2026 应用几何及相关主题国际研讨会

2026 International Workshop on Applied Geometry and Related Topics

会议通知

尊敬的　　教授：

本次研讨会旨在汇聚一批深耕微分几何、几何应用及其交叉领域的研究学者，展示相关领域的最新研究进展，并致力于推动跨学科合作、促进学术思想交流。会议主题主要涉及信息科学和人工智能中的流形几何理论、方法及应用等方面，涵盖但不限于信息几何、流形学习、流形优化、流形拟合、几何力学、几何信号处理等研究方向。会议将搭建起理论与实践对话交流的平台，以期推动几何方法在各类科学研究领域中的广泛应用。本次研讨会将于 2026 年 7 月 21 日—7 月 26 日在四川南充西华师范大学召开，诚挚邀请您及您的学生参加，并致以热情欢迎和衷心感谢！

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承办单位：西华师范大学数学科学学院

会议时间：2026 年 7 月 21 日至 7 月 26 日

会议地点：四川南充

会议网址：https://workshopagrt.github.io/conference/2026/

报到地点：南充北湖宾馆（南充北湖宾馆 - 百度地图）

报到时间：2026 年 7 月 21 日 12：00—22：00

交通：高坪机场（12 公里）、南充站（1.7 公里）、南充北站（7.9 公里）

住宿酒店：南充北湖宾馆（南充北湖宾馆 - 百度地图）

会议费用：无会务费，食宿及交通费用自理

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西华师范大学科技处

西华师范大学数学科学学院

2026 年 6 月 30 日

会议日程：

2026 年 7 月 22 日上午（AM）（北湖宾馆 六楼 晨曦厅）（Page7-8）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
8:30-9:00	**开幕式（合影）**		**潘大志**
9:00-9:40	**程永强**	Recent Advances in Information Geometric Signal Processing	**应时辉**
9:40-10:00	**茶歇**		
10:00-10:40	**赵熙乐**	New Continuous Representation for Multi-Dimensional Data Recovery	**冉瑞生**
10:40-11:20	**高志**	Riemannian Bi-Level Optimization in Machine Learning	
11:20-15:00	**午餐**		

2026 年 7 月 22 日下午(PM)（北湖宾馆 六楼 晨曦厅）（Page8-10）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
15:00-15:35	**叶明露**	Two-step Inertial Projection and Contraction Algorithm for Nonmonotone Variational Inequalities with Lipschitz Continuous Operators	**黄文**
15:35-16:10	**李晨毅**	Accelerated Natural Gradient Method for Parametric Manifold Optimization	
16:10-16:30	**茶歇**		
16:30-17:05	**李朝荣**	Physically Constrained Generative Models for Meteorological Forecasting	**赵熙乐**
17:05-17:40	**刘芯菱**	Sparse signal recovery fused smoothness	
18:30-21:00	**晚餐**		

2026 年 7 月 23 日上午（AM）（北湖宾馆 六楼 晨曦厅）（Page10-12）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
9:00-9:40	**黄文**	An Inexact Riemannian Gradient Descent Algorithm on the Stiefel Manifold with One Newton-Schulz Iteration	**高志**
9:40-10:00	**茶歇**		
10:00-10:40	**华小强**	Radar Target Detection on Matrix Manifold: From Shallow to Deep Manifold Network	**张二川**
10:40-11:20	**张晔**	Neural network yields regularization for ill-posed inverse problems	
11:20-15:00	**午餐**		

2026 年 7 月 23 日下午（PM）（北湖宾馆 六楼 晨曦厅）（Page12-14）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
15:00-15:35	**冉瑞生**	Machine Learning Methods and Applications in Matrix Information Geometry	**华小强**
15:35-16:10	**石俊飞**	Manifold Deep learning for High-Resolution Polarimetric SAR Images: Challenges and Approaches	
16:10-16:30	**茶歇**		
16:30-17:05	**孙笠**	Graph Machine Learning in the Era of Large Model——The Opportunity of Graph Foundation Model on Vector Bundles	**王锐**
17:05-17:40	**陈子恒**	Hyperbolic Deep Learning: Space, Networks, and Applications	
18:30-21:00	**晚餐**		

2026 年 7 月 24 日上午（AM）（北湖宾馆 六楼 晨曦厅）（Page14-16）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
9:00-9:40	**史东华**	Curvature shaping control of nonlinear mechanical systems	**彭林玉**
9:40-10:00	**茶歇**		
10:00-10:40	**陈建怡**	MACRO: A Benchmark for Clarification-Aware Multi-Agent Orchestration	**应时辉**
10:40-11:20	**代荣获**	正则化反问题在油气地球物理中的应用	
11:20-15:00	**午餐**		

2026 年 7 月 24 日下午（PM)（北湖宾馆 六楼 晨曦厅）（Page16-18）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
15:00-15:35	**王春**	A New Technique of ADM to Improve the Precision and Stability of Numerical Solutions	**向政瑞**
15:35-16:10	**潘钰**	Online-Optimized RAG for Tool Use and Function Calling	
16:10-16:30	**茶歇**		
16:30-17:05	**向政瑞**	DVD: Discrete Voxel Diffusion for 3D Generation and Editing	**潘钰**
17:05-17:40	**高兴明**	Novel Discrete Transparent Boundary Conditions for The Two-Dimensional Time-Dependent Schrödinger Equation on a Rectangular Region	
18:30-21:00	**晚餐**		

2026 年 7 月 25 日上午（AM）（北湖宾馆 六楼 晨曦厅）（Page18-20）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
9:00-9:40	**彭林玉**	Moving Frames and Symmetry-Preserving Variational Integrators	**郑涛**
9:40-10:00	**茶歇**		
9:40-10:20	**青楫翔**	Self-Induced Active Learning: Learning Only Where It Matters	**曹越琦**
10:40-11:20	**郑涛**	Ricci Flow with Curvature L^p Bounds	
11:20-15:00	**午餐**		

2026 年 7 月 25 日下午（PM）（北湖宾馆 六楼 明珠厅）（Page20-21）			
Time （时间）	Speaker （报告人）	Title （题目）	Chair （主持人）
15:00-15:35	**王静**	Research on Image Dehazing Based on Deep Learning	**许皓**
15:35-16:10	**王宇欣**	微分几何与拓扑学的教学实践	
16:10-16:30	**茶歇**		
16:30-17:05	**李明明**	Bayesian Inference from an Information-Geometric Perspective: Geometric Structure of Statistical Models and Construction of Jeffreys Priors	**张世强**
17:05-17:40	**孙福鹏**	LLM Competition and the Aggregator Economy	
17:40-18:00	**闭幕式**		
18:30-21:00	**晚餐**		

程永强(Yongqiang Cheng)（**National University of Defense Technology** 国防科技大学）

Title: *Recent Advances in Information Geometric Signal Processing*

Abstract: Information geometry has emerged as a powerful non-Euclidean analytical paradigm for modern signal processing, which maps statistical signal models onto Riemannian manifolds and exploits intrinsic geometric properties including Fisher metric, information divergence, and manifold projection to address the limitations of conventional Euclidean-based methods in non-Gaussian, high-dimensional, and non-stationary signal scenarios. This talk systematically reviews the state-of-the-art progress of information geometric signal processing in recent years, covering fundamental theoretical innovations on manifold modeling, typical engineering applications in radar signal processing, deep learning integration, and prospective research directions.

赵熙乐(Xile Zhao)（**University of Electronic Science and Technology** 电子科技大学）

Title: *New Continuous Representation for Multi-Dimensional Data Recovery*

Abstract: Classical low-rank tensor representations can only represent data on meshgrid, which hinders their potential applicability in many scenarios beyond meshgrid. To break this barrier, we propose a low-rank tensor function representation (LRTFR), which can continuously represent data beyond meshgrid with infinite resolution. Specifically, the suggested tensor function, which maps an arbitrary coordinate to the corresponding value, can continuously represent data in an infinite real space. Parallel to discrete tensors, we develop two fundamental concepts for tensor functions, i.e., the tensor function rank and low-rank tensor function factorization. We theoretically justify that both low-rank and smooth regularizations are harmoniously unified in the LRTFR, which leads to high effectiveness and efficiency for data continuous representation. Extensive multi-dimensional data recovery applications arising from image processing (image inpainting and denoising), machine learning

(hyperparameter optimization), and computer graphics (point cloud upsampling) substantiate the superiority and versatility of our method as compared with state-of-the-art methods. Especially, the experiments beyond the original meshgrid resolution (hyperparameter optimization) or even beyond meshgrid (point cloud upsampling) validate the favorable performances of our method for continuous representation.

高志(Zhi Gao)（Beijing Institute of Technology 北京理工大学）

Title: *Riemannian Bi-Level Optimization in Machine Learning*

Abstract: 许多机器学习任务可建模为流形约束下的黎曼双层优化，但现有优化方法面临计算成本高、跨任务扩展难等瓶颈。为此，本人提出了一套高效、通用的黎曼双层优化新框架。首先，探索了黎曼隐式微分方法，将微分范围缩减至最后两个优化步，有效避免了梯度爆炸并显著降低了计算与内存开销；其次，针对跨任务推导困难的挑战，本文将内层优化统一建模为定点方程求根过程，推导出任务无关的外层梯度统一表达式，实现了算法的灵活推广；此外，针对内层多解导致的收敛难题，本文创新性地将双层优化转化为带惩罚项的单层黎曼最小化问题，结合增广拉格朗日法和对偶变量解析解，在理论上保证了多解情况下的全局最优性。在提供完备收敛性与近似误差分析的基础上，图像分类、小样本识别及持续学习等多项实验表明，本方法相较于欧氏空间方法具有明显优势，能有效推动黎曼双层优化的落地应用。

叶明露(Minglu Ye)（China West Normal University 西华师范大学）

Title: *Two-step inertial projection and contraction algorithm for nonmonotone variational inequalities with Lipschitz continuous operators*

Abstract: This paper develops a two-step inertial projection and contraction algorithm (TIPCA) to address variational inequality problems (VIP) for nonmonotone and

Lipschitz continuous in Euclidean space. Its difference from the known two-step inertial method is that the parameter in the second inertial term can be not only a negative constant, but also a positive constant. The computational complexity of TIPCA is comparable to that of the classic projection and contraction algorithm (PCA). The global convergence of TIPCA is established whenever the underlying mapping is Lipschitz continuous and the solution set of the dual VIP is nonempty. No additional assumptions on the primal VIP's solution set are required. Numerical experiments show the efficiency of TIPCA and reveal that a positive parameter in the second inertial term accelerates convergence more effectively than a negative one.

李晨毅(Chenyi Li)（Peking University 北京大学）

Title: *Accelerated Natural Gradient Method for Parametric Manifold Optimization*

Abstract: Parametric manifold optimization arises naturally in scientific computing and machine learning, particularly in physics-informed neural networks and variational Monte Carlo. In these problems, neural networks often parameterize state functions or probability distributions, and the resulting objects carry intrinsic geometric structures. In this talk, I will present an accelerated natural gradient descent (ANGD) framework for such problems. The method formulates an accelerated Riemannian gradient flow with Hessian-driven damping on the underlying state manifold, and discretizes the resulting dynamics through tangent and cotangent variables to obtain practical parameter updates. The framework accommodates several geometries, including H^s, Fisher–Rao, and Wasserstein-2 metrics, and can be combined with different linear solvers and approximation schemes. I will also discuss the convergence properties of the continuous-time model and present numerical results on PDE-based learning problems and many-body quantum systems, illustrating the effectiveness of ANGD over standard natural gradient methods.

李朝荣(Chaorong Li)（Yibin University 宜宾学院）

Title: *Physically Constrained Generative Models for Meteorological Forecasting*

Abstract: Recent generative artificial intelligence greatly accelerates meteorological forecasting, yet most data-driven models ignore intrinsic atmospheric physical rules, leading to distorted wind, temperature and precipitation fields. This work systematically elaborates the core principle, implementation methods and application effects of physically constrained generative prediction systems. Physical equations are encoded as regularization terms to restrict model generation space. Experiments prove that physical constraints effectively reduce non-physical artifacts and enhance forecast reliability for short-range and medium-range meteorological prediction tasks.

刘芯菱(Xinling Liu)（**China West Normal University** 西华师范大学）

Title: *Sparse signal recovery fused smoothness*

Abstract: In this talk, we investigate the mathematical theory and numerical algorithms for the ℓ1-TV model in the context of signal recovery: we derive the sample complexity of the ℓ1-TV model for recovering signals with sparsity and gradient sparsity. Also we propose a novel algorithm (PGM-ISTA) for the regularized ℓ1-TV problem, and establish its global convergence and parameter selection criteria. Furthermore, we construct a fast learned solver (LPGM-ISTA) by unrolling PGM-ISTA. The results for the experiment on ECG signals show the superior performance of LPGM-ISTA in terms of recovery accuracy and computational efficiency. Additionally, we also discuss some ongoing work and future directions.

黄文(Wen Huang)（**Xiamen University** 厦门大学）

Title: *An Inexact Riemannian Gradient Descent Algorithm on the Stiefel Manifold with One Newton-Schulz Iteration*

Abstract: We propose an inexact Riemannian gradient descent algorithm on the Stiefel manifold (IRGS-StieONS) using adaptive step size, where the ``inexact'' refers to the inexactness of retraction. It is proven that one single Newton-Schulz iteration for the retraction is sufficient for global convergence and local linear convergence. Compared to the landing and augmented Lagrangian-based algorithms, the proposed algorithm is

the first infeasible algorithm that permits adaptive step size and guarantees global convergence and local linear convergence under mild assumptions. Moreover, we show that the local convergence rate depends on the condition number of the Riemannian Hessian, which matches the Riemannian steepest descent algorithm. This result implies that the infeasibility in the proposed algorithm does not influence the local convergence rate. Furthermore, a stochastic gradient version of IRGD-StieONS is proposed and is shown to achieve the same convergence rate as Riemannian stochastic gradient descent with decreasing step size. Numerical experiments demonstrate that both IRGD-StieONS and its stochastic counterpart exhibit superior performance and robustness.

华小强(Xiaoqiang Hua)（**National University of Defense Technology** 国防科技大学）

Title: *Radar Target Detection on Matrix Manifold: From Shallow to Deep Manifold Network*

Abstract: This talk presents a progressive information-geometric framework for target detection on the Riemannian manifold. We introduce four interconnected detectors. The matrix information geometry detector (MIG) models covariance matrices as points on a Hermitian positive definite (HPD) manifold and employs geometric metrics for robust target detection. The kernelized MIG detector extends this idea to reproducing kernel Hilbert spaces, capturing nonlinear dependencies via geodesic decision rules. To reduce dimensionality and computational cost, the manifold dimensionality reduction detector projects HPD matrices onto lower-dimensional manifold subspaces while preserving discriminative geometry. Finally, the deep manifold network learns hierarchical matrix-valued representations, trained end-to-end with a manifold-preserving loss. Experiments on radar datasets demonstrate consistent improvements over the shallow Riemannian baselines. We conclude with computational considerations and future research directions.

张晔(Ye Zhang)（**Shenzhen MSU-BIT University 深圳北理莫斯科大学**）

Title: *Neural network yields regularization for ill-posed inverse problems*

Abstract: In this talk, we establish universal approximation theorems for neural networks applied to general nonlinear ill-posed operator equations. In addition to the approximation error, the measurement error is also taken into account in our error estimation. We introduce the expanding neural network method as a novel iterative regularization scheme and prove its regularization properties under different a priori assumptions about the exact solutions. Within this framework, the number of neurons serves as both the regularization parameter and iteration number. We demonstrate that for data with high noise levels, a small network architecture is sufficient to obtain a stable solution, whereas a larger architecture may compromise stability due to overfitting. Furthermore, under standard assumptions in regularization theory, we derive convergence rate results for neural networks in the context of variational regularization. Several numerical examples are presented to illustrate the robustness of the proposed neural network-based algorithms.

冉瑞生(Ruisheng Ran)（**Chongqing Normal University 重庆师范大学**）

Title: *Machine Learning Methods and Applications in Matrix Information Geometry*

Abstract: This report systematically reviews the theoretical and applied research on matrix information geometry methods based on symmetric positive definite (SPD) manifolds across three typical scenarios: brain-computer interface decoding, mechanical fault diagnosis, and image set classification. The first part focuses on EEG signal decoding, establishing an SPD manifold modeling framework, proposing mathematical theories such as distribution discrepancy measures and forward/backward propagation of statistical moments, and designing SPD domain-adversarial neural networks. The second part addresses rotating machinery fault diagnosis, constructing SPD representations of vibration signals, proposing deep metric learning models, and designing domain-adaptive networks based on geometric moment alignment. The third part targets image set classification, presenting discriminant neighborhood preserving

embedding and local preserving projection methods on both Grassmann and SPD manifolds, along with an SPD autoencoder and its training optimization strategies. These three lines of work form a complete chain from theoretical foundations and model design to application validation, and discuss the theories and methodologies of information geometry in intelligent signal processing.

石俊飞(Junfei Shi)（Xi'an University of Technology 西安理工大学）

Title: *Manifold Deep learning for High-Resolution Polarimetric SAR Images: Challenges and Approaches*

Abstract: Accurate classification of high-resolution polarimetric SAR images is a prerequisite for the intelligent interpretation of remote sensing data. This report aims to learn the unique imaging characteristics of high-resolution polarimetric SAR imagery by integrating physical scattering mechanisms with advanced feature learning methods on Riemannian manifolds. Specifically, it focuses on overcoming major challenges in polarimetric SAR image classification, including strong speckle noise, large variations in object scales, and the non-separability of complex data. To this end, this report gives a series of novel classification models and methodologies, providing a solid technical foundation for intelligent and precise interpretation of remote sensing imagery.

孙笠(Li Sun)（Beijing University of Posts and Telecommunications 北京邮电大学）

Title: *Graph Machine Learning in the Era of Large Model——The Opportunity of Graph Foundation Model on Vector Bundles*

Abstract: Graph is the natural language to model complex, interrelated objects across diverse domains, including social networks, transportation systems, financial transactions, and molecular structures. With the advent of Large Language Models (LLMs) like ChatGPT, artificial intelligence is transitioning from task-specific paradigms to general-purpose foundation models. However, the inherent non-Euclidean topology, complex relational dependencies, and high task heterogeneity of graphs pose

significant challenges for applying existing LLMs. Consequently, the Graph Foundation Model has emerged as a focal point in contemporary graph learning. Addressing a fundamental yet underexplored question—what representation space is best suited for complex graph structures—this talk explores the intrinsic connection between graph structures and geometry. This talk first introduces the theoretical framework of Riemannian geometry, examining the unique properties of Riemannian manifolds such as mixed-curvature spaces and quotient spaces. This talk then reviews recent advancements in classification, clustering, contrastive learning, graph structure learning, and continual graph learning leveraging these geometries. Finally, I present preliminary explorations into constructing graph foundation models based on Riemannian manifolds, aiming to pave the way for the next-generation graph intelligence.

陈子恒(Ziheng Chen)（**University of Trento 意大利特伦托大学**）

Title: *Hyperbolic Deep Learning: Space, Networks, and Applications*

Abstract: Hyperbolic geometry is well-suited for modeling hierarchical and tree-like structures, making it a powerful tool in geometric deep learning. In this talk, I will present three recent works on hyperbolic deep learning from the perspectives of geometry, networks, and applications. First, I will introduce Proper Velocity Space, a stable and unconstrained model of hyperbolic space. I will then discuss how ideas from metric geometry can guide the design of hyperbolic neural networks. Finally, I will present an application to EEG decoding, where hyperbolic embeddings help capture hierarchical structures in EEG signals. Together, these works illustrate how hyperbolic geometry can lead to principled and effective deep learning models.

史东华(Donghua Shi)（**Beijing Institute of Technology 北京理工大学**）

Title: *Curvature shaping control of nonlinear mechanical systems*

Abstract: This talk introduces a curvature-shaping approach for stabilizing nonlinear mechanical systems. The procedure involves modifying the metric to change curvature,

thus making the geodesics corresponding to the closed-loop system confined within a prescribed region. The control laws realizing curvature shaping are derived for fully actuated and underactuated systems, respectively. The effectiveness of the proposed approach is demonstrated through the stabilization of the cart-pendulum system. The curvature shaping method reduces stability verification to a scalar sectional curvature, facilitates intuitive parameter tuning, and suggests a promising geometric framework for robust control design in robotics and aerospace systems. This is a joint work with Benliang Wang and Yongxin Guo.

陈建怡(Jianyi Chen)（**Beijing Institute of Technology 北京理工大学**）

Title: *MACRO: A Benchmark for Clarification-Aware Multi-Agent Orchestration*

Abstract: Clarification-aware multi-agent orchestration is challenging because systems must elicit missing information, maintain task state, and coordinate dependent subtasks. Existing benchmarks do not comprehensively evaluate such orchestration under underspecified user requests, focusing instead on end-to-end success or isolated abilities like tool use and dialogue. We introduce MACRO, a travel-domain benchmark designed to address these gaps by providing structured task tiers, process-level user-side and system-side milestone annotations that include expected user clarifications, and standardized sub-agent interfaces. MACRO-Full contains 107 fully annotated tasks with 703 milestones, and MACRO-Core provides a tractable 30-task subset with 164 milestones. We evaluate three representative orchestration frameworks and a reference decoupled planning--execution orchestrator (MACRO-DPE) using trace-level metrics and failure analysis. Results show that MACRO-DPE improves routing fidelity and execution efficiency while maintaining task completion, whereas staged planning ensures milestone coverage at higher cost.

代荣获(Ronghuo Dai)（**China West Normal University 西华师范大学**）

Title: *正则化反问题在油气地球物理中的应用*

Abstract: 反问题是数学等自然科学中的一个重要问题，构成了人们认识周围世界的基础。当人们试图了解一些物理规律、地球内部结构或宇宙本质时，会收集数据并试图从中提取所需的信息，这实际上就是反演或反问题。在油气地球物理中，观测数据通常是由天然或人工源产生的并通过地球介质传播的物理场，再设法利用这些数据并借助数学方法重建地球内部介质的结构，对地下油气藏进行预测与描述。这是一个典型的反演问题。但对地球物理反演问题进行求解是严重病态的、不适定的。求解不适定反问题的有效方法是对反问题进行正则化。对于地球物理反演而言，正则化方法则利用各种先验地质或地球物理信息，将不适定的病态反演问题转换成有条件的适定问题，减少反演解的歧义性，提高反演稳定性与准确性。本报告介绍了正则化反问题理论与方法在油气地球物理中的应用。

王春(Chun Wang)（Changzhi University 长治学院）

Title: *A new technique of ADM to improve the precision and stability of numerical solutions*

Abstract: In this talk, a new technique of Adomian decomposition method (ADM) for the numerical solutions of nonlinear differential equations and mathematical models is presented. Different from the traditional ADM and LADM (Laplace Adomian decomposition method), the main idea of this new technique is to properly divide the interval where the problem is to be into several subintervals and then apply ADM on each subinterval, respectively. When applying ADM on the latter subinterval, we take the approximate solution on the former subinterval as the initial value so that we can get the numerical solutions at the nodes of these subintervals by calculating in turn. The new technique of ADM has higher precision than the original and traditional ADM and LADM. By using this technique, the accuracy of the numerical solutions is greatly improved. An obvious advantage of this technique is that the precision of the numerical solutions can be finely adjusted according to the actual needs. On the other hand, compared with the traditional method, the errors of the numerical solutions obtained by this technique have a very strong stability.

潘钰(Yu Pan)（**University of Sydney 悉尼大学**）

Title: *Online-Optimized RAG for Tool Use and Function Calling*

Abstract: In many applications, retrieval-augmented generation (RAG) drives tool use and function calling by embedding the (user) queries and matching them to pre-specified tool/function descriptions. In this report, we address an embedding misalignment issue that often arises in practical applications due to imperfect embedding models or noisy descriptions; such misalignment may lead to incorrect retrieval and task failure. We introduce Online-Optimized RAG, a deployment-time framework that continually adapts retrieval embeddings from live interactions using minimal feedback (e.g., task success). Online-Optimized RAG applies lightweight online gradient updates with negligible per-query latency and requires no changes to the underlying LLM. We provide a problem-dependent theoretical analysis that quantifies how the method's performance depends on the initialization quality of the embeddings and other related quantities. Across diverse tool-use and document-retrieval scenarios, our Online-Optimized RAG consistently improves tool selection accuracy and end-task success, thus providing a simple, practical path to robust, self-improving RAG systems.

向政瑞(Zhengrui Xiang)（**Imperial College London 帝国理工学院**）

Title: *DVD: Discrete Voxel Diffusion for 3D Generation and Editing*

Abstract: We introduce Discrete Voxel Diffusion (DVD), a discrete diffusion framework to generate, assess, and edit sparse voxels for SLat (Structured LATent) based 3D generative pipelines. Although discrete diffusion has not generally displaced continuous diffusion in image-like generation, we show that it can be an effective first-stage prior for sparse voxel scaffolds. By treating voxel occupancy as a native discrete variable, DVD avoids continuous-to-discrete thresholding and provides a simple framework for voxel generation, uncertainty estimation, and editing. Beyond quality gains, DVD provides more interpretable generation dynamics through explicit categorical modeling. Furthermore, we leverage the predictive entropy as a robust

uncertainty metric to identify ambiguous voxel regions and complicated samples, facilitating tasks such as data filtering and quality assessment. Finally, we propose a lightweight fine-tuning strategy using block-structured perturbation patterns. This approach empowers the model to inpaint and edit voxels within a single sampling round, requiring negligible auxiliary computation and no additional model evaluations

高兴明(Xingming Gao)（**Beijing Institute of Technology 北京理工大学**）

Title: *Novel discrete transparent boundary conditions for the two-dimensional time-dependent Schrödinger equation on a rectangular region*

Abstract: This work investigates discrete transparent boundary conditions for the time-dependent Schrödinger equation and develops two new approximate discrete transparent boundary conditions for two-dimensional problems within the Crank-Nicolson scheme. The proposed treatments accurately describe wave transmission through artificial boundaries while enabling efficient computation on bounded domains. A rigorous stability analysis is established for the coupled CN-ADTBC schemes. To quantify residual numerical reflections, an a posteriori reflection indicator is introduced by extending the computational domain. Numerical experiments show that the methods achieve second-order accuracy in both space and time and effectively suppress artificial reflections under various incident angles and potential configurations, demonstrating their accuracy, robustness, and applicability to open quantum-system simulations.

彭林玉(Linyu Peng)（**Keio 庆应大学**）

Title: *Moving frames and symmetry-preserving variational integrators*

Abstract: Moving frames provide a powerful geometric framework for the systematic construction of differential and difference invariants associated with Lie group actions. Originating from the classical work of Cartan and later reformulated by Fels and Olver, modern moving frame theory offers an effective approach to invariantization, symmetry reduction, and the analysis of geometric structures. This talk presents an overview of both continuous and discrete moving frame methods, emphasizing their role in invariant

variational calculus and the derivation of conservation laws. These lead naturally to invariant Euler-Lagrange equations and an invariant formulation of Noether's theorem, in which conservation laws are obtained through the adjoint representation of the symmetry group. The framework is further applied to the construction of invariant variational integrators, numerical schemes derived from discrete variational principles that preserve underlying geometric structures and symmetries. Examples include discrete models of Euler's elastica and the Kepler problem, illustrating how invariant discretizations preserve conservation laws and exhibit favorable numerical behavior.

青楫翔(Jixiang Qing)（Lancaster University 兰卡斯特大学）

Title: *Self-Induced Active Learning (SIDAL): Learning Only Where It Matters*

Abstract: In this talk, we consider the active learning problem where the goal is to learn an unknown function with low prediction error under a Boltzmann distribution induced by the function itself. By leveraging Gaussian Process surrogates and exploiting moment generating function identities to approximate the intractable Bayesian target distribution in closed form, we propose acquisition functions that avoid partition function estimation and are applicable to both discrete and continuous input domains. Under mild regularity conditions, we establish sublinear convergence guarantees for the terminal prediction error in both high-probability and average-case settings, and provide the first convergence analysis of existing heuristic approaches within this framework. These results are validated on synthetic benchmarks and real-world problems in potential energy surface modeling and molecular drug discovery. This talk is mainly based on a joint work with Dr. Henry Moss and Dr. Matthias Sachs.

郑涛(Tao Zheng)（Beijing Institute of Technology 北京理工大学）

Title: *Ricci Flow with Curvature L^p Bounds*

Abstract: In this talk, we consider Ricci flow with curvature L^p bound for p > n/4+1 and bounded scalar curvature. We show an isoperimetric inequality along such Ricci flow, which generalizes Tian-Zhang's result in Am. J. Math. 2014. We also consider the

convergence of this flow and show that there exists a sequence of time slice metrics converging to a Ricci soliton outside a closed singular set with codimension 2p, and that the convergence is smooth outside the singular set. Moreover, in the Kähler-Ricci flow case, we can estimate the Hausdorff measure of this singular set. This is a joint work with Professor Chang Li and Professor Liangming Shen.

王静(Jing Wang)（Beijing Wuzi University 北京物资学院）

Title: *Research on Image Dehazing Based on Deep Learning*

Abstract: In this talk, we present our research on deep learning-based image dehazing, focusing on lightweight and high-precision dehazing network architecture. Our model integrates diverse attention mechanisms and pooling modules and is optimized via a hybrid loss function, enabling it to handle complex scenarios with non-uniform and dense haze. Experimental results show that the proposed method outperforms traditional dehazing algorithms. Combined with YOLOv8, the model can effectively improve the accuracy of road object detection in foggy weather. This work was completed in collaboration with Wang Zixuan and Li Shaoxin.

王宇欣(Yuxin Wang)（China University of Geosciences Beijing 中国地质大学）

Title: *几何与拓扑类课程教学贯通设计——兼谈与信息几何人才培养的衔接*

Abstract: 本报告介绍几何与拓扑类课程（空间解析几何、拓扑学、微分几何）教学贯通设计的初步实践。该设计以几何与拓扑学史为主线，通过绪论课构建学科认知框架，在教学过程中注重课程间的内在联系，帮助学生建立对几何学科的整体认知。报告还结合大学生创新项目与毕业设计指导，介绍学生在拓扑数据分析等方向的初步探索，并讨论几何基础教学对信息几何人才培养的潜在意义。

李明明(Mingming Li)（Yibin University 宜宾学院）

Title: *Bayesian Inference from an Information-Geometric Perspective: Geometric Structure of Statistical Models and Construction of Jeffreys Priors*

Abstract: In this talk, we introduce an information-geometric approach to Bayesian inference, providing a natural differential-geometric framework for parametric statistical models, where the Fisher information matrix endows the parameter manifold with a Riemannian metric, and the Jeffreys prior coincides with the volume form induced by that metric, thus ensuring parametrization invariance in Bayesian inference.

孙福鹏(Fupeng Sun)（Imperial College London 帝国理工学院）

Title: *LLM Competition and the Aggregator Economy*

Abstract: Large Language Model (LLM) aggregators, such as Poe and ChatHub, sell a single subscription that gives users access to the models of multiple competing providers, exploiting the providers' horizontal differentiation across tasks and vertical differentiation in performance. For LLM providers such as OpenAI and Anthropic, an aggregator is simultaneously a complement and a competitor: it generates wholesale API revenue, but it cannibalizes direct retail subscriptions. We develop a game-theoretic framework in which two LLM providers, each stronger in one of two features, serve users with heterogeneous feature preferences who choose between subscribing directly, subscribing to the aggregator, or opting out. We show that the aggregator serves users with balanced preferences, and that its impact on providers reverses as the market matures: in unsaturated markets it primarily expands coverage, so providers gain API revenue at little cost to their subscription base, whereas in saturated markets it grows by cannibalizing direct subscriptions and benefits a provider only if its API margin is sufficiently high. Aggregation also redirects innovation incentives: improving a provider's strong feature steals market share from its rival but enlarges the aggregator's user base, while improving its weak feature wins users back from the aggregator. Finally, when users differ in usage intensity, heavy users subscribe directly while light, variety-seeking users adopt the aggregator, rationalizing the tiered pricing and usage caps observed in practice.

西华师范大学简介

西华师范大学是四川省属重点大学、四川省首批一流学科建设高校、全国博士和硕士学位授予单位，坐落于历史文化名城南充。发轫于抗战时期内迁至四川省三台县办学的国立东北大学，抗战胜利后，国立东北大学迁回沈阳，留川师生于 1946 年在三台原校址创建私立川北农工学院，学校办学文脉由此发端。1949 年，学校吸纳著名墨学专家伍非百先生创办的西山书院，更名为私立川北大学。1950 年，学校与私立川北文学院合并，成立公立川北大学，由三台迁至南充办学，改称川北大学。1952 年，学校合并川东教育学院（原中国乡村建设学院）、四川大学和华西大学等院校的部分系科及教师，组建四川师范学院。1953 年，原重庆师范学院部分系科师生并入四川师范学院。1956 年，学校一分为二，一部分迁往成都；留在南充的部分更名为南充师范专科学校，1958 年更名为南充师范学院，1989 年恢复“四川师范学院”校名，2003 年经教育部批准更名为西华师范大学。

学校现有行署、华凤两个校区，占地面积 3000 亩，校舍建筑面积 100 余万平方米，绿化面积 70 余万平方米，运动场地面积 10 余万平方米。图书馆是四川省古籍重点保护单位，馆藏纸质图书 348 余万册，其中珍藏古籍 5600 余种、74000 余册。电子图书 430 余万册，电子期刊读物 8 万余种。学校现有 2 个博士学位授权一级学科，20 个硕士学位授权一级学科，18 个硕士专业学位授权类别。现有教职员工 3000 余人，其中高级职称教师 1000 余人，博士、硕士学位教师 2200 余人，百千万人才工程国家级人选、国家有突出贡献中青年专家、享受国务院政府特殊津贴专家、教育部新世纪优秀人才、四川省学术和技术带头人及后备人选、四川省有突出贡献的优秀专家、四川省“天府峨眉计划”“天府青城计划”等国省级高层次人才称号 120 余人次，Elsevier“中国高被引学者”1 人，洪堡学者 2 人。著名墨学专家伍非百，著名古代文学专家郑临川、周虚白、傅平骧，史学专家吴景贤、赵吕甫、龙显昭，哲学专家李耀仙，遗传学专家汤泽生，国际公认大熊猫生态生物学研究奠基人、“中国大熊猫之父”胡锦矗等一大批知名专家学者曾在学校治学育人。学校建有教育部重点实验室 1 个、国家生态质量综合监测站 1 个、四川省重点实验室 1 个、四川省 2011 协同创新中心 1 个、四川省工程实验室 1 个、四川省野外科学观测研究站 1 个、四川省高校重点实验室 7 个、四川

省林业和草原局长期科研基地 2 个、四川省林业和草原局重点实验室 1 个、南充市重点实验室 7 个。拥有四川省社会科学高水平研究团队 3 个、四川省青年科技创新团队 4 个、四川新型智库 2 个。

学校具备培养学士、硕士、博士的完整教育体系，现有全日制学生共 38000 余人。入选国家卓越人才教育培养计划、四川省卓越教师培养计划和首批公费师范生培养计划，是被授牌“四川省优秀大学生选调基地”的首个省属高校。建有国家生态环境科普基地、国家级大学生校外实践教育基地、全国教育硕士专业学位研究生联合培养示范基地、四川省知识产权培训基地、四川省生态文明普及基地、四川省中小学环境教育社会实践基地，川北历史文化普及基地、川东北环境教育与科普基地、川东北航空模型科普基地、川东北机器人科普基地等 11 个国省级科普教育和联合培养基地。学校建立了基础教育、高等教育、职业教育、继续教育等教育类型齐全的教育培训体系。现有 21 个师范专业，其中 8 个专业入选国家级一流本科专业建设点，12 个专业入选省级一流本科专业建设点，15 个专业通过师范类专业二级认证。学校注重国际合作与交流，与英国桑德兰大学、新西兰惠灵顿维多利亚大学、日本千叶大学、韩国世宗大学、马来西亚世纪大学、意大利贝内文托音乐学院等 20 余所海外高校签署校际合作协议，在学术交流、互派访学、学生联合培养、海外实习实践及就业等方面开展实质性合作。

奋斗创造历史，实干成就未来。学校高举习近平新时代中国特色社会主义思想伟大旗帜，全面学习贯彻党的二十大和二十届二中、三中全会精神，深入贯彻落实习近平总书记关于教育的重要论述，落实立德树人根本任务，牢记教育强国时代使命，聚焦一流目标，全面深化改革，扎实推进学校事业高质量发展，团结奋进新时代，建功强校新征程，为加快建设特色鲜明、国内一流的师范大学努力奋斗。

数学科学学院简介

数学科学学院前身始建于 1946 年。历经私立川北农工学院数理学系、私立川北大学理工学院、川北大学数学物理系、四川师范学院数学系、南充师范专科学校数学科、南充师范学院数学系、四川师范学院数学系、西华师范大学数学与信息学院、西华师范大学数学科学学院等发展历程，经过几代人的努力奋斗，办学规模、成效及学生培养质量一直居四川省同类院系前列。学院先后被授予“教育部、财政部‘国培计划’子项目教学先进单位”“四川省教育工作先进集体”称号，学院党委被授予“四川省先进基层党组织”称号，学院团委被授予“四川省五四红旗团委”称号。

近年来，学院通过外引内培，已逐渐形成了一支结构合理、学历层次高、思想稳定的教师队伍。目前，最优化理论与应用为四川省高校重点实验室、非线性分析及最优化为四川省高校创新团队。学院享受国务院政府特殊津贴专家 1 人、四川省学术与技术带头人 1 人、四川省学术与技术带头人后备人选 1 人、四川省天府峨眉计划专家 2 人、四川省杰出青年科学基金获得者 1 人、四川省杰出青年学术技术带头人培育计划 1 人、西华师范大学首届登峰学者 1 人、全国教育硕士优秀管理工作者 2 人、全国教育硕士优秀教师 3 人、全国大生数学建模竞赛优秀指导教师 2 人、四川省师德标兵 1 人、四川省优秀青年教师 1 人、四川省优秀党务工作者 1 人、四川省大学生思想政治教育先进工作者 1 人、西华师范大学教学名师 2 人、西华师范大学教学标兵 4 人。近年来，学院教师先后承担国家级、省部级以上项目 30 多项，获得国家级教学成果二等奖 1 项、四川省教学成果一等奖 1 项、四川省教学成果二等奖 3 项、教育部高等学校科学研究优秀成果奖自然科学类二等奖 1 项、四川省科技进步奖自然科学类三等奖 1 项、四川省高校青年教师教学竞赛二等奖 1 项、四川省高校辅导员素质能力大赛三等奖 1 项、四川省导航名师高校创业指导大赛优胜奖 1 项、南充市科技创新成果二等奖 2 项、中国数学会计算数学分会优秀青年论文一等奖 1 项、四川省数学会基础数学奖二等奖和三等奖各 1 项、四川省数学会应用数学奖三等奖 3 项、第三届川渝科技学术大会优秀论文三等奖 1 项。

学院具有数学一级学科硕士学位授予权和学科教学(数学)教育硕士授予权。现有基础数学、计算数学、概率论与数理统计、应用数学、运筹学与控制论、学

科教学（数学）等硕士学位专业（方向）。目前有在校硕士研究生300余人。学院现有数学与应用数学、信息与计算科学、统计学、人工智能四个本科专业，面向全国招生，现有全日制本科生2400余人。数学与应用数学专业和信息与计算科学专业为四川省一流本科专业。《初等几何研究》为国家“十二五”规划教材，《实变函数论新编》为四川省“十二五”规划教材。《数学分析》为省级重点课程，《C 语言程序设计》为省级混合式一流课程，《实变函数论》《泛函分析》《数值方法与计算机技术》为省级精品（资源共享）课程，《数学建模实践与创新》为省级创新创业教育示范课程，《数学思想方法》《常微分方程》为校级精品课程，《数学思想方法》《数学建模》《概率论基础》《数学分析 I》为第一批校级精品在线开放建设课程，《解析几何》《高等代数 I》《初等几何研究》为第二批校级精品在线开放建设课程，《概率论基础》《数理统计》《计算机网络》为校级课程思政示范课程，《复变函数论基础》《解析几何》为校级混合一流课程。

70 多年来，学院累积培养各行各专业人才 3 万余名，学院毕业生一直深受各用人单位普遍欢迎。近5年以来，本科生就业率一直保持在90%以上、硕士研究生平均就业率在98%以上，签约成都七中、南充高中、绵阳中学、绵阳南山中学、成都外国语学校、成都实验外国语学校、成都嘉祥实验外国语学校、川内各地税务系统、各大保险公司、五大银行及地方商业银行、中国移动通讯、中国联通等企事业单位；学院本科生深造率保持在30%左右，考取华东师范大学、山东大学、电子科技大学、重庆大学、兰州大学、上海大学、陕西师范大学、南京师范大学、西南交通大学、西南大学等高校的硕士研究生。近年来，学院多名硕士研究生考取四川大学、湖南大学、电子科技大学、兰州大学、湘潭大学等高校攻读博士学位。