



西安电子科技大学  
XIDIAN UNIVERSITY

数学与统计学院  
School of Mathematics and Statistics

2024最优化前沿论坛

西安电子科技大学  
“2024最优化前沿论坛”

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议  
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册

陕西 西安

2024年6月8日

主办单位：西安电子科技大学数学与统计学院



## 目 录

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## 西安电子科技大学数学与统计学院简介

西安电子科技大学数学与统计学院前身可追溯至建校初期的基础部，历经数学教研室、应用数学系、理学院数学系，不断发展壮大，于2013年7月成立。

学院现有数学一级学科博士点、统计学一级学科硕士点、应用统计硕士专业学位授权点，数学博士后科研流动站，以及数学与应用数学（国家级一流本科专业建设点、省名牌专业、省级特色专业）、信息与计算科学（国家级一流本科专业建设点）、统计学（陕西省一流本科专业建设点）3个本科专业，并依托基础学科拔尖学生培养计划，开设旨在培养拔尖创新型复合人才的数学信息英才拔尖班。学院目前设有4个系、1个研究中心、1个研究所。学院现有专任教师125人，博士生导师19人，教授24人、副教授60人。师资力量雄厚，有国家级人才3人、国家教学名师1人、国家级青年人才2人、入选教育部跨（新）世纪优秀人才3人、国家教材委员会专家委员1人、教育部教学指导委员会委员1人、享受国务院政府特殊津贴2人、省部级人才8人、陕西省师德楷模1人、陕西省教书育人楷模1人、陕西省杰出青年基金获得者3人、陕西省青年科技新星1人、陕西省高校青年杰出人才3人、陕西省科协青年人才托举计划入选者5人。

学院秉持“教学奠基、学科立院、科研兴院、人才强院”的办学理念，以建设海内外知名的特色鲜明学科为目标，学院坚持教学科研并重，注重跨学科交叉研究，着力加强国际化和信息化建设，各项工作取得了长足发展。近五年，主持科研项目180余项，科研经费2600余万；发表中科院II区及以上论文150余篇；获得陕西省科技一等奖3项、二等奖2项，西安市科技二等奖1项，陕西青年科技奖4项，并获得多项省部级学会科研奖励。数学学科已毕业博士200余人，入选陕西省优秀博士论文8篇，连续多年入选“中国最好学科排名”，排名进入前20%。

学院有国家级教学团队1个、国家级虚拟教研室1个、国家级一流本科课程2门、陕西省一流本科课程5门、国家精品资源课程2门、陕西省精品资源课程4门，出版国家级规划教材2部，先后获得国家级教学成果奖3项、省级教学成果10余项。指导学生参加



数模竞赛，共获国际及国家级奖励 300 余项，其中有国际大学生数模竞赛特等奖3项、特等奖提名奖13项，全国大学生数模竞赛 Matlab 创新奖1项、全国优秀论文1篇，全国研究生数模竞赛专项奖1项，获奖层次和数量在全国高校中位居前列。

近五年，主持科研项目国家自然科学基金 73 项；发表SCI检索论文400余篇，部分成果发表在相关领域的顶级和权威期刊，如《Advances in Mathematics》、《Transactions of the American Mathematical Society》、《The Annals of Applied Probability》、《Mathematics of Operations Research》、《SIAM Journal on Control & Optimization》、《SIAM Journal on Applied Mathematics》、《Calculus of Variations and Partial Differential Equations》、《Journal of Algebra》、《Journal of Differential Equations》、《SIAM Journal on Financial Mathematics》、《IEEE Transactions on Neural Networks》、《IEEE Transactions on Signal Processing》、《Stochastic Processes and their Applications》、《Production and Operations Management》、《Mathematical Finance》等；对全校SCI论文和优势学科ESI排名均有显著贡献。

## 日程安排

会议时间：2024年 6 月 8 日

线上地点：腾讯会议：259-234-805

会议密码：2024



## 日程安排

6月8日 星期六			
腾讯会议：259-234-805 密码：2024			
时间	报告题目	报告人	主持人
08:00-08:10	开幕式		刘三阳 薄立军
08:10-08:55	ODE-based Learning to Optimize	文再文教授 北京大学	高卫峰 西安电子科技大学
08:55-09:40	Block Sparse Bayesian Learning: A Diversified Scheme	夏勇教授 北京航空航天大学	
09:40-10:25	A Single-Loop Algorithm for Decentralized Bilevel Optimization	杨俊锋教授 南京大学	张青富 香港城市大学
10:25-11:10	随机优化算法的学习理论	雷云文 助理教授 香港大学	
11:10-11:55	Non-convergence Analysis of Randomized Direct Search	张在坤 助理教授 香港理工大学	



午休			
02:30-03:15	Spurious Stationarity and Hardness Results for Bregman-Type Algorithms	苏文藻 教授 香港中文大学	胡胜龙 杭州电子科技大学
03:15-04:00	Adaptive Sampling Strategies for Stochastic Composite Optimization	陈彩华 教授 南京大学	
04:00-04:45	A Globally Convergent Inexact Augmented Lagrangian Method for Zero-One Composite Optimization	罗自炎 教授 北京交通大学	林贵华 上海大学
04:45-05:30	Data-Driven Distributionally Robust Multiproduct Pricing Problems Under Pure Characteristics Demand Models	孙海琳 教授 南京师范大学	
05:30-06:15	Sparse Robust Enhanced Indexation Optimization	徐凤敏 教授 西安交通大学	
06:15-06:20	闭幕式		刘三阳



## 特邀报告摘要与报告人简介

(按专家姓名拼音排序, 排名不分先后)

- 报告专家：陈彩华 教授 南京大学



**专家简介:** Caihua Chen is a professor and associate dean in the School of Management and Engineering at Nanjing University. He received his Ph.D. in Mathematics from Nanjing University in 2012. He then joined the faculty of Nanjing University as an assistant professor and was promoted to associate professor in 2016 and professor in 2021. His research interests lie in optimization theory and algorithms, data-driven decision-making, trustworthy machine learning, human-centered AI, and their applications in revenue management, machine learning, and finance.

**报告题目：** Adaptive Sampling Strategies for Stochastic Composite Optimization

**报告摘要：**

In this talk, we focus on the stochastic composite problems where the objective function comprises both smooth and nonsmooth components. When only an estimate of the gradient of the smooth component is available, we introduce adaptively sampling strategies for proximal gradient methods and its acceleration counterpart. The sample size used to estimate the gradients in each iteration is selected according to the observed trajectory of the algorithm. We develop convergence rate guarantees for unaccelerated and accelerated schemes for convex, strongly convex, and nonconvex problems, which show that the stochastic accelerated proximal gradient algorithms with adaptive sampling strategies can achieve the optimal convergence rate of first order methods. Further, under some mild conditions, we also show the asymptotic behavior of the iteration sequences. In particular, for strongly convex objectives, the iteration sequences generated by the proposed algorithms enjoy linear convergence in distribution. Our numerical experiments demonstrate the effectiveness of the proposed algorithms in both machine learning and operation management problems.



● 报告专家：雷云文 助理教授 香港大学



**专家简介：**雷云文，香港大学数学系助理教授。他的研究兴趣包括学习理论和优化，主要集中在算法稳定性分析、深度学习以及随机优化等主题，代表作发表于 IEEE TPAMI、TIT、TNNLS 等系列杂志，JMLR, ICML、ICLR、NeurIPS 等国际知名的机器学习学术期刊和会议。

**报告题目：**随机优化算法的学习理论

**报告摘要：**

随机优化是训练机器学习模型的主流算法。本次报告通过同时考虑优化误差和泛化误差来研究随机优化算法的学习理论。我们引入新的稳定性指标来去掉现有分析中的一些约束条件并显著改善了现有的泛化误差界。结果建立了优化与泛化之间的新联系，并揭示了如何通过提前停止来实现最佳学习性能。





● 报告专家：罗自炎 教授 北京交通大学



**专家简介：**罗自炎，北京交通大学数学与统计学院教授、博士生导师，中国运筹学会数学规划分会副秘书长，中国运筹学会女性工作委员会委员，中国运筹学会算法软件与应用分会理事。曾访问美国斯坦福大学、新加坡国立大学、香港理工大学、英国南安普顿大学等。主要从事张量优化、稀疏优化及统计优化的理论、算法及应用研究，在 *SIAM J Optim*、*Math Program*、*MOR*、*IEEE TSP*、*JMLR* 等顶级期刊发表学术论文，合著 *SIAM* 出版社英文专著 1 部，获教育部自然科学奖二等奖、中国运筹学会青年科技奖提名奖、北京市高校本科优秀毕业论文指导教师，2023 年入选国家级青年人才计划。

**报告题目：** A Globally Convergent Inexact Augmented Lagrangian Method for Zero-One Composite Optimization

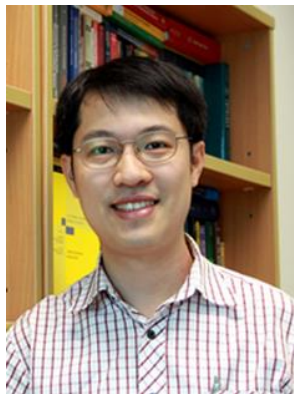
**报告摘要：**

The zero-one composite optimization problem (0/1-COP) aims to minimize the sum of a smooth function and a composition of a zero-one loss function with a linear operator. It has wide applications, including the support vector machine (SVM), calcium dynamics fitting (CDF), 1-bit compressive sensing (1-bit CS) and so on. However, it remains challenging to design a globally convergent algorithm for the original model of 0/1-COP, due to the nonconvex and discontinuous zero-one loss function. We aim to develop an inexact augmented Lagrangian method (IALM) in which the generated whole sequence converges to a local minimizer of 0/1-COP under reasonable assumptions. In the iteration process, IALM performs minimization on a Lyapunov function with an adaptively adjusted multiplier. The involved Lyapunov penalty subproblem is shown to admit the exact penalty theorem for 0/1-COP, provided that the multiplier is optimal in the sense of the proximal type stationarity. An efficient zero-one Bregman alternating linearized minimization (0/1-BALM) algorithm is also designed to achieve an approximate solution of the underlying subproblem in finite steps. Numerical experiments for handling SVM, CDF and 1-bit CS demonstrate the satisfactory performance of the proposed method in terms of solution accuracy and time efficiency.

This is a joint work with Penghe Zhang and Naihua Xiu.



● 报告专家：苏文藻 教授 香港中文大学



**专家简介：**苏文藻教授，香港中文大学研究生院院长、晨兴书院副院长及系统工程与工程管理学系教授，主要研究方向为数学优化理论及其在计算几何、机器学习、信号处理和统计等领域的应用。他于 2019 年被任命为香港中文大学工程学院杰出学人，2023 年当选 IEEE（电机电子工程师学会）会士，2024 年当选香港工程师学会会士。他曾获得多个研究和教学奖项，包括 2018 年 IEEE 信号处理分会最佳论文奖、2015 年 IEEE 信号处理分会

《IEEE Signal Processing Magazine》最佳论文奖、2014 年 IEEE 通信分会亚太杰出论文奖、2010 年 INFORMS（运筹学与管理学研究协会）优化学会青年奖、香港大学教育资助委员会 2022 年杰出教学奖、香港中文大学 2022 年博文教学奖、香港中文大学 2013 年校长模范教学奖等。他的学生也曾获得国内与国外的研究奖项。他现担任数学优化领域国际期刊《Journal of Global Optimization》、《Mathematical Programming》、《Mathematics of Operations Research》、《Optimization Methods and Software》和《SIAM Journal on Optimization》的编辑，并曾担任信号处理领域国际期刊《IEEE Transactions on Signal Processing》的编辑和信号处理领域国际期刊《IEEE Signal Processing Magazine》中 Special Issue on Non-Convex Optimization for Signal Processing and Machine Learning 的客座主编。他现为 中国运筹学会 数学规划分会 副理事长和常务理事。

**报告题目：Spurious Stationarity and Hardness Results for Bregman-Type Algorithms**

**报告摘要：**

Although Bregman-type algorithms have been extensively studied over the years, it remains unclear whether existing stationarity measures, often based on Bregman divergence, can distinguish between stationary and non-stationary points. In this talk, we answer this question in the negative. Furthermore, we show that Bregman-type algorithms are unable to escape from a spurious stationary point in finite steps when the initial point is unfavorable, even for convex problems. Our results highlight the inherent distinction between Euclidean and Bregman geometries and call for further investigation of Bregman-type algorithms.



● 报告专家：孙海琳 教授 南京师范大学



**专家简介：**孙海琳，南京师范大学数学科学学院教授，副院长，国家优秀青年基金获得者。孙教授于2007年在吉林大学获得统计学学士学位，2013年毕业于哈尔滨工业大学，获数学博士学位。在其博士期间，先后前往英国南安普顿大学和香港理工大学联合培养。2015-2017年在香港理工大学应用数学系做博士后研究。2018年获中国运筹学会青年科技奖和江苏省数学成就奖，主持国家自然科学基金优秀青年科学基金项目、面上项目和青年科学基金项目。他的研究领域包括随机优化，分布鲁棒优化、随机变分不等式及其在投资组合、风险管理和经济学模型上的应用。他在包括《Mathematical Programming》、《SIAM Journal on Optimization》、《Mathematics of Operations Research》等国际权威期刊发表了二十多篇论文。

**报告题目：** Data-Driven Distributionally Robust Multiproduct Pricing Problems Under Pure Characteristics Demand Models

**报告摘要：**

**摘要：** This paper considers a multiproduct pricing problem under pure characteristics demand models when the probability distribution of the random parameter in the problem is uncertain. We formulate this problem as a distributionally robust optimization (DRO) problem based on a constructive approach to estimating pure characteristics demand models with pricing by Pang, Su and Lee. In this model, the consumers' purchase decision is to maximize their utility. We show that the DRO problem is well-defined, and the objective function is upper semicontinuous by using an equivalent hierarchical form. We also use the data-driven approach to analyze the DRO problem when the ambiguity set, i.e., a set of probability distributions that contains some exact information of the underlying probability distribution, is given by a general moment-based case. We give convergence results as the data size tends to infinity and analyze the quantitative statistical robustness in view of the possible contamination of driven data. Furthermore, we use the Lagrange duality to reformulate the DRO problem as a mathematical program with complementarity constraints, and give a numerical procedure for finding a global solution of the DRO problem under certain specific settings. Finally, we report numerical results that validate the effectiveness and scalability of our approach for the distributionally robust multiproduct pricing problem.



● 报告专家：夏勇 教授 北京航空航天大学



**专家简介：**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，曾任统计与运筹系系主任。研究方向为非凸全局优化。中国运筹学会理事、中国运筹学会数学规划分会常务理事、JORC 编委。2018 获批国家优青项目。在 MP 和 SIOPT 等期刊发表 SCI 论文 70 多篇，代表性工作：对诺贝尔经济学奖得主 Koopmans1957 年提出的经典二次指派问题提出新模型，在国际上被称为 Xia-Yuan 线性化。

**报告题目：Block Sparse Bayesian Learning: A Diversified Scheme**

**报告摘要：**

This talk introduces a novel prior called Diversified Block Sparse Prior to characterize the widespread block sparsity phenomenon in real-world data. By allowing diversification on intra-block variance and inter-block correlation matrices, we effectively address the sensitivity issue of existing block sparse learning methods to pre-defined block information, which enables adaptive block estimation while mitigating the risk of overfitting. Based on this, a diversified block sparse Bayesian learning method (DivSBL) is proposed, utilizing EM algorithm and dual ascent method for hyperparameter estimation. Moreover, we establish the global and local optimality theory of our model. Experiments validate the advantages of DivSBL over existing algorithms.



● 报告专家：徐凤敏 教授 西安交通大学



**专家简介：**徐凤敏，西安交通大学经济与金融学院教授，金融科技系主任。她的研究兴趣包括稀疏随机优化和金融工程，主要集中在投资组合管理、系统性风险等系列问题，代表作发表于《IEEE Transaction on Neural Networks》、《SIAM Journal on Scientific Computing》、

《Quantitative Finance》、《Computers & Operations Research》、《Annals of Operational Research》、《Journal of Global Optimization》等国际知名学术期刊，现为中国双选法学会经济数学与管理数学分会副理事长。

**报告题目： Sparse Robust Enhanced Indexation Optimization**

**报告摘要：**

In this talk, we investigate two enhanced indexation methodologies using sparse and robust optimization, including two main parts. **Part I:** we develop a sparse  $\ell_{1/2}$  regularization model of enhanced indexation, which is expected to avoid the over-fitting and promote a better out-of-sample performance. An Alternating Quadratic Penalty (AQP) method is proposed to solve this nonconvex optimization problem. Under some suitable assumptions, we establish that any accumulation points of the sequence generated by the AQP method is a KKT point. **Part II:** we describe the tail risk of enhanced indexation using the worst-case CVaR of excess returns, and the process of industry selection using a weighted  $\ell_{\{\infty,1\}}$ -norm constraint. We develop an accelerated alternating minimization algorithm for solving this problem. The global convergence rates in terms of the primal and dual residuals are also provided. Finally, empirical tests on actual data sets are presented to demonstrate the superior out-of-sample performance of our proposed methods.

This is a joint work with Zhihua Allen-Zhao, Yu-Hong Dai and Sanyang Liu.



● 报告专家：文再文 教授 北京大学



**专家简介：**文再文，北京大学北京国际数学研究中心教授，主要研究最优化算法与理论及其在机器学习、人工智能中的应用。2016年获中国青年科技奖。2020年获国家万人计划科技创新领军人才，2024年入选教育部长江学者特聘教授，现为中国运筹学会常务理事，中国运筹学会数学规划分会副理事长。

**报告题目：ODE-based Learning to Optimize**

**报告摘要：**

In recent years, ordinary differential equation (ODE) has become a promising starting point to understand the nature of acceleration methods. However, there still exists gap between ODE and optimization methods. In this talk, we introduce the idea behind learn to optimize and optimization-inspired ODE, and try to provide a framework that automatically looks for efficient problem-orientational optimization methods with a guarantee of worst-case convergence.



● 报告专家：杨俊锋 教授 南京大学



**专家简介：**杨俊锋，南京大学数学系教授；2009年7月起在南京大学数学系工作至今，主要从事数学优化计算方法及其应用研究，代表作发表在 Math. Comput.、SIOPT、SISC、SIIMS、JSC、Inverse Prob.、IEEE J Sel Top Signal Process 等杂志；入选教育部新世纪优秀人才支持计划、获中国运筹学会青年科技奖等。

**报告题目：** A Single-Loop Algorithm for Decentralized Bilevel Optimization

**报告摘要：**

Bilevel optimization (BO) has gained significant attention in recent years due to its broad applications in machine learning. In this talk, we focus on decentralized BO and proposes a novel single-loop algorithm for solving it with a strongly convex lower-level problem. Our approach is a fully single-loop method that approximates the hypergradient using only two matrix-vector multiplications per iteration. Our algorithm does not require any gradient heterogeneity assumption and achieves the best-known convergence rate for BO algorithms. We also present experimental results on hyperparameter optimization problems using both synthetic and MNIST datasets, which demonstrate the efficiency of our proposed algorithm.



● 报告专家：张在坤 助理教授 香港理工大学



**专家简介：**张在坤博士 2007 年本科毕业于吉林大学，2012 年博士毕业于中国科学院，目前任香港理工大学应用数学系助理教授。主要研究兴趣包括：无导数优化方法，基于不精确信息的方法，随机化方法等。主持香港—法国 PROCORE 研究项目一项，香港研究资助局 ECS 项目一项，GRF 项目三项。研究工作发表于《Mathematical Programming》，《SIAM Journal on Optimization》，《SIAM Journal on Scientific Computing》等杂志，于2023 年入选国家级青年人才计划。

**报告题目：Non-convergence Analysis of Randomized Direct Search**

**报告摘要：**

Direct search is a popular method in derivative-free optimization. Randomized direct search has attracted increasing attention in recent years due to both its practical success and theoretical appeal. It is proved to converge under certain conditions at the same global rate as its deterministic counterpart, but the cost per iteration is much lower, leading to significant advantages in practice. However, a fundamental question has been lacking a systematic theoretical investigation: when will randomized direct search fail to converge? We answer this question by establishing the non-convergence theory of randomized direct search. We prove that randomized direct search fails to converge if the searching set is probabilistic ascent. Our theory does not only deepen our understanding of the behavior of the algorithm, but also clarifies the limit of reducing the cost per iteration by randomization, and hence provides guidance for practical implementations of randomized direct search.

This is a joint work with Cunxin Huang, a Ph.D. student funded by the Hong Kong Ph.D. Fellowship Scheme.