, the approach is based on an exact negative $\ell 1$ penalty model, which penalizes the one-bit constraint into the objective with a negative $\ell 1$-norm term. To solve the penalty model, we further transform it into an equivalent min-max problem and propose an efficient alternating optimization (AO) algorithm. The AO algorithm enjoys low per-iteration complexity and is guaranteed to converge to a stationary point of the min-max problem. Numerical results show the superiority of the negative $\ell 1$ penalty approach over the existing approaches.

Stochastic Bregman projected reflected gradient algorithm for non-monotone stochastic variational inequalities

杨澈洲

重庆工商大学

Abstract: In this paper, we propose a stochastic Bregman projected reflected gradient algorithm with variance reduction for the stochastic variational inequality. A salient feature of the algorithm only requires single projection per iteration, and so it reduces the computation load. Under the Minty variational inequality condition, we obtain some properties of the asymptotic convergence and the $\mathcal{O}(1/t)$ convergence rate in terms of the restricted residual function. Moreover, we derive the iteration complexity $\mathcal{O}(1/{\epsilon})$ and the optimal oracle complexity $\mathcal{O}(1/{\epsilon^2})$. Finally, numerical experiments illustrate the competitive of our proposed algorithm.

Variance-based operator extrapolation algorithm for stochastic mixed variational inequalities beyond Lipschitz continuity

杨静

重庆工商大学

Abstract: In the study of stochastic mixed variational inequalities, the Lipschitz continuity is a indispensable assumption for the convergence analysis. However, this assumption may fail in many practice applications. In this paper, we propose a variance-based operator extrapolation algorithm for solving

stochastic mixed variational inequality problems. One salient feature of the algorithm is that it requires only one evaluation of the expected operator and one generalized Bregman projection calculation per iteration. Furthermore, we deduce the optimistic convergence rate $\mathcal{O} (1/T)$ without the assumption of Lipschitz continuity. Finally, we apply the proposed algorithm to solve regularized logistic regression problems, stochastic network game problems and resource sharing problems. The simulation results show the advantages of our algorithm comparing the existing algorithm.

Γ-robust linear complementarity problems with ellipsoidal uncertainty sets

谭露琳

华南师范大学

Abstract: We study the existence of solutions of Γ-robust linear complementarity problems, in which Γ plays a role in adjusting the robustness of the model against the level of conservatism of the solution. If the Γ-robust uncertainty set is nonconvex, it is hard to prove the existence of the solution of the corresponding robust counterpart. Using the techniques of asymptotic functions, we prove the existence theorems for the corresponding robust counterparts in the case of the nonconvex Γ-robust ellipsoidal uncertainty set, which is not established in the paper [Krebs et al., Int. Trans. Oper. Res. 29 (2022), pp. 417--441].

分组报告 F9　　张量优化

5 月 14 日 16:20-17:30 中苑贵宾厅会议室

非负张量谱范数与 Frobenius 范数的极端比率

曹圣宇

上海财经大学

摘要： 多重线性代数中的一个基本问题是张量的谱范数和 Frobenius 范数之间的最小比率，近年来引起了人们的广泛关注。尽管大多数情况下，实数和复数张量的此比率均未知，但已经确定了渐近数量级和紧密下界。然而，对于非负张量，目前还知之甚少。本文提供了非负张量的比率几乎完整的分析。特别地，本文提供了一种紧密下界，它可以通过一个简单的充分必要条件被非常广泛的非负张量实现，这有助于刻画达到该最小比率的张量并获得诸如渐近数量级等结果。另一方面，本文发现对称张量的谱范数和 Frobenius 范数最小比率不超过一般张量的常数倍，且该常数仅关于张量阶数有关，从而确定了实数、复数和非负对称张量该利率的渐近数量级。最后，本文发现非负张量的谱范数和 Frobenius 范数之间的最小比率以及 Frobenius 范数和核范数最小比率是不同的，这与实数张量和复数张量的情

况形成了鲜明的对比。

Extension of Newton's method for solving tensor equation with semi-symmetric technique

甘甜

中南大学

Abstract: In the past decades, tensor computation has attracted lots of attention in the fields of chemometrics, signal processing, computer vision, linear algebra, and so on. It usually includes tensor decomposition, computations of tensor eigenvalue and tensor equation. Generally speaking, tensor equation, also called multi-linear system, can be viewed as a kind of nonlinear equation. And customized algorithms have been developed to solve them with particular characteristics, for instance, the Newton method for the multi-linear systems with M-tensors. In this talk, we present an extended version of Newton's method for the solving of tensor equation without common qualifications. We introduce a kind of semi-symmetric technique to reformulate the general multi-linear system with equidimensional tensor. It is essential to calculate the Jacobi matrix of nonlinear function. Then we employ the Newton's method to solve it correspondingly. In the final, numerical experiments will be reported to verify the performance of the proposed method.

三阶张量 Triple 分解的一种自适应算法研究

秦康

广西大学

摘要：Triple 分解，是近年来被提出的一种针对于三阶张量的新型分解方法，并且其具有良好的分解性质和应用前景。在 Triple 分解中使用了一种被称为改良型交替最小二乘法的算法，其迭代步中用到了固定系数的外推方法。在本文中，我们引入自适应方法，提出了一种自适应的改良型交替最小二乘法算法，即通过构造一系列和该外推系数有关的最优化问题，使用自适应外推系数项代替原有的固定外推系数项，使得新算法中的每一个迭代步都得到了优化。同时，我们从理论上证明了新算法生成的无穷张量迭代序列具备全局收敛性质和较弱的线性收敛速度。数值实验部分也证明了新算法在分解精度、迭代步数和运算时间上都相较原始算法有着更好的表现。

分组报告 F10　金融中的优化、统计中的优化

5 月 14 日 16:20-17:30　川汇楼二层 2 号会议室

考虑尾部风险的风险度量优化和风险预测方法

李伟梅

辽宁工程技术大学

摘要：风险度量是金融市场风险管理研究中的极其重要的内容之一，风险度量一般数学化为方差风险度量，偏峰风险度量和厚尾风险度量，尾部风险度量是其中最容易忽略但又十分重要的一部分，重点分析的是小概率突变等风险度量。一般风险度量和风险预测基于分布参数估计问题和 3sigma 原理的极大似然估计原理，分布尾部估计误差易于忽略，由此造成尾部风险度量误差权重被错误低估，在实际风险管理决策中会引发严重的后果。因此，首先引入鲁棒风险度量优化。对不确定分布信息的捕捉需依赖不完善的假设和估计，分布尾部反映直接影响分布预测的精准度。在构造鲁棒风险度量优化模型不确定集时，创造性地提出基于 Wasserstein 距离的分布估计修正方法，克服已有参数分布无法反映真实分布尾部行为的限制。鉴于分数阶矩对分布尾部信息的精准刻画能力，在解析分布估计的基础上建立分数阶矩约束的鲁棒风险度量模型。其次研究了期望分位数 (Expectile)对分布尾部信息的敏感性，提出基于 Expectile 的已实现 GARCH 模型对金融市场中收益率波动风险的预测，最后对尾部风险的修正和精准设计的风险度量理论和方法进行展望。

L1-范数正则分位数回归的筛选规则

尚盼

北京交通大学

摘要：大规模高维数据中常常伴有异常值或缺失值，数据误差可能具有异方差，误差分布可能具有重尾分布、甚至分布未知等特点，这使得正则化稳健回归方法的研究十分重要而且必要。其中，L1-范数正则分位数回归是一类常用的统计方法。为了加速高维情况下正则化回归模型的求解，研究者们针对不同的统计方法建立了相应的筛选规则。根据现有文献分析，正则化回归的筛选规则大都集中在以二次函数为损失函数的模型上，如：LASSO、Elastic Net、Fused LASSO、Group LASSO，其使用的技巧包含单位梯度假设、次微分的单调性、投影算子的性质、变分不等式和半空间约束等。然而，上面技术建立的筛选规则不能用于加速 L1-范数正则分位数回归优化模型的求解。本研究首次提出对偶外切球技术，由此建立了 L1-范数正则分位数回归的筛选规则。通过给定数据，该筛选规则一方面可以删除数据中的非积极特征，从而降低数据维数。另一方面，此筛选规则可以嵌入到 L1-范数正则分位数回归相应的优化问题的任何求解算法，理论结果保证嵌入筛选规则的算法在保持计算效果不变的情况下节约了大量的计算时间。数值实验验证了该筛选规则的有效性。

Estimation of error variance in regularized regression models via

adaptive Lasso

王鑫

北京交通大学

Abstract: Estimation of error variance in a regression model is a fundamental problem in statistical modeling and inference. In high-dimensional linear models, variance estimation is a difficult problem, due to the issue of model selection. In this paper, we propose a novel approach for variance estimation that combines the reparameterization technique and the adaptive lasso, which is called the natural adaptive lasso. This method can, simultaneously, select and estimate the regression and variance parameters. Moreover, we show that the natural adaptive lasso, for regression parameters, is equivalent to the adaptive lasso. We establish the asymptotic properties of the natural adaptive lasso, for regression parameters, and derive the mean squared error bound for the variance estimator. Our theoretical results show that under appropriate regularity conditions, the natural adaptive lasso for error variance is closer to the so-called oracle estimator than some other existing methods. Finally, Monte Carlo simulations are presented, to demonstrate the superiority of the proposed method.

多半定约束优化的随机逼近方法

张明堃

石河子大学

摘要： 半定规划问题的算法研究已趋于成熟，但在实际问题中常遇到大量半定约束的情况。例如信号覆盖问题，鲁棒桁架设计问题，时变线性系统的稳定性的判别等。这一类问题如果仍然使用经典的半定规划方法，将面临高昂的计算成本的，即乘子的数量巨大且缓存昂贵。本次报告针对这类问题设计了随机逼近类的方法，型的方法可分为两步，第一步是对目标函数的下降方向步，第二步可视为随机选取一个半定约束执行可行方向步。这一方法有效的降低了计算成本，并在较弱的条件下有算法收敛的理论保证。

The analysis of two-population replicator dynamics with periodic impulses

房才雅

贵州大学

This paper investigates the stability of replicator dynamics with periodic impulses in two population game. First, the model of a game with interacting populations is proposed. Precisely, individuals involved in the

strategic interactions compete with opponents in intragroup and intergroup with different probabilities. Further, the replicator dynamics which characterize the interaction overlap are derived, and we obtain the stability conditions for the unique interior Nash equilibrium. After introducing the periodic impulses, we determine that the boundary equilibrium can be stable, which shows that the evolution of strategies is affected by impulsive effects. Last but not least, we utilize our theoretical results in the two-community Hawk-Dove games.

分组报告 F11　人工智能与机器学习中的优化

5 月 14 日 16:20-17:30　东苑七层会议室

An adaptive weighted self-representation method for incomplete multi-view clustering

常静雅

广东工业大学

Abstract: For multi-view learning problems coming from reality, it is common that missing data occur. Thus, we consider the incomplete multi-view clustering problem. In the clustering process, the influence of each view of one object may be different and the data are often low rank. On the other hand, self-representation subspace method works well on multi-view clustering problem. Taking these factors into account, we propose an adaptive weighted self-representation subspace clustering (AWSR)method for solving the incomplete multi-view clustering problem. The AWSR method employs a weight matrix to measure the contribution of each missing view, and seeks for the low rank coefficient matrix to enhance the clustering effect. Moreover, the regularization terms are properly designed to eliminate the possible data noise and keep the convexity property of the objective function. The convergence analysis is provided for the alternate minimization algorithm of the AWSR model. Meanwhile, numerical experiments of AWSR method are implemented on five real datasets. The numerical performance shows that the AWSR method is effective and delivers superior results when compared to other six common approaches considering the clustering accuracy, normalized mutual information and purity.

Distributed stochastic gradient tracking methods with momentum acceleration for non-convex optimization

高娟

河北工业大学

Abstract: We consider a distributed non-convex optimization problem of minimizing the sum of all local

cost functions over a network of agents. This problem often appears in large-scale distributed machine learning, known as non-convex empirical risk minimization. We propose two accelerated algorithms, named DSGT-HB and DSGT-NAG, which combine the distributed stochastic gradient tracking (DSGT) method with momentum accelerated techniques. Under appropriate assumptions, we prove that both algorithms sublinearly converge to a neighborhood of a first-order stationary point of the distributed non-convex optimization. Moreover, we derive the conditions under which DSGT-HB and DSGT-NAG achieve a network-independent linear speedup. Numerical experiments for a distributed non-convex logistic regression problem on real data sets and a deep neural network on the MNIST database show the superiorities of DSGT-HB and DSGT-NAG compared with DSGT.

Spatial group sparsity and $l_{1/2}$ regularized nonnegative matrix factorization for hyperspectral unmixing

高琦

北京交通大学

Abstract: Hyperspectral unmixing plays an important role in the application of hyperspectral images. In order to obtain the more accurately extract endmembers and correspond abundances, a novel unmixing model called the Spatial Group Sparsity and $L_{1/2}$ regularized Nonnegative Matrix Factorization (SGS-$L_{1/2}$-NMF) is proposed for the hyperspectral unmixing, which is based on the fact that hyperspectral data has the group structure and abundance matrix has the sparsity. The spatial group sparsity and $L_{1/2}$ norm as regularized terms are added to the classical NMF for enforcing sparsity, where the adaptive superpixels space group is generated by the improved simple linear iterative clustering (ISLIC). The proposed model is non-Lipschitz nonconvex, and a smoothing active set method is introduced to solve it. Experimental results demonstrate the effectiveness of the proposed model through the both simulated data and real hyperspectral data, respectively.

Splitting method for support vector machines in reproducing kernel Banach spaces

莫明煜

华南师范大学

Abstract: In this talk, we use the splitting method based on alternating direction method of multipliers (ADMM) for support vector machines (SVM) in reproducing kernel Banach spaces (RKBS) with lower semi-continuous loss functions. Making use of Kurdyka-Lojasiewicz inequality, the iterative sequences obtained by these splitting methods are globally convergent to a stationary point if the loss functions are lower semi-continuous and subanalytic. Finally, several numerical performances demonstrate the

effectiveness.

青年邀请报告

New gradient methods for smooth unconstrained optimization problems

孙聪

北京邮电大学

Abstract: In this talk, a new gradient method for unconstrained optimization problem is proposed, where the stepsizes are updated in a cyclic way, and the Cauchy step is approximated by the quadratic interpolation. Combined with the adaptive non-monotone line search technique, we prove the global convergence of this method. Moreover, the algorithms have sublinear convergence rate for general convex functions and R-linear convergence rate for strongly convex problems. The numerical results show that our proposed algorithm outperforms the benchmark methods.

报告人简介：孙聪，北京邮电大学理学院副教授、博士生导师。2008 年本科毕业于北京邮电大学理学院，2013 年博士毕业于中国科学院数学与系统科学研究院。她的主要研究领域是非线性优化方法，特别是优化在信号处理中的应用。她曾获第三届中国科协青年托举人才工程的资助，入选北京邮电大学 1551 人才计划。孙聪博士发表论文二十余篇，其中包括 IEEE Transactions on Signal Processing 等信号处理领域顶级期刊和会议等。她目前是中国运筹学会理事、副秘书长，北京市运筹学会理事。

Solving Stackelberg prediction game with least squares loss via spherically constrained least squares reformulation

江如俊

复旦大学

Abstract: The Stackelberg prediction game (SPG) is popular in characterizing strategic interactions between a learner and an attacker. As an important special case, the SPG with least squares loss (SPG-LS) has recently received much research attention. Although initially formulated as a difficult bi-level optimization problem, SPG-LS admits tractable reformulations which can be polynomially globally solved by semidefinite programming or second order cone programming. However, all the available approaches are not well-suited for handling large-scale datasets, especially those with huge numbers of features. In this paper, we explore an alternative reformulation of the SPG-LS. By a novel nonlinear change of variables, we rewrite the SPG-LS as a spherically constrained least squares (SCLS) problem. Theoretically, we show that an ϵ optimal solution to the SCLS (and the SPG-LS) can be achieved in $\tilde O (N/\sqrt{\epsilon})$ floating-point operations, where N is the number of nonzero entries in the data matrix. Practically, we apply two well-known methods for solving this new reformulation, i.e., the Krylov subspace method and the Riemannian trust region method. Both algorithms are factorization free so that they are suitable for solving large scale problems. Numerical results on both synthetic and real-world datasets indicate that the SPG-LS, equipped with the SCLS reformulation, can be solved orders of magnitude faster than the state of the art.

报告人简介：江如俊，复旦大学大数据学院副教授，博士生导师。2016 年 7 月于香港中文大学获得博士学位。研究方向主要包括优化算法和理论分析，二次规划，及其在运筹学、机器学习和金融工程领域的应用。其研究成果发表在 Math. Program.、SIAM J. Optim.、Math. Oper. Res.、INFORMS J. Comput. 和 ICML 等国际顶级期刊或会议上。获上海市扬帆计划、国家级青年人才计划支持，主持国家自然科学基金青年项目和面上项目。曾获国际机器学习大会 ICML 2022 杰出论文奖。

过参数化深度学习分类问题中梯度下降的估计误差

焦雨领

武汉大学

摘要： 这个报告中，我们讨论在过参数化情形下深度学习分类任务中梯度下降算法输出结果的估计误差的上界，以及错误预测概率的上界。技术上，我们需要能在过参数化情形下兼容逼近、统计和优化的误差分析。

报告人简介： 焦雨领，武汉大学数学统计学院副教授，主要从事统计学习、科学计算的研究。研究成果发表在统计学、应用数学、计算数学、人工智能的期刊和会议。

负载均衡问题的次指数时间近似方案

陈林

德州理工大学

摘要：我们考察经典的调度问题。给定 m 台平型机与 n 个工件，对任意常数 $q>1$，我们需要将工件分配到机器上使得目标函数 $\sum_{i=1}^m C_i^q$ 最小，其中 C_i 是机器 i 的负载，即机器 i 上所有工件的处理时间之和。这是一个经典的强 NP 困难问题。在比较自然的复杂性假设下，强 NP 困难问题的 $(1+\epsilon)$ 近似算法 (即近似方案) 不能是 $1/\epsilon$ 的多项式。目前已知的强 NP 困难问题，其近似方案的运行时间至少为 $2^{\Omega (1/\epsilon)}+n^{\OO (1)}$。对上述负载均衡问题，我们首次得到了次指数时间的近似方案，特别的，其运行时间为 $2^{\tilde{\OO} (\sqrt{1/\epsilon})}+n^{\OO (1)}$。我们同时证明了该运行时间在指数时间猜想 (Exponential time hypothesis)下是几乎最优的。

报告人简介：陈林现为德克萨斯理工 (Texas Tech)大学的助理教授，研究方向为组合优化问题的近似算法与参数算法，重点从事分块结构整数规划，调度 (scheduling)，装箱等问题的算法研究，在 SODA, SPAA, ICALP 等会议，SICOMP, Math Program 等期刊发表过十余篇文章。在美国现主持自然科学基金一项。

Streaming algorithms for maximizing k-submodular functions under the multi-knapsack constraint

刘彬

中国海洋大学

Abstract: Submodular optimization, as the important branch of combinatorial optimization, is an interdisciplinary area of operational research, economics, computer science, etc. The general problem of optimizing a submodular function subject to different constraints captures many problems of interest both in theory and in practice, including maximum coverage, social welfare maximization, influence maximization in social networks, sensor placement, maximum cut, and facility location, etc. On the other hand, in the current big data environment, the input data of many applications is much larger than the storage capacity of individual computer. Therefore, it becomes of crucial importance to process the data in a streaming fashion. In this talk, I will show several streaming algorithms for the problem of maximizing k-submodular functions under the multi-knapsack constraint.

报告人简介：刘彬，中国海洋大学数学科学学院教授、博导、院长助理。2010 年毕业于山东大学运筹学与控制论专业，获理学博士学位。2016 年作为访问学者赴美国德克萨斯大学达拉斯分校访问一年。研究领域和兴趣包括：次模优化、近似算法的设计与分析、图论及其应用等。在 Journal of Global Optimization、Journal of Graph Theory、Journal of Combinatorial Optimization 等期刊和 INFOCOM 等会议发表论文 50 余篇，先后主持国家自然科学基金面上项目等科研项目共 8 项。目前担任中国工业与应用数学学会副秘书长、信息和通讯技术领域的数学专委会委员，中国运筹学会图论组合分会青年理事和副秘书长、数学规划分会青年理事，山东省运筹学会理事，美国数学会 Mathematical Reviews 评论员等。

Fair and efficient multi-resource allocation for cloud computing

罗俊杰

北京交通大学

Abstract: We study the problem of allocating multiple types of resources to agents with Leontief preferences. The classic Dominant Resource Fairness (DRF) mechanism satisfies several desired fairness and incentive properties, but is known to have poor performance in terms of social welfare approximation ratio. In this work, we propose a new approximation ratio measure, called fair-ratio, which is defined as the worst-case ratio between the optimal social welfare (resp. utilization) among all fair allocations and that by the mechanism, allowing us to break the lower bound barrier under the classic approximation ratio. We then generalize DRF and present several new mechanisms with two and multiple types of resources that satisfy the same set of properties as DRF but with better social welfare and utilization guarantees under the new benchmark. We also demonstrate the effectiveness of these mechanisms through experiments on both synthetic and real-world datasets. (Joint work with Bei Xiaohui and Li Zihao.)

报告人简介：罗俊杰，北京交通大学数学与统计学院讲师，本科毕业于浙江大学数学系，博士毕业于中国科学院数学与系统科学研究院，之后分别在德国柏林工业大学和新加坡南洋理工大学担任博士后研究员，研究方向为组合优化、算法博弈论，在 Algorithmica, WINE, AAAI, IJCAI 等国际重要期刊与会议发表多篇论文。

Memory-efficient Anderson mixing methods and beyond

包承龙

清华大学

Abstract: Anderson mixing (AM) is a useful method that can accelerate fixed-point iterations by exploring the information from historical iterations. Despite its numerical success in various applications, the memory requirement in AM remains a bottleneck when solving large-scale optimization problems in a resource-limited machine. In this talk, I will discuss our work on a short-term recurrent AM method that significantly reduces the computational burden. Various experiments on network training will validate the effectiveness of the proposed method. Finally, I will introduce the extension of AM to minimization problems on Riemannian manifolds.

报告人简介：包承龙，清华大学丘成桐数学科学中心，助理教授。2009 年本科毕业于中山大学数学系，2014 年博士毕业于新加坡国立大学数学系，2015 年至 2017 年在新加坡国立大学数学系进行博士后研究。其研究兴趣主要在数学图像处理的模型与算法方面，目前已在 MP, IEEE TPAMI, SIIMS, SISC, ACHA 等期刊和 CVPR, ICML, NeurIPS, ICLR 等会议上共计发表学术论文 40 余篇。

Bregman proximal point algorithm revisited: a new inexact version and its inertial variant

杨磊

中山大学

Abstract: In this talk, we focus on a general convex optimization problem, which covers various classic problems in different areas and particularly includes many optimal transport related problems arising in recent years. To solve this problem, we revisit the classic Bregman proximal point algorithm (BPPA) and introduce a new inexact stopping condition for solving the subproblems, which can circumvent the underlying feasibility difficulty often appearing in existing inexact conditions when the problem has a complex feasible set. Our inexact condition also covers several existing inexact conditions as special cases and hence makes our inexact BPPA (iBPPA) more flexible to fit different scenarios in practice. As an application to the standard optimal transport (OT) problem, our iBPPA with the entropic proximal term can bypass some numerical instability issues that usually plague the popular Sinkhorn's algorithm in the OT community. The iteration complexity of $O (1/k)$ and the convergence of the sequence are also established for our iBPPA under some mild conditions. Moreover, inspired by Nesterov's acceleration technique, we develop an inertial variant of our iBPPA, denoted by V-iBPPA, and establish the iteration complexity of $O (1/k^{\lambda})$, where $\lambda\geq1$ is a quadrangle scaling exponent of the kernel function. In particular, when the proximal parameter is a constant and the kernel function is strongly convex with Lipschitz continuous gradient (hence $\lambda=2$), our V-iBPPA achieves a faster rate of $O (1/k^2)$ just as existing accelerated inexact proximal point algorithms. Some preliminary numerical experiments for solving the standard OT problem are conducted to show the convergence behaviors of our iBPPA and V-iBPPA under different inexactness settings. The experiments also empirically verify the potential of our V-iBPPA for improving the convergence speed.

报告人简介：杨磊，副教授、硕士生导师，2022 年 8 月入选中山大学"百人计划"，加入计算机学院科学计算研究所。杨磊博士本硕毕业于天津大学，2017 年底在香港理工大学获得博士学位，2018 年起至 2022 年 7 月先后在新加坡国立大学和香港理工大学从事博士后研究工作。杨磊博士主要从事最优化理论、算法及其应用研究，特别专注于机器学习、图像处理等重要应用领域中出现的大规模结构优化问题，致力于设计和分析高效稳健的求解算法以及相关求解器的开发。目前已在 SIOPT, MOR, JMLR, SIIMS, TSP 等国际重要期刊上发表多篇论文，其中 1 篇论文入选 ESI 高被引论文，博士学位论文荣获香港数学会最佳博士学位论文奖，主持广东省自然科学基金面上项目 1 项。

Lower bounds and nearly optimal algorithms in distributed optimization with communication compression

袁坤

北京大学

Abstract: Recent advances in distributed optimization and learning have shown that communication compression is one of the most effective means of reducing communication. While there have been many results on convergence rates under communication compression, a theoretical lower bound is still missing. Analyses of algorithms with communication compression have attributed convergence to two abstract properties: the unbiased property or the contractive property. In this talk, we consider distributed stochastic algorithms for minimizing smooth, convex and non-convex objective functions under communication compression. We establish a convergence lower bound for algorithms whether using unbiased or contractive compressors. To close the gap between the lower bound and the existing upper bounds, we further propose an algorithm which almost reaches our lower bound (up to logarithm factors) under mild conditions. The experimental results validate our findings.

报告人简介：袁坤博士现任北京大学国际机器学习研究中心研究员。他在西安电子科技大学获得学士学位，中国科学技术大学获得硕士学位，并在美国加州大学洛杉矶分校获得博士学位。他在 2018 年 1 月至 6 月在瑞士洛桑联邦理工学院任访问研究员，2019 年 8 月至 2022 年 7 月在阿里巴巴（美国）达摩院任职高级算法专家。袁坤博士的研究兴趣是分布式优化与机器学习的理论、算法与应用。他曾获得 2017 年 IEEE 信号处理协会青年作者最佳论文奖以及 2017 年世界华人数学家大会杰出论文奖。

Sensitivity of the price of anarchy in nonatomic congestion games with respect to changes in cost functions and demands

吴自军

合肥学院

摘要：本次报告将介绍非原子拥堵博弈 PoA 敏感性研究的几个新结果。非原子拥堵博弈的 PoA (Price of Anarchy)是量化静态均衡交通无效性的重要指标。过去的研究十分注重非原子拥堵博弈 PoA 的上界分析，一定程度上忽略了博弈建模误差导致的 PoA 理论分析偏差。我们将在构建非原子拥堵博弈拓扑度量空间基础上，引入 PoA 算子的 Hoelder 连续性理论，从而给出 PoA 算法对出行时间函数和需求分布复合变化的综合敏感度。

报告人简介：吴自军，男，运筹学博士 (后)，2006 年 7 月获得经济学学士学位 (安徽工业大学)，2010 年 7 月获得基础数学硕士学位 (四川大学)，2015 年 4 月获得运筹学博士学位 (德国克劳斯塔工业大学)，2015 年 7 月至 2017 年 7 月间于北京工业大学北京科学与工程计算研究院从事博士后研究 (合作导师：Rolf Moehring 教授)，现任合肥学院特聘教授、校学术委员，长期从事博弈和算法领域研究工作，在 Operations Research、Mathematics of Operations Research、Mathematical Programming、Theoretical Computer Science 、 Mathematics and Computers in Simulation 、 IEEE Transactions on Evolutionary Computation，以及 AAAI 等学术期刊和会议发表论文多篇，主持国家自然科学基金面上项目、青年项目，以及安徽省高校杰出青年项目、安徽省自然科学基金等科研项目。

FPT approximations for capacitated clustering

许宜诚

中国科学院深圳先进技术研究院

Abstract: Clustering with capacity constraints is a fundamental problem that attracted significant attention throughout the years. Capacitated clusterings are notoriously difficult since the best known approximation bound for k-means in high-dimensional Euclidean space and general metric space is $\Theta (\log k)$, and it remains open whether a constant factor exists. In this presentation, I will introduce our work and some of the latest advancements in FPT approximation algorithms for capacitated clustering.

报告人简介：许宜诚，现为中科院深圳先进技术研究院副研究员，2018 年毕业于北京工业大学数学专业，获优秀博士学位论文，后在先进院从事博士后研究，历任助理研究员和副研究员，入选深圳市孔雀计划。研究兴趣是聚类问题和公平约束问题的近似算法，曾获北京运筹学会青年论文一等奖以及 CCF 推荐会议 WASA 最佳论文奖。

A spectral approach to network design and experimental design

周宏

福州大学

Abstract: Network design is a classical combinatorial optimization problem on graphs, which has been a central topic in combinatorial optimization, approximation algorithms and operations research for decades. Experimental design is a classical topic in statistics, which has recently found many applications in various areas, e.g., machine learning, signal processing, and numerical linear algebra to name a few. In this talk, we will see that a general linear algebra problem called spectral rounding connects these two fundamental problems from different areas. In particular, we will show that: (1) spectral rounding offers a new spectral perspective to design approximation algorithms, and significantly extends the scope of the traditional network design; (2) spectral rounding also provides a unified and elegant framework that matches and improves all existing approximation algorithm results for a family of popular experimental design problems.

报告人简介：周宏，福州大学副教授，2020 年博士毕业于滑铁卢大学；2021 年在滑铁卢大学从事博士后研究工作；2022 年 3 月加入福州大学数学与统计学院。主要研究方向为组合优化、近似算法、图谱理论等，研究成果发表于领域内权威期刊 SIAM J. Comput.，Math. Program.，ACM Trans. Algorithms 以及权威国际会议 STOC、SODA 等。

电子科技大学数学科学学院简介

数学学科是电子科技大学最早组建的理学学科之一，于 1956 年成立数学教研室，1984 年成立应用数学系，2001 年成立应用数学学院，2009 年成立数学科学学院。学院现设有基础数学系、计算科学系、应用数学系、概率统计系和工科数学部，建有校级应用数学特色研究中心，共建四川国家应用数学中心、中科院科学与工程计算国家重点实验室共建联合研究中心、数学与智能系统实验室、联合应用数学创新中心等科研平台，拥有数学一级学科博士点、统计学一级学科硕士点、数学学科博士后流动站，数学一级学科为四川省重点学科，建有国家工科数学课程教学基地，拥有国家级教学团队-"国家工科数学课程教学基地教学团队"。

学院现有教职员工 110 余人，其中专任教师 90 余人，教授/研究员 30 余人，国家级人才项目入选者 7 人。近 5 年，学院教师主持 40 余项国家自然科学基金项目，获得四川省科技进步奖 (自然科学类)2 项，在高水平学术论文发表和学术专著出版方面取得了长足的进步，获国家级教学成果一等奖和四川省教学成果一等奖各 1 项。学院现建有 1 门国家精品视频公开课、2 门国家精品资源共享课、2 门国家精品课程、5 门国家一流课程、7 部普通高等教育国家级规划教材。

学院设有"数学与应用数学"、"信息与计算科学"和"数据科学与大数据技术"三个本科专业，并作为共建学院承担建设电子科技大学"互联网+"专业，其中"数学与应用数学"为国家级特色专业，2019 年入选国家级一流本科专业建设点，"信息与计算科学"为四川省特色专业。现有在读本科生 450 余人，硕士和博士研究生 230 余人。学院高度重视本科生和研究生的多元化培养，建有注重科技创新能力培养的创新拔尖班、注重个人领导力培养的立人班和注重产教融合的极道班等。毕业生深受国家重要部门和单位、IT 和互联网企业、金融企事业单位、著名高校和科研院所的欢迎和赞扬，成为知名企业、科研院所和高校成长为相关领域的领军人物和中坚力量。同时，学院学科竞赛团队为全校学生人才培养做出了重要贡献， 在美国大学生数学建模竞赛、ACM 国际大学生程序设计竞赛、全国大学生数学建模竞赛和全国大学生数学竞赛中每年均获得多项一等奖。

四川大学数学学院简介

川大数学历史悠久、底蕴深厚。始于 1896 年四川中西学堂的算学馆，魏时珍、胡坤陞、柯召、张鼎铭、李国平、吴大任、蒲保明、刘应明等著名学者在此任教。柯召院士是我国近代数论和组合论的创始人之一；刘应明院士是国际上格上拓扑有点化流派奠基人。

目前川大数学由李安民院士领导，李安民院士在整体仿射微分几何、辛几何与辛拓扑方面做出大量奠基性工作。

川大数学的基础数学和应用数学是国家最早的重点学科之一，后首批成为一级学科国家重点学科、"211"和"985"工程重点建设学科、双一流建设学科等，具有数学、统计学两个一级学科博士学位授予权。在几何与拓扑、代数与数论、微分方程与动力系统、数学控制与信息处理、数理逻辑与不确定性数学等领域成果斐然，形成极具国际影响力的特色方向，彰显川大数学的辉煌。

川大数学人才培养成效显著。首批获得国家基础科学数学人才培养基地、国家基础学科拔尖学生培养试验计划、国家拔尖学生培养计划 (2.0 版)、强基计划、国家交叉复合人才计划等，为国家培养了大量的数学人才。

川大数学师资力量雄厚、学术氛围浓郁，平台建设成效显著。以李安民院士为代表，现有教育部重要人才计划 15 人，国家杰出青年科学基金获得者 12 人等；具有国家天元数学西南中心、四川国家应用数学中心；先后主持包括国家基金委创新群体项目、国家自然科学基金重大项目、重点项目，国家杰出青年基金项目 10 多项。

川大数学是潜心数学研究与人才培养的好地方。

酒店、会场相关地图

郫湾国际酒店—金牛宾馆摆渡车时间表

日期	始发站	终点站	发车时间
12 日	金牛---郫湾		10:00-21:15（每隔 30 分钟 1 班） 10:00 和 21:15 分别是金牛宾馆的首班 和末班发车时间，到达郫湾后即刻返回
13 日	郫湾	金牛	7:30，8:00
	金牛	郫湾	12:00，13:00，13:30，18:00，19:30，20:00
14 日	郫湾	金牛	7:30，8:00
	金牛	郫湾	12:00，13:00，13:30，18:00，19:00，19:30，20:00
15 日	郫湾	金牛	7:30，8:00
	金牛	郫湾	12:00，13:00，13:30

明翰·檀香花园酒店—金牛宾馆摆渡车时间表

日期	始发站	终点站	发车时间
12 日	金牛---檀香		10:00-21:15（每隔 30 分钟 1 班） 10:00 和 21:15 分别是金牛宾馆的首班 和末班发车时间，到达檀香后即刻返回
13 日	檀香	金牛	7:30，8:00
	金牛	檀香	12:00，13:00，18:00，19:30，20:00
14 日	檀香	金牛	7:30，8:00
	金牛	檀香	12:00，13:00，18:00，19:30
15 日	檀香	金牛	7:30，8:00
	金牛	檀香	12:00，13:00

智选假日酒店—金牛宾馆摆渡车时间表 (联系人：李为 13699418219)

(注：上述各班车特殊情况坐满即发车，其余时间按点发车)

会场（金牛宾馆）会议厅、餐厅地图
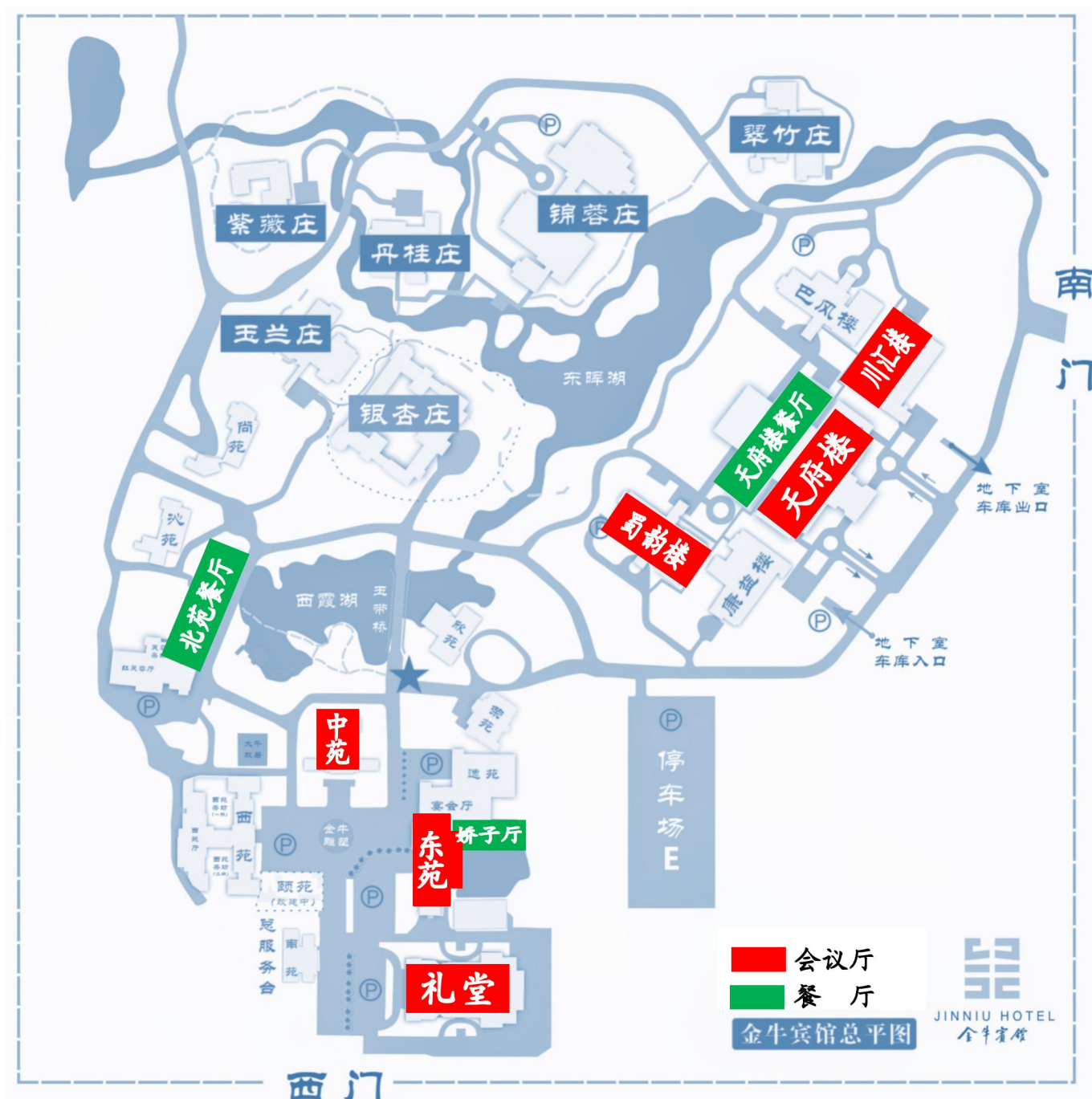
群聊：MOS2023 会议群-A   群聊：MOS2023 会议群-B