The 10th International Conference on Matrix Analysis and Applications

ICMAA 2023

Book of Abstracts

Kunming, the People's Republic of China

August 15-18, 2023

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This conference is supported by Yunnan University and K.C.Wong Education Foundation.

Title

The 10th International Conference on Matrix Analysis and Applications – ICMAA 2023: Book of Abstracts

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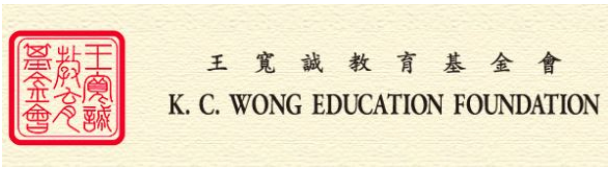
王寬誠教育基金會
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The 10th International Conference on Matrix Analysis and Applications

Welcome

Dear Participants.

On behalf of the International and Local Organizing Committees of the 10th International Conference on Matrix Analysis and Applications (ICMAA 2023), it is our great pleasure to extend a warm welcome to you to the School of Mathematics and Statistics of Yunnan University in the beautiful city of Kunming, People's Republic of China.

This meeting aims to foster research and promote collaboration among mathematicians working in diverse areas of linear and multilinear algebra, matrix analysis, graph theory, and their real-world applications. By bringing together researchers from around the globe, ICMAA 2023 aims to provide an excellent platform for the exchange of ideas and advancements in these exciting subjects. Over the years, this conference series has had the privilege of being hosted in various locations, including Beijing and Hangzhou in China, Nova Southeastern University in Florida, USA, Selcuk University in Konya, Turkey, Duy Tan University in Da Nang, Vietnam, Shinshu University in Nagano Prefecture, Japan, University of Nevada, Reno, USA, and University of Aveiro in Aveiro, Portugal. We are proud to continue this tradition of international collaboration and academic excellence.

The distinguished list of former keynote speakers includes renowned experts such as Roger Horn, Richard Brualdi, Chi-Kwong Li, Steve Kirkland, Alexander Klyachko (ILAS guest speaker), Shmuel Friedland, Man-Duen Choi, Tsuyoshi Ando, Fumio Hiai, Lek-Heng Lim, and Peter Šemrl. Their invaluable contributions have enriched our previous conferences and inspired researchers worldwide.

We are delighted to announce that we have received a total of thirty one abstracts for presentation, and the conference has attracted the participation of approximately one hundred and twenty-five registered attendees. We are particularly honored to have had Professor Zhaojun Bai, a Distinguished Professor from the University of California, Davis, USA, as our keynote speaker.

Our sincere appreciation goes to the School of Mathematics and Statistics at Yunnan University (https://www.ynu.edu.cn/) for hosting this conference. Furthermore, we would like to express our gratitude to the K.C. Wong Education Foundation in Hong Kong and Yunnan University for their generous support.

We owe our heartfelt gratitude to the dedicated members of the International Scientific Committee and the Local Organizing Committee, whose hard work and commitment have made this event possible. Once again, a warm welcome to ICMAA 2023. May this conference be a memorable and rewarding experience for all.

Tin-Yau Tam,
Chair of the International Organizing Committee
Department Chair and Professor
Seneca C. and Mary B. Weeks Chair in Mathematics
Department of Mathematics and Statistics
University of Nevada, Reno, USA

General Information

Keynote Speaker

- Zhaojun Bai, Distinguished Professor, University of California, Davis, USA.

Invited Speakers

- Zhengjian Bai, Xiamen University, China
- Changjiang Bu, Harbin Engineering University, China
- Luyining (Elaine) Gan, Beijing University of Posts and Telecommunications, China
- Hualin Huang, Huaqiao University, China
- Zejun Huang, Shenzhen University, China
- Zhigang Jia, Jiangsu Normal University, China
- Yanfei Jing, University of Electronic Science and Technology of China, China
- Hanyu Li, Chongqing University, China
- Zhongshan Li, Georgia State University, USA
- Lei Liu, Xidian University, China
- Meiyue Shao, Fudan University, China
- Guangjing Song, Weifang University, China
- Tin-Yau Tam, University of Nevada, Reno, USA
- Ryo Tabata, National Institute of Technology, Ariake College, Japan
- Qing-Wen Wang, Shanghai University, China
- Takeaki Yamazaki, Toyo University, Japan
- Yichuan Yang, Beihang University, China
- Ke Ye, University of Chinese Academy of Sciences, China
- Fuzhen Zhang, Nova Southeastern Univeristy, USA
- Xiao-Dong Zhang, Shanghai Jiao-Tong University, China
- Yang Zhang, University of Manitoba, Canada

Scientific Organizing Committe

- Chaoqian Li, Yunnan University, Kunming, Yunnan, China
- Yaotang Li, Yunnan University, Kunming, Yunnan, China
- Tin-Yau Tam (Chair), University of Nevada, Reno, Nevada, USA
- Nian-Sheng Tang, Yunnan University, Kunming, Yunnan, China
- Qing-Wen Wang, Shanghai University, Shanghai, China
- Fuzhen Zhang, Nova Southeastern University, Ft. Lauderdale Florida, USA

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- Suhua Li, Yunnan University, Kunming, Yunnan, China
- Jifei Miao, Yunnan University, Kunming, Yunnan, China
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Contacts

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The conference website https://icmaa2023.scimeeting.cn/en/web/index/

Registration Desk

The Registration Desk is on the first floor of Yuantong Building (圆通楼), Lian Yun Hotel (连云宾馆) :

- **Registration Time**: Beijing Time 10:00 am-20:00 pm, Tuesday, August 15, 2023.
- **Registration Place**: The first floor of Yuantong Building (圆通楼), Lian Yun Hotel (连云宾馆), Kunming, Yunnan, China.

Lecture Rooms

The Opening Session will take place on August 16, 2023 (9:00-9:30 am), West Room 3, 2nd floor, Auditorium (礼堂二楼西3厅), Lian Yun Hotel (连云宾馆).

Plenary talks and contributed talks will take place in the following rooms (Zoom):

- **West Room 3**, 2nd floor, Auditorium (礼堂二楼西3厅), Lian Yun Hotel (连云宾馆) (or **Zoom 1** (https://zoom.us/j/94295637030?pwd=V053Q25CdUxDbWtsbWg3OGRubkJSUT09 Conference number：942 9563 7030, Password：112233)
- **West Room 4**, 2nd floor, Auditorium (礼堂二楼西4厅), Lian Yun Hotel (连云宾馆) (or **Zoom 2** (https://zoom.us/j/99722035579?pwd=dXZEVFQyTWxxL3EzVXlBWWVOTCtYQT09 Conference number：997 2203 5579, Password：123456)

The Closing Session will take place on August 17, 2023 (16:00-16:30pm) in West Room 3, 2nd floor, Auditorium, Lian Yun Hotel (连云宾馆).

Useful Information

Phone Numbers

The country code of China for telecommunications is **+86**.
The phone number of your hotel is **0871-65156661**.
The Emergency National Numbers are **110** (Alarm call), **119** (Fire alarm number), and **120** (Emergency number).

Banks and Currency

Official banking hours in China are between 9:00 and 17:00 (Beijing Time) from Monday to Friday.
Nearby the hotel there are China Construction Bank and ATM machines.
The currency unit in China is Renminbi (RMB).

Transportation in Kunming

Train

If you arrive at Kunming South Railway Station (or Kunming Railway Station) by train, you have the option to take the Kunming metro line 1 (or Kunming metro line 2), both conveniently located in front of the railway station. From there, you can get off at Chuanxin Gulou Subway Station (穿心鼓楼地铁站) and easily reach the ICMAA 2023 conference venue or your hotel (Lian Yun Hotel 连云宾馆) on foot. The maximum walking distance is approximately 15 minutes. Alternatively, you can also opt to take a taxi directly to the hotel. The journey from Kunming South Railway Station would take approximately 50 minutes, while it would take around 20 minutes from Kunming Railway Station.

Airplane

If you arrive in Kunming by airplane, you can take a taxi or the Kunming metro line 6, which is conveniently located in front of Kunming Changshui International Airport. From there, you can transfer to Kunming metro line 2 at Tangzixiang Subway Station (塘子巷地铁站) and get off at Chuanxin Gulou Subway Station (穿心鼓楼地铁站). This will allow you to reach the ICMAA 2023 conference venue or your hotel (Lian Yun Hotel 连云宾馆) on foot, with the

maximum walking distance being approximately 15 minutes. You can also opt to take a taxi directly to the hotel. The journey from Kunming Changshui International Airport would take approximately 30 minutes.

Taxi

The price of a taxi trip from Kunming South Railway Station, Kunming Railway Station and the Kunming Changshui International Airport to ICMAA 2023 conference venue or your hotel (Lian Yun Hotel 连云宾馆) is about 100, 25, and 80 RMB, respectively.

Conference Program Timetable (Beijing Time)

ICMAA 2023	
Tuesday, August 15, 2023	
10:00-20:00	Registration Floor 1, Yuantong Building (圆通楼), Lianyun Hotel (连云宾馆)
17:30-19:30	Dinner Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)
Wednesday, August 16, 2023	
Wednesday morning: West Room 3, 2nd floor, Auditorium (礼堂二楼西 3 厅) Zoom 1：https://zoom.us/j/94295637030?pwd=V053Q25CdUxDbWtsbWg3OGRubkJSUT09 Conference number：942 9563 7030 Password：112233	
Chair: Chaoqian Li	West Room **3**（礼堂二楼西 3 厅）
9:00-9:30	**Opening Ceremony**
9:30-9:40	Group Photo — In front of the Auditorium
Chair: Tin-Yau Tam	West Room **3**（礼堂二楼西 3 厅）
9:40-10:40	Speaker: **Zhaojun Bai**, University of California, Davis, USA Title: Recent advances in eigenvector-dependent nonlinear eigenvalue problems
10:40-11:00 Coffee Break	

Chair: Qing-Wen Wang	West Room **3**（礼堂二楼西 3 厅）
11:00-11:30	Speaker: **Tin-Yau Tam**, University of Nevada, Reno, USA Title: On Yamamoto-Nayak's theorem
11:30-12:00	Speaker: **Zhengjian Bai**, Xiamen University, China Title: A columnwise update algorithm for sparse stochastic matrix factorization
12:00-13:30 Lunch Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)	
Parallel Sessions (Wednesday afternoon). Session One (Zoom 1)	
Chair: Zhigang Jia	West Room **3**（礼堂二楼西 3 厅）
14:00-14:30	Speaker: **Qing-Wen Wang**, Shanghai University, China Title: The $\eta-$ (anti-)Hermitian solution to a constrained Sylvester-type generalized commutative quaternion matrix equation
14:30-15:00	Speaker: **Ke Ye**, University of Chinese Academy of Sciences, China Title: Geometric distance between positive semidefinite matrices via the fibre bundle structure
15:00-15:30	Speaker: **Hualin Huang**, Huaqiao University, China Title: Simultaneous direct sum decompositions of several multivariate polynomials
15:30-15:45 Coffee Break	
Chair: Ke Ye	West Room **3**（礼堂二楼西 3 厅）
15:45-16:15	Speaker: **JunFeng Yin**, Tongji University, China Title: Restarted randomized reflection algorithms for solving large linear equations
16:15-16:45	Speaker: **Zhigang Jia**, Jiangsu Normal University, China Title: Robust quaternion matrix completion theory and applications
16:45-17:15	Speaker: **Hanyu Li**, Chongqing University, China Title: SVD-based algorithms for fully-connected tensor network decomposition
17:15-17:45	Speaker: **Guangjing Song**, Weifang University, China Title: Nonnegative low rank tensor approximation with applications to multi-dimensional images

17:45-19:30 Dinner

Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)

Parallel Sessions (Wednesday afternoon). Session Two：West Room 4, 2nd floor, Auditorium (礼堂西侧门二楼西 4 厅)

Zoom 2：https://zoom.us/j/99722035579?pwd=dXZEVFQyTWxxL3EzVXlBWWVOTCtYQT09

Conference number：997 2203 5579 Password：123456

Chair: Lei Liu West Room **4**（礼堂二楼西 4 厅）

14:00-14:30	Speaker: **Yichuan Yang**, Beihang University, China Title: On the existence of compatible directed partial orders on fields
14:30-15:00	Speaker: **Zejun Huang**, Shenzhen University, China Title: Combinatorial problems on the Birkhoff polytope
15:00-15:30	Speaker: **Wen-Wei Li**, University of Science and Technology of China, China Title: The cycle structure and the autotopism group of a Latin square

15:30-15:45 Coffee Break

Chair: Zejun Huang West Room **4**（礼堂二楼西 4 厅）

15:45-16:15	Speaker: **Ryo Tabata**, National Institute of Technology, Ariake College, Japan Title: Matrix identities associated with group representations
16:15-16:45	Speaker: **Xiao-Dong Zhang**, Shanghai Jiao-Tong University, China Title: On weighted spectral radius of unraveled balls and normalized Laplacian eigenvalues
16:45-17:15	Speaker: **Lei Liu**, Xidian University, China Title: Lie all-derivable points of nest algebras
17:15-17:45	Speaker: **Luyining (Elaine) Gan**, Beijing University of Posts and Telecommunications, China Title: Log majorization and properties on matrix means of positive definite matrices

17:45-19:30 Dinner

Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)

Thursday, August 17, 2023	
Parallel Sessions (Thursday morning). Session One (Zoom 1)	
Chair: JunFeng Yin	West Room **3**（礼堂二楼西 3 厅）
9:00-9:30	Speaker: **Zhongshan Li**, Georgia State University, USA Title: Similarity via transversal intersection of manifolds
9:30-10:00	Speaker: **Meiyue Shao**, Fudan University, China Title: A new perturbation bound for Williamson's symplectic normal form
10:00-10:20 Coffee Break	
Chair: Meiyue Shao	West Room **3**（礼堂二楼西 3 厅）
10:20-10:50	Speaker: **Takeaki Yamazaki**, Toyo University, Japan Title: Limit of the iteration of induced Aluthge transformations of centered matrices
10:50-11:20	Speaker: **Changjiang Bu**, Harbin Engineering University, China Title: Perron-Frobenius theorem from matrices\graphs to tensors\hypergraphs
11:20-11:50	Speaker: **Jiang Zhou**, Harbin Engineering University, China Title: Counting spanning trees in graphs
11:50-13:30 Lunch Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)	
Parallel Sessions (Thursday morning). Session Two (Zoom 2)	
Chair: Yanfei Jing	West Room **4**（礼堂二楼西 4 厅）
9:00-9:30	Speaker: **Yang Zhang**, University of Manitoba, Canada Title: SVDs of third-order reduced biquaternion tensors and applications
9:30-10:00	Speaker: **Xiang Xiang Wang**, University of Nevada, Reno, USA Title: Geometric means and their properties of Grassmannians

10:00-10:20 Coffee Break	
Chair: Hanyu Li	West Room **4**（礼堂二楼西 4 厅）
10:20-10:50	Speaker: **Jiahang Xu**, Hebei University, China Title: Satellite form of Gan-Liu-Tam type log-majorization and its application to quantum relative entropy
10:50-11:20	Speaker: **Yongyan Guo**, China University of Mining and Technology, China Title: A restarted large-scale spectral clustering with self-guiding and block diagonal representation
11:20-11:50	Speaker: **Li-Zhen Chen**, Huaqiao University, China Title: Some Lie-type mappings on incidence algebras
11:50-13:30 Lunch Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)	
Thursday afternoon (Zoom 1)	
Chair: Fuzhen Zhang	West Room **3**（礼堂二楼西 3 厅）
14:00-14:30	Speaker: **Yanfei Jing**, University of Electronic Science and Technology of China, China Title: Understanding partial convergence from space partition for large linear systems with multiple
14:30-15:00	Speaker: **Zhenhua Lyu**, Shenyang Aerospace University, China Title: Two infinity norm bounds for the inverse of Nekrasov matrices
15:00-15:30	Speaker: **Fengsheng Wu**, Yunnan University, China Title: Robust low-rank tensor completion via new regularized model with approximate SVD
15:30-16:00	Speaker: **Fuzhen Zhang**, Nova Southeastern Univeristy, USA Title: Eigenvalue and singular value inequalities via extreme principles
Chair: Fuzhen Zhang	West Room **3**（礼堂二楼西 3 厅）
16:00-16:30	The closing ceremony
17:45-19:30 Dinner Luofeng, 3rd floor, Yuantong Building (圆通楼三楼螺峰厅)	

Friday, August 18, 2023
The free discussion **Goodbye**

Abstracts

Recent advances in eigenvector-dependent nonlinear eigenvalue problems

Zhaojun Bai (zbai@ucdavis.edu)
University of California, Davis, USA

Co-authors: Dong Min Roh, University of California, Davis, USA; Ren-Cang Li, University of Texas at Arlington, USA; Ding Lu, University of Kentucky, Lexington, USA

Abstract: Eigenvector-dependent Nonlinear Eigenvalue Problems (NEPv) arise in computational science and engineering, and machine learning. NEPv pose intriguing challenges for analysis and computation, and are a much less explored topic compared to nonlinear eigenvalue problems with eigenvalue nonlinearity (NEP). From a linear algebra point of view, I will present some recent advances in theory, algorithms and applications of NEPv.

A columnwise update algorithm for sparse stochastic matrix factorization

Zhengjian Bai (zjbai@xmu.edu.cn)
Xiamen University, Xiamen, China

Co-authors: Guiyun Xiao, Xiamen University, Xiamen, China; Wai-Ki Ching, University of Hong Kong, Hong Kong, China.

Abstract: Nonnegative matrix factorization arises widely in machine learning and data analysis. In this talk, for a given factorization of rank r, we consider the sparse stochastic matrix factorization (SSMF) of decomposing a prescribed m-by-n stochastic matrix V into a product of an m-by-r stochastic matrix W and an r-by-n stochastic matrix H, where both W and H are required to be sparse. With the prescribed sparsity level, we reformulate the SSMF as an unconstrained nonconvex-nonsmooth minimization problem and introduce a column-wise

update algorithm for solving the minimization problem. We show that our algorithm converges globally. The main advantage of our algorithm is that the generated sequence converges to a special critical point of the cost function, which is nearly a global minimizer over each column vector of the W-factor and is a global minimizer over the H-factor as a whole if there is no sparsity requirement on H. Numerical experiments on both synthetic and real data sets are given to demonstrate the effectiveness of our proposed algorithm.

Perron-Frobenius Theorem from matrices/graphs to tensors/hypergraphs

Changjiang Bu (buchangjiang@hrbeu.edu.cn)

College of Mathematical Sciences, Harbin Engineering University, Harbin, China

Abstract: The Perron-Frobenius theorem was originally developed for matrices and graphs, and has now been extended to tensors and hypergraphs, yielding important results regarding their eigenvalues, eigenvectors, spectral symmetry. This report provides an overview of certain developments in this field, with a focus on the estimation of the spectral radius and its algebraic multiplicity. We first review the basics of the Perron-Frobenius theorem for matrices and graphs, and then move on to its generalization to tensors and hypergraphs. We highlight the differences and similarities between the matrix and tensor case.

Some Lie-type mappings on incidence algebras

Li-Zhen Chen (chlzhmath@hqu.edu.cn)
Huaqiao University, Quanzhou, China

Co-authors: Zhan-Kui Xiao, Huaqiao University, Quanzhou, China and Hong-Yu Jia, Jilin university, Changchun, China.

Abstract: In this talk, we survey some recent studies of Lie-type mappings on incidence algebras, containing several results we obtained. The concerning mappings we consider on incidence algebras include (generalized) Lie higher derivations, (nonlinear) Jordan higher derivations, local derivations and the mappings derivable at zero, etc. Let $\mathcal{R}$ be a 2-torsion free commutative ring with unity and X be a locally finite pre-ordered set. We proved every Lie

higher derivation on the incidence algebra $I(X, \mathcal{R})$ is proper and every Jordan derivation on it is a derivation. In addition, we apply the theory of zero product determined algebras to study local derivations and the mappings derivable at zero.

Log majorization and properties on matrix means of positive definite matrices

Luyining (Elaine) Gan (luyining.gan@gmail.com)
Beijing University of Posts and Telecommunications, Beijing, China

Abstract: Matrix means and their properties have garnered some interest among researchers in recent decades due to their profound connection with the Riemannian structure of positive definite matrices. Understanding the relationship between the spectra of matrix means has been one of primary focuses in this area. In this talk, our main focus will be on exploring the (weak) log-majorization relations between three key matrix means: the metric geometric mean, the spectral geometric mean, and the Wasserstein mean. Additionally, we will delve intosome properties of matrix means, such as geodesic properties and the related quantum divergence

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A restarted large-scale spectral clustering with self-guiding and block diagonal representation

Yongyan Guo (guoyy@cumt.edu.cn)
China University of Mining and Technology, Xuzhou, China

Abstract: Spectral clustering is one of the most popular unsupervised machine learning methods. Constructing similarity matrix is crucial to this type of method. In most existing works, the similarity matrix is computed once for all or is updated alternatively. However, the former is difficult to reflect comprehensive relationships among data points, and the latter is time-consuming and is even infeasible for large-scale problems. In this work, we propose a restarted clustering framework with self-guiding and block diagonal representation. An advantage of the framework is that some useful clustering information obtained from previous cycles

could be preserved as much as possible. To the best of our knowledge, this is the first work that applies this strategy to spectral clustering. The key difference is that we reclassify the samples in each cycle of our method, while they are classified only once in existing methods. To further release the overhead, we introduce a block diagonal representation with Nyström approximation for constructing the similarity matrix. Theoretical results are established to show the rationality of inexact computations in spectral clustering. Comprehensive experiments are performed on some benchmark databases, which show the superiority of our proposed algorithms over many state-of-the-art algorithms for large-scale problems. Specifically, our framework has a potential boost for clustering algorithms and works well even using an initial guess chosen randomly.

Simultaneous direct sum decompositions of several multivariate polynomials

Hualin Huang (hualin.huang@hqu.edu.cn)
Huaqiao University, Quanzhou, China

Abstract: Let $f_1, f_2, \ldots, f_m \in K[x_1, x_2, \ldots, x_n]$. The set of multivariate polynomials $f_1, f_2, \ldots, f_m$ is called a simultaneous direct sum if, after a change of variables, they can be written as sums of two polynomials in disjoint sets of variables simultaneously:

$$f_i = f_{i1}(x_1, \ldots, x_l) + f_{i2}(x_{l+1}, \ldots, x_n)$$

for all $1 \leq i \leq m$. Many interesting problems, such as diagonalization of a set of symmetric matrices via congruence, Waring decompositions of a set of polynomials, rank one decompositions of a set of symmetric tensors, etc. are closely related to simultaneous direct sum decompositions of several multivariate polynomials. We introduce an invariant algebra

$$Z(f_1, \ldots, f_m) = \{X \in K^{n\times n} \mid (H_i X)^T = H_i X, \ \ 1 \leq i \leq m\}$$

of the set $f_1, f_2, \ldots, f_m$, where H_i is the Hessian matrix of f_i, and show that complete sets of orthogonal idempotents of $Z(f_1, \ldots, f_m)$ are in bijection with simultaneous direct sum decompositions of $f_1, f_2, \ldots, f_m$. This enables us to provide a simple algorithm for simultaneous direct sum decompositions of several multivariate polynomials.

Combinatorial problems on the Birkhoff polytope

Zejun Huang (zejunhuang@szu.edu.cn)
Shenzhen University, Shenzhen, China

Co-authors: Chi-Kwong Li, William & Mary, Williamsburg, USA; Eric Swartz, William & Mary, Williamsburg, USA; Nung-Sing Sze, The Hong Kong Polytechnic University, Hong Kong, China.

Abstract: The Birkhoff polytope Ω_n is the set of $n \times n$ doubly stochastic matrices. In this talk, we will present some combinatorial properties of Ω_n.

Robust quaternion matrix completion theory and applications

Zhigang Jia (zhgjia@jsnu.edu.cn)

Jiangsu Normal University, Xuzhou, China

Abstract: In this talk, we introduce quaternion matrix completion and provide a rigorous analysis for provable estimation of quaternion matrix from a random subset of their corrupted entries. In order to generalize the results from real matrix completion to quaternion matrix completion, we derive some new formulas to handle noncommutativity of quaternions. We solve a convex optimization problem, which minimizes a nuclear norm of quaternion matrix that is a convex surrogate for the quaternion matrix rank, and the ℓ_1-norm of sparse quaternion matrix entries.We show that, under incoherence conditions, a quaternion matrix can be recovered exactly with overwhelming probability, provided that its rank is sufficiently small and that the corrupted entries are sparsely located. The quaternion framework can be used to represent red, green, and blue channels of color images. The results of missing/noisy color image pixels as a robust quaternion matrix completion problem are given to show that the performance of the proposed approach is better than that of the testing methods, including image inpainting methods, the tensor-based completion method, and the quaternion completion method using semidefinite programming.

Understanding partial convergence from space partition for large linear systems with multiple right-hand sides and beyond

Yan-Fei Jing (yanfeijing@uestc.edu.cn)

University of Electronic Science and Technology of China, Chengdu, Sichuan, China

Co-authors: Luc Giraud, HiePACS Project, Inria Bordeaux – Sud-Ouest, Talence Cedex, France; Yan-Fei Xiang, Cerfacs, Inria Bordeaux – Sud-Ouest, Talence Cedex, France.

Abstract: Many modeling process in scientific and engineering computing requires efficient solution of a series of large-scale systems of linear equations with multiple right-hand sides. Partial convergence and inexact breakdown detection mechanism in the block classical GMRES method characterized by Robbe and Sadkane is a significant progress. We interpret such partial convergence from space partition, providing flexible choices for approximation search subspace at each iteration. Beyond, we report our recent progress in block GMRES-type solvers, and show the efficiency of our solvers by some typical numerical experiments.

SVD-based Algorithms for fully-connected tensor network decomposition

Hanyu Li (hyli@cqu.edu.cn)
Chongqing University, Chongqing, China

Co-authors: Mengyu Wang, Chongqing University, Chongqing, China

Abstract: The popular fully-connected tensor network (FCTN) decomposition has achieved successful applications in many fields. A standard method to this decomposition is the alternating least squares (ALS). However, it often converges very slowly. In this work, we investigate the SVD-based algorithms for FCTN decomposition. On the basis of a result about FCTN-ranks, a deterministic algorithm is first proposed, which can find the FCTN decomposition of a tensor under a fixed accuracy. Then, we present the randomized versions of the algorithm. They can be classified into two categories and allow various sketching types. Error analysis for randomized algorithms are provided. We test and compare our algorithms using both synthetic and real data. Numerical results show that they exhibits much better performance compared with the ALS method, and also have quite decent robustness.

Similarity via transversal intersection of manifolds

Zhongshan Li (zli@gsu.edu)
Georgia State University, Georgia, USA

Co-authors: Marina Arav, Frank J. Hall, Hein van der Holst, Aram Mathivanan, Jiamin Pan, Hanfei Xu, and Zheng Yang.

Abstract: Let A be an $n \times n$ real matrix. As shown in the recent paper "The bifurcation lemma for strong properties in the inverse eigenvalue problem of a graph", Linear Algebra Appl. 648 (2022), 70–87, by S.M. Fallat, H.T. Hall, J.C.-H. Lin, and B.L. Shader, if the manifolds $\mathcal{M}_A = \{G^{-1}AG | G \in \mathrm{GL}(n, \mathbb{R})\}$ and $Q(\mathrm{sgn}(A))$ (consisting of all real matrices having the same sign pattern as A), both considered as embedded submanifolds of $\mathbb{R}^{n \times n}$, intersect transversally at A, then every superpattern of $\mathrm{sgn}(A)$ also allows a matrix similar to A. Let $X = [x_{ij}]$ be a generic matrix of order n whose entries are independent variables. In this paper, this similarity-transversality property is characterized in a direct and convenient way by the full row rank property of the Jacobian matrix of the entries of $AX - XA$ at the zero entry positions of A with respect to the nondiagonal entries of X. This new approach makes it possible to take better advantage of the combinatorial structure of the matrix A, and provides theoretical foundation for constructing matrices similar to a given matrix while the entries have certain desired signs. In particular, several important classes of zero-nonzero patterns and sign patterns that require or allow this transversality property are identified. Examples illustrating many possible applications (such as diagonalizability, number of distinct eigenvalues, nilpotence, idempotence, semi-stability, eigenvalues and their algebraic and geometric multiplicities, Jordan canonical form, minimal polynomial, and rank) are provided.

The cycle structure and the autotopism group of a Latin square

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Abstract: Latin square is widely used in practice and theory. The autotopism group or paratopism group of a Latin square is a useful tool in enumeration and classification of Latin squares. Although most Latin squares have a trivial autotopism group consists of the identity transformation only, it is still of great significance to find the autotopism group of an arbitrary Latin square as efficient as possible. But very few papers introduced the details of the

enumeration or generation of the members in the autotopism group of a Latin square. Here an efficient method to generate or enumerate the elements in the autotopism group of any Latin square is introduced. The relation of a Latin square and all the Latin squares isotopic to it construct a graph, we will visit a tree contained in this graph when searching for the autotopism group of the given Latin square. It will be important to obtain the information sufficient to generate the autotopism group by visiting a tree as small as possible. Cycle structures plays an important role in this method.

Keywords: Convolutional codes, free distance, generalized Singleton bound, maximum distance separable (MDS) codes.

Lie all-derivable points of nest algebras

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Abstract: Let $\mathcal{N}$ be a nest on a separable Hilbert space H and $alg\mathcal{N}$ be the associated nest algebra. In this talk, I shall give some new Lie all-derivable points of $alg\mathcal{N}$.

Two infinity norm bounds for the inverse of Nekrasov matrices

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Abstract: Nekrasov matrices play an important role in various scientific disciplines. The estimation of infinity norm bounds for the inverse of Nekrasov matrices brings a lot of convinces in many fields. In this paper, we introduce two new bounds for the inverse of Nekrasov matrices. The advantages of our bounds and numerical examples are also presented.

A new perturbation bound for Williamson's symplectic normal form

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Abstract: Given a symmetric and positive definite matrix $A \in \mathbb{R}^{2n\times 2n}$, there exist a symplectic matrix $S \in \mathbb{R}^{2n\times 2n}$ and a diagonal matrix $D = \mathrm{diag}(D_+, D_+)$, where $D_+ \in \mathbb{R}^{n\times n}$ has increasing diagonal entries, such that $S^\top AS = D$. The diagonal matrix D is known as Williamson's symplectic normal form of A. We prove a new perturbation bound

$$\|D - \widetilde{D}\|_{\mathrm{ui}} \le \big(\kappa(A)\kappa(\widetilde{A})\big)^{1/4}\|A - \widetilde{A}\|_{\mathrm{ui}},$$

where D and $\widetilde{D}$, respectively, are Williamson's symplectic normal forms of A and $\widetilde{A}$, $\|\cdot\|_{\mathrm{ui}}$ denotes a unitarily invariant norm, and $\kappa(\cdot) = \|\cdot\|\,\|\cdot^{-1}\|$ denotes the condition number in spectral norm. This new estimate is better than several existing ones recently developed in the literature. We also show that our new bound is tight in the sense that the prefactor, $\big(\kappa(A)\kappa(\widetilde{A})\big)^{1/4}$, is already optimal. Finally we derive several alternative forms of our bound, including some new perturbation bounds for the Bethe–Salpeter eigenvalue problem.

Nonnegative low rank tensor approximation with applications to multi-dimensional images

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Abstract: The main aim of this paper is to develop a new algorithm for computing nonnegative low rank tensor approximation for nonnegative tensors that arise in many multi-dimensional imaging applications. Nonnegativity is one of the important property as each pixel value refers to nonzero light intensity in image data acquisition. Our approach is different from classical nonnegative tensor factorization (NTF) which requires each factorized matrix and/or tensor to be nonnegative. In this paper, we determine a nonnegative low Tucker rank tensor to approximate a given nonnegative tensor. We propose an alternating projections algorithm for computing such nonnegative low rank tensor approximation, which is referred to as NLRT. The convergence of the proposed manifold projection method is established. Experimental results for synthetic data and multi-dimensional images are presented to demonstrate the performance of NLRT is better than state-of-the-art NTF methods.

On Yamamoto-Nayak's theorem

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Abstract: A very recent result of Nayak asserts that $\lim_{m\to\infty} |A^m|^{1/m}$ exists for each $n\times n$ complex matrix A, where $|A| = (A^*A)^{1/2}$, and the limit is given in the language of linear transformation. This is an extension of Yamamoto's result in 1967. We extend the result of Nayak, namely, we prove that $\lim_{m\to\infty} |BA^mC|^{1/m}$ exists for any $n\times n$ complex matrices A, B, and C; the limit is given in matrix language and is independent of B. We then provide generalization in the context of real semisimple Lie groups.

Matrix identities associated with group representations

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Abstract: An immanant is a matrix function associated with the representation of the symmetric group. The permanent and determinant are the special cases with the trivial and alternating representations, respectively. One of the most interesting properties for immanants is the Littlewood-Richardson rule, which is a type of matrix identities in terms of minors parallel to the expantion of the product of two Schur functions.

In this talk, we discuss matrix identities parallel to plethysm, another product of Schur funcitons which originates from the representation theory of the general linear groups. The key observation is to modify immanants with a parameter. It may be an important connection with Robinson's approach to the representations of the wreath products. We also present some applications to linear algebra.

The η-(anti-)Hermitian solution to a constrained Sylvester-type generalized commutative quaternion matrix equation

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Abstract: We present some practical necessary and sufficient conditions for the existence of an η-(anti-)Hermitian solution to a constrained Sylvester-type generalized commutative quaternion matrix equation. We also provide the general η-(anti-)Hermitian solution to the constrained matrix equation when it is solvable. Moreover, we present algorithms and numerical examples to illustrate the results of this talk.

Geometric means and their properties of Grassmannians

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Abstract: We obtain inequalities for the geometric mean of two elements in the Grassmannians. These inequalities reflect the elliptic geometry of the Grassmannians as Riemannian manifolds, for example, semi-parallelogram law and geodesic triangle inequalities. In particular, we obtain weak majorization for geodesic triangle's tangent vectors and their related inequalities.

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

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Abstract: Tensor recovery with tensor singular value decomposition has recently become increasingly popular in the computer vision field. One of the most important subproblem is the low-rank tensor completion with the partial and/or corrupted observations. 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.

Satellite form of Gan-Liu-Tam type log-majorization and its application to quantum relative entropy

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Abstract: In this paper, we obtain two extensions of satellite form of Gan-Liu-Tam type log-majorization and show its application to quantum relative entropy.

Limit of the iteration of induced Aluthge transformations of centered matrices

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Abstract: Let $\mathcal{M}_m(\mathbb{C})$ be the set of all m–by–m matrices. For the polar decomposition $T = U|T|$ of a matrix $T \in \mathcal{M}_m(\mathbb{C})$, the Aluthge transformation $\Delta(T) = |T|^{\frac{1}{2}}U|T|^{\frac{1}{2}}$ is well known, and it has a lot of nice properties. On the other hand, S.H. Lee, W.Y. Lee and J. Yoon defined the mean transform $\hat{T} = \frac{|T|U+U|T|}{2}$. Very recently, we defined an extension of these maps which is called the induced Aluthge transformation. It depends on matrix means, for

example, $\Delta(T)$ and $\hat{T}$ are the induced Aluthge transformations with respect to the geometric and arithmetic means, respectively. In this talk, we shall introduce convergence of iteration of the induced Aluthge transformations. Precisely, if $T \in \mathcal{M}_m(\mathbb{C})$ is an invertible centered matrix (i.e., $\{|T|, U^n|T|U^{*n}, U^{*m}|T|U^m : n, m = 1, 2, ...\}$ is a commuting set), then the iteration of the induced Aluthge transformations with respect to an arbitrary matrix mean converges to a normal matrix, and the limit points are given.

On the existence of compatible directed partial orders on fields

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Abstract: Artin and Schreier showed that there is no linear orders on complex field C in 1926. Then Birkhoff and Pierce posed an open question whether the field C can be lattice-ordered in 1956, which has not yet been solved. Generalizing the known results of Bourbaki that a lattice-ordered field with positive squares is linearly ordered to non-commutative case [Yang, AMM, 2006], Yang initiated the question of the existence of compatible directed partial orders on fields in 2006, which has been solved in 5 papers [Yang, J. Alg., 2006; Schwartz and Yang, J. Alg., 2011; Rump and Yang, J. Alg., 2014; Yang and Zhang, Soft Computing, 2017; Schwartz and Yang, Symmetry, 2023].

Geometric Distance between positive semidefinite matrices via the fibre bundle structure

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Abstract: Positive semidefinite (PSD) matrices are important structured matrices in many applications. Examples include the covariance matrix of a random variable, the density matrix of a quantum system, the kernel matrix in machine learning and the representation of a quadratic Mahalanobis distance metric. Thus there are numerous measurements proposed

in the literature to compare the similarity between two PSD matrices. However, all of them require the two PSD matrices to be of the same size and same rank. In practice, however, it is inevitable to measure the difference between two non-equidimensional PSD matrices of different ranks. In this talk, we present a method to construct such a measurement which we call the geometric distance. The construction is based on the fibre bundle structure of PSD matrices and the geometric distance is easily computable in a generic case. In particular, the geometric distance can recover most commonly used distances/divergences for PSD matrices of the same rank. We also discuss both theoretical and computational properties of the geometric distance. If times permits, we also briefly discuss an application of the geometric distance in objective selection for cancer treatment.

Restarted randomized reflection algorithms for solving large linear equations

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Abstract: Iteratiion methods play important roles in the solution of linear equations. A new algorithm is proposed to accelerate the surrounding algorithms based on a sequence of Householder reflections by restarted techniques for solving large linear equations. Theoretical analysis show that this method converges and the convergence rate is estimated. Numerical experiments verify the efficiency of restarted strategies, which can greatly decrease the number of iteration steps and save the elapsed CPU time.

Eigenvalue and singular value inequalities via extreme principles

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Abstract: Given two square matrices of the same order, we consider the eigenvalues and singular values of the sum and product of the matrices. For example, what can be said about

the sum of the largest and smallest eigenvalues of the product of two positive semidefinite matrices? This talk reviews some eigenvalue and singular value inequalities recently obtained via minimax principles. In particular, we present singular value inequalities of log-majorization type.

On weighted spectral radius of unraveled balls and normalized Laplacian eigenvalues

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Abstract: In this talk, we obtain a lower bound on the maximum weighted spectral radius of unraveled balls of radius r in a graph, which is used to prove that the s-th smallest normalized Laplacian eigenvalue of a graph is at most $1-\frac{2\sqrt{d-1}}{\widetilde{d}}\cos\left(\frac{\pi}{r+1}\right)$ if the graph satisfies that the average degree is $\geq d$ and the second order average degree is $\leq \widetilde{d}$ after sequentially deleting any $s-1$ balls of radius r. These results extend and strengthen the Alon-Boppana bound and other known bounds.

SVDs of third-order reduced biquaternion tensors and applications

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Abstract: In this talk, we introduce the singular value decomposition (SVD) of a third-order reduced biquaternion tensor via a new Ht-product, and develop computing algorithms. As theoretical applications, we define the Moore-Penrose inverse of a third-order reduced biquaternion tensor and discuss its properties. Using above results, we give the general (or Hermitian) solutions to reduced biquaternion tensor equation $\mathcal{A}*_{Ht}\mathcal{X}=\mathcal{B}$ as well as its least-square solution. Finally, we apply this SVD in color video processing.

Counting spanning trees in graphs

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Abstract: The enumeration of spanning trees of graphs is a classic problem in graph theory, and has important applications in physics and complex network. From the Matrix-tree theorem, we know that the number of spanning trees of a graph G equals to each cofactor of the Laplacian matrix of G. In this talk, we introduce some recent results on counting spanning trees in graphs.

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Yunnan University Overview

Yunnan University Overview

Website: http://english.ynu.edu.cn/ynuabout.html

Yunnan University was founded in 1922, when it was Private Donglu University. In 1934, it was renamed as Provincial Yunnan University and in 1938 renamed as National Yunnan University. It is one of the earliest comprehensive universities in Southwest China. In 1937, when Xiong Qinglai, the well-known mathematician and educationist, served as the president, a large number of renowned scholars were employed to teach at the university, which laid foundation for its development and profound academic tradition, leading to the first glorious era in the history of Yunnan University. In 1940s, Yunnan University developed into one of the famous large universities in China with international influence and offered courses in arts, law, science, engineering, agriculture and medical science. In 1946, Yunnan University was listed by Concise Encyclopedia Britannica as one of the 15 world's famous universities in China.

In 1950s, when Yunnan University was under the direct administration of the Ministry of Education, the national faculty restructuring was introduced. Some important featured departments, like aeronautics, civil engineering, law, and railway spun off from Yunnan University and merged into colleges like Beijing Aeronautical and Astronautical Institute, Sichuan University, Southwest University of Political Science and Law and Changsha Railway Institute. Departments like engineering, medical science and agriculture were also divested from the University and gradually developed into today's Kunming University of Science and Technology, Kunming Medical University, Yunnan Agricultural University and Southwest Forestry University, etc. In 1958, the administrative management of Yunnan University was delegated from the central Ministry of Higher Education to Yunnan province. In 1978, it was ranked by the State Council as one of the 88 national key universities. The university boasts a large number of first-class and important scientific research facilities and platforms-such as the Laboratory Animal Center, the Advanced Computing Center, the Electron Microscope Center and the 1.6-meter multi-channel photometric sky survey telescope. Yunnan University is one of the first demonstration universities appointed by the Ministry of Education to deepen innovation and entrepreneurship education reform.

Since the reform and opening-up, Yunnan University has made huge progress. In 1996, it was among the first universities to win the membership of "Project 211". In 2001, it was listed as one of the higher education institutions to be intensively supported in China's development of its western region. In 2004, it became a key university to benefit from focused support from the People's Government of Yunnan and the Ministry of Education. In 2006, all its 19 secondary indicators were A-graded and it was rated as an excellent college for undergraduate education by the MOE. In 2012, it became a participant of the Central-western Chinese Universities Capacity-building Project, and a participant in the Central-western Chinese Universities Comprehensive Capacity Promotion Project. In 2017, it became one of the first 42 first-class universities in China. In 2018, it became one of the 14 universities in central and western China that were jointly supported by the Ministry of Education and local provincial governments.

In recent years, Yunnan University has integrated itself into the national strategy by serving the economic and social development of Yunnan. It has committed to "taking a foothold in the southwestern frontiers, serving the people of Yunnan, promoting academic strengths, and developing distinct features" and "extraordinary and frog-leaping development from a higher starting point".

Its innovative strategy to meet those goals is to emphasize talent recruitment in a highly-focused and cooperative joint development context that includes the Talent Cultivation Plan and the Action Plan of Yunnan University to Serve Yunnan Province. The "go-global" approach will allow the university to reach new academic heights and a stronger competitive position.

Yunnan University has now gathered a galaxy of talents in liberal arts, science, law, technology, economics, agriculture, medicine, business administration, and fine arts, and has developed into a modern university featuring ethnology, biology, resource development and environmental protection, borderland research, and Southeast Asia and South Asia research. According to a recent discipline ranking released by the MOE, its ethnology, ecology and political science programs rank 2nd, 6th and 10th respectively in the country. According to the 2012 Essential Science Indicators, biology and chemistry at Yunnan University were among the top one percent of the world's academic disciplines.

Yunnan University consists of 27 schools, 10 research institutes, one affiliated hospital and a graduate school. There are over 3,000 teaching and research personnel in professional and technical positions, among whom nearly 1,500 have doctorates. The university has nearly 17,000 full-time undergraduate students, nearly 12,000 master's degree students, over 1,500 PhD students and nearly 1,500 international students. It has 82 majors in undergraduate programs, 12 state-level featured majors, two state-level professional comprehensive pilot reform programs, 10 state-level quality courses, three state-level publicly-available quality courses. A total of 22 of its primary disciplines are authorized to offer PhDs, 42 primary disciplines offer master's degrees, and 26 disciplines offer professional master's degrees. In the fourth round of discipline evaluation conducted by the Ministry of Education, two A-level disciplines (ethnology with an A+ rating and ecology with an A-) and 14 B-level disciplines were evaluated. The university has developed into a comprehensive academic institution with a full range of disciplines and a concentration of top-flight talent – with ethnology, ecology, biology, resource development and environmental protection, as well as studies on frontier issues and international issues in Southeast and South Asia, seen as constituting its distinctive competitive advantages and chief characteristics. It has four national bases for talent cultivation, four national experiment teaching model centers, three national training programs for excellent engineers, one national educational training center for excellent practical and inter-disciplinary legal professionals, four national innovation experiment areas for talent cultivation model as well as one national pilot software school. At YNU, there is one national international joint center, two national maker spaces, and one national college students' cultural quality education base. The university has one key laboratory that was built by the Ministry of Education and Yunnan province, and one philosophy and social science laboratory built by the Ministry of Education. In addition, there are 12 Ministry of Education research centers, observation stations and education bases.

Yunnan University has 12 academicians as well as 11 selected scholars from the national High-level Talents

Introduction Program, 14 especially invited professors and lecture professors from the "Cheung Kong Scholars Program" of the Ministry of Education, 14 recipients of the National Science Fund for Distinguished Young Scholars and two recipients of the National Science Fund for Excellent Young Scholars. There are more than 70 national high-level talents, five chief scientists in the National Key Basic Research and Development Program, four members on the Academic Degree Committee of the State Council and two national model teachers. Some 14 people from the university were selected to participate in the talent training cultivation programs of the Ministry of Education, while another six were named as the Publicity Department of the CPC Central Committee ideological and cultural publicity young talent.

The university understands the importance of top-quality high school education and is noted for its teacher-training programs. For example, it takes part in the MOE's Supporting Program for High-School Key Teachers, and is home to a winner of the MOE's High-School Excellent Young Teacher Award. There are 20 leaders in high-school teaching and scientific research in Yunnan, as well as 20 high-school famous teacher workshops. The university has four national teaching groups, 11 provincial teaching groups, an MOE innovation group, 12 provincial innovation groups, and seven provincial high-school technological innovation groups. Yunnan University is committed to excellence at all levels of China's educational system.

It is also active in talent and innovation development and cultural training. Many of its students were selected under the National Hundred, Thousand and Ten Thousand Talent Project or the 10,000 Talents Program for exceptional young talents. Five of its faculty were named as Leading Scientific Talents in Yunnan, 10 as Yunling Scholars, and one as a Yunling Industrial Technological Leading Talent. Four of its students are recipients of the Yunnan Prosperity Talent Award, while 13 came to the university in the Program for Introduction of Overseas High-level Talents in Yunnan, 103 have been identified as young leaders in academics and technology and technological innovators in Yunnan, and 40 designated as backup young talents for leaders in academics and technology. Yunnan University hosts 12 provincial innovation groups, seven provincial high-school technological innovation groups and 15 provincial innovation groups for philosophy and social sciences. It is also home to the recipient of the 10th China Young Female Scientist Award.

The university's faculty, programs, student body and commitments come together in the various projects it undertakes.

In recent years, it has independently presided 6 projects of the 973 Plan, the 863 Plan, and 40 major bidding projects of the National Social Science Foundation and MOE humanities and social science milestone projects.

These projects have had practical effect. The university's report on the China-Myanmar Oil and Gas Pipeline helped the project start. Its achievements in Research on Cross-border Ecological Safety and International Rivers provided decision-making reference for solving issues related to water resources and the ecological health of rivers that flow across borders. Its research achievements in several projects, such as Dealing with Arsenic Pollution in Yangzonghai Lake, Ecological Rehabilitation and Dealing with Polluted Rivers and Investigation of Non-Point Source Pollution in Dianchi Lake and Controlling Measures have made key contributions to dealing with pollution in plateau lakes. A series of research papers on YNU's scientific achievements – including "research on paleontology and the origin of life", "research on conservation and utilization of biodiversity resources" and "perennial rice technology" - have directly served to solve major practical problems and made important contributions to the national strategy and local economic and social development.

In addition to generating important practical effects, the projects have garnered many awards for the university. It has been awarded several national prizes, such as a first prize for National Natural Science Award, another first prize recognizing a National Higher Institutional Humanities and Social Sciences Outstanding Achievement and a second prize for National Science and Technology Progress, among others.

Pursuit of excellence underlies all of Yunnan University's academics. A total of 20 papers by its professors have been published in world's famous academic publications, like Nature and Science. It has also sponsored academic publications in arts and sciences like Yunnan University Journal and Ideological Front, one of 11

publications listed by the MOE in its Famous Publications Program.

The University, covering an area of 300 hectares, is divided into Chenggong Campus and Donglu Campus, with a public floor area of more than 1,330,000 square meters, asset value of more than 1.5 billion yuan ($209.67 million) for teaching and scientific research instruments and equipment, and a collection of more than 4 million books in the library. The campus network is the main node of CERNET in Yunnan.

Looking into the future, Yunnan University will stick to its spirit of "wisdom from many, justice for all", highlighting rule of law, establishment by virtue, developing by relying on academic research and talents. It will continue to explore the formation of modern university system, enhance its academic strengths, improve its education quality, strengthen its research capacity and social services, promoting its cultural inheritance and innovation capability. It is now working hard to become a regional first-class university that is "best in China, and famous throughout the world".

Yunnan University Overview (Chinese)

Website: http://www.ynu.edu.cn/

云南大学始建于1922年，1923年正式开学，时为私立东陆大学，1934年更名为省立云南大学，1938年改为国立云南大学，是我国西部边疆最早建立的综合性大学之一。1937年，著名数学家、教育家熊庆来出任校长，一大批著名学者受聘到校任教，奠定了学校较高的发展基础和深厚的学术底蕴，开创了云大办学历史上的第一个辉煌时期。20世纪40年代，云南大学已发展成为一所包括文、法、理、工、农、医等学科在内，规模较大，在国际上有影响的中国著名大学之一。1946 年，《不列颠百科全书》将云南大学列为中国15 所在世界最具影响的大学之一。

五十年代院系调整，部属云南大学一些重要而有特色的系科，如航空、土木、法律、铁道等划出并入当时的北京航空学院、四川大学、西南政法学院、长沙铁道学院等高校；工、医、农等先后独立建校，并逐步发展为今天的昆明理工大学、昆明医科大学、云南农业大学、西南林业大学等高校。1978 年，云南大学被国务院确定为全国88 所重点大学之一。

改革开放后，云南大学获得了长足的进步。1996 年首批列入国家“211工程”重点建设大学，2001 年列入西部大开发重点建设院校，2004年成为教育部和云南省人民政府重点共建高校，2006年本科教学工作水平评估共19 项二级指标全部评定为A，被教育部评为本科教学优秀学校，2012年成为国家“中西部高校基础能力建设工程”和“中西部高校综合实力提升工程”实施院校，2017年成为国家首批42所“一流大学”建设高校之一，2018 年跻身中西部14 所“以部为主、部省合建”高校行列，2022 年，继续入选第二轮国家“双一流”建设高校。

2023年4月20日，中共中央总书记、国家主席、中央军委主席习近平致信祝贺云南大学建校100 周年。贺信指出：100 年来，云南大学秉承“会泽百家、至公天下”的办学精神，扎根祖国西南边疆民族地区，培养了大批优秀人才，为促进民族团结进步、服务区域经济社会发展作出了积极贡献。

云南大学下设28个学院、10个研究机构，1个附属医院，设有研究生院。云南大学现有教职员工3000 余人（不包括附属医院），其中专业技术岗位2700 余人，具有高级职称人员近1300 人，具有博士学位人员近1500人。学校有全日制本科生近17000 人，全日制硕士研究生近12000 人，博士研究生1500 余人，学历教育国际学生近1500 人。学校占地面积4367亩，有呈贡校区和东陆校区，公用校舍建筑面积133余万平方米，教学科研仪器设备资产总值15亿余元，图书馆纸质藏书400 万余册。学校是中国教育科研计算机网络（CERNET）云南主节点单位。

学校有本科专业84个，其中有国家级和省级一流本科建设专业68 个。有12个国家特色专业，7个专业“菁英班”，10个专业“卓越班”，27门“国家级一流本科课程”；有22个一级学科博士学位授权点，1个专业博士学位授权，42 个一级学科硕士学位授权，26 个专业硕士学位授权，形成了以民族学、生态学、统计学、生物与生物医药、特色资源开发与环境保护，以及边疆问题和区域国别研究为优势特色，学科较为齐全，人才密集的学科专业体系。

学校大力实施“人才强校”战略，高层次人才持续增长。现有院士12人（含双聘），长江、杰青、优青等国家高层次人才近80人，国家重点基础研究发展计划首席科学家8人，国家“百千万人才工程”入选者16 人，中科院“百人计划”入选者16 人，国务院学位委员学科评议组成员4 人，全国模范教师2 人，中宣部文化名家暨“四个一批”人才2人，教育部“新世纪优秀人才培养计划”“跨世纪优秀人才培养计划”和“高等学校骨干教师资助计划”入选者14 人，中宣部宣传思想文化青年英才6人，国家级教学团队4个，科技部重点领域创新团队1 个，教育部创新团队1 个。

学校大力实施“学术兴校”战略，科学研究成绩显著。学校先后主持国家“973计划”“863计划”项目6 项，国家水专项重大项目2项，国家重点研发计划6 项，国家科技支撑计划2项，国家社会科学基金重大招标项目28

项，国家社会科学基金重大专项10 项，国家社科基金冷门绝学研究专项团队项目1 项，教育部人文社会科学重大项目8项，马克思主义理论研究和建设工程项目2项，国家社科基金成果文库5项，国家自然科学基金重大项目1 项。荣获国家自然科学一等奖、国家自然科学二等奖、全国创新争先奖、何梁何利奖、全国高校人文社科优秀成果一等奖、国家科学技术进步二等奖、惠特克杰出生态学家奖、国际青年古生物学家“Hodson Award”奖等多项大奖。荣获云南省科学技术奖杰出贡献奖3 项、特等奖3项。20 余篇论文发表于《Nature》《Science》和《中国社会科学》。学校主办有《思想战线》《云南大学学报》等学术刊物，《思想战线》是首批入选教育部“名刊工程”建设的11 种期刊之一。

学校有1个省部共建国家重点实验室，1个国际联合研究中心，1 个国家技术转移中心，2个国家级众创空间，1 个教育部哲学社会科学实验室，1 个四部委铸牢中华民族共同体意识研究基地，1 个教育部人文社科重点研究基地，2个省部共建协同创新中心，1 个教育部国际联合研究中心，1 个教育部工程研究中心，1个教育部野外科学观察站，2个省部共建教育部重点实验室，1个国家Linux技术培训与推广中心，1个教育部中华优秀传统文化传承基地，1 个教育部国家教材建设重点研究基地，1个国家大学生文化素质教育基地，1 个国家科学决策咨询研究中心。有4个国家级人才培养基地，4个国家级实验教学示范中心，3项国家级卓越工程师培养计划项目，1个国家级应用型、复合型卓越法律职业人才教育培养基地，4个国家人才培养模式创新实验区以及国家示范性软件学院。拥有实验动物中心、先进计算中心、电镜中心、1.6米多通道测光巡天望远镜等一批重大科研设施平台。学校为教育部首批深化创新创业教育改革示范高校。

学校发挥毗邻南亚东南亚的区位优势，主动融入服务“一带一路”和中国面向南亚东南亚辐射中心建设，构建多方位、多领域、多层次的国际合作交流格局。学校与国际上100多所高校和机构开展合作交流，其中与剑桥大学、欧洲南方天文台、耶鲁大学等29 所一流大学和国际学术组织合作开展科研，与东京大学、温莎大学等33所国外高水平大学开展联合培养项目。留学生生源国数量达70个，基本实现南亚东南亚国家全覆盖，是教育部首批“高层次国际化人才培养创新实践基地”。构建有10个非通用语种和国际中文为基础的“语言+专业”复合型人才培养体系。建有覆盖东南亚、南亚、西亚、非洲和“一带一路”沿线国家较为完备的区域国别研究体系和新型特色智库体系。作为永久秘书长单位发起成立涵盖16个南亚东南亚国家120余所高校的“南亚东南亚大学联盟”。

学校积极主动服务国家和区域经济社会发展。合作承担了《习近平谈治国理政》（第一、二、三卷）缅甸、老挝等五国语言的翻译、出版、推广工作；“中缅油气管道与中国能源安全”“南方丝绸之路经济大走廊”等成果上升为国家重大决策，“铸牢中华民族共同体意识研究”“阳宗海砷污染治理”“跨境生态安全和国际河流研究”“高原湖泊治理研究”“中国周边外交研究”“政治学与边疆民族问题研究”“古生物和生命起源研究”“生物多样性资源保育与利用研究”“致密天体与高能现象”“银河系与近邻宇宙”“根结线虫生物防治技术”“多年生稻技术”等科研方向和成果直接服务于解决重大现实问题，创造了良好的效益，产生了重要影响，为国家战略和地方经济社会发展作出重要贡献。

站在新的百年征程起点上，学校将以习近平新时代中国特色社会主义思想为指导，全面学习贯彻党的二十大精神、习近平总书记致云南大学建校100 周年贺信精神，全面贯彻落实党的教育方针，坚守为党育人、为国育才初心使命；秉承“会泽百家、至公天下”的云大精神，以一流党建为引领，以一流大学建设为中心，以立德树人为根本任务，以高质量发展为主线，以改革创新为动力，全面提升学校办学水平和综合实力，加快建设立足祖国西南边疆、面向南亚东南亚的综合性、国际性、研究型世界一流大学，走出一条边疆民族地区建设世界一流大学的特色发展之路，为建设教育强国，以中国式现代化全面推进中华民族伟大复兴贡献云大力量。

Introduction to the School of Mathematics and Statistics of Yunnan University

云南大学数学与统计学院
School of Mathematics and Statistics,Yunnan University

Website: http://www.ms.ynu.edu.cn/

Introduction to the School of Mathematics and Statistics

The School of Mathematics and Statistics of Yunnan University was established in December 2005. The mathematics department, its predecessor, was founded in 1934. The Department of Statistics was founded in 1989. It is one of the long-standing mathematics and statistics departments of Chinese universities. Many famous mathematicians, such as Xiong Qinglai, He Lu, Hua Luogeng, Chen Xingshen, He Yanxuan, Wang Shikui, and Zhuang Yintai, have taught at the Mathematics Department of Yunnan University. They have all made outstanding contributions in the construction and development of mathematics in Yunnan University.

Over the years, with the support of the university, with the joint efforts of all the teachers and students, the school has now developed into a research and teaching and society serving school. The school now has two first-level doctoral degree programs in mathematics and statistics, two first-level master's degree programs in mathematics and statistics, two post-doctoral research stations in mathematics and statistics, a master's degree program in quantitative economics, and programs of Master of Applied statistics and Master of Bigdata. Our school now has formed a complete talent-training system for undergraduates-master-PhD and post-doctoral. Among them, probability theory and mathematical statistics, and basic mathematics are provincial key disciplines.

The school has five undergraduate majors in mathematics and applied mathematics, information and computational science, statistics, data science and big data technology, and national science talent training base–"mathematical and physical based", "Xu Zongben Academician Workstation", and "Yunnan institution of Higher learning Postgraduate Education and Innovation Joint Training Base", "Central and Local Joint Construction of University's Characteristic Advantage Laboratory (Yunnan University Statistical Modeling and Data Integration Laboratory)", "Yunnan Key Laboratory of Statistical Modeling and Data Analysis", "Key Laboratory of Statistics and Information Technology of Yunnan Colleges and Universities", "Innovative Team of Research on Complex Data Statistics and Inference Methods of Yunnan University", "Computing Theory and Applied Technology Innovation Team of Yunnan Colleges and Universities", "Information and Computing Science Professional Teaching Team of Yunnan Colleges and Universities", 1 provincial-level quality course, 2 provincial bilingual teaching demonstration courses, and 1 national bilingual teaching demonstration course.

After several generations of efforts, the School of Mathematics and Statistics has formed five obvious advantages, characteristics and stable research directions of modern analysis, algebra, differential equations, combination optimization and algorithm theory and mathematical statistics. We now formed a teaching team with reasonable title, age, academic qualifications, professional structure, and obvious advantage, its core members are young and middle-aged teachers. There are 80 full-time faculty members (71 teachers), including 18 profes-

sors, 32 associate professors, 21 lecturers. Among them, there are 51 teachers with doctoral degrees, 2 part-time academicians, and 8 part-time professors. Also, we have 1 academician (specially hired), 2 distinguished professors of the "Changjiang Scholars Award Program", 2 lecture professors of the "Changjiang Scholars Award Program", 1 winner of the "National Science Fund for Distinguished Young Scholars", 1 expert of "National Thousand Plan", 1 person of the "Million and Ten Million Talent Projects" of Ministry of Human Resources and Social Sciences, one expert with outstanding contributions at the national level, one member of the Academic Leadership Group of the Mathematics Tianyuan Fund of the National Natural Science Foundation, one member of the Teaching Guidance Committee of the Statistics Department of the Ministry of Education, one person of the Ministry of Education's "New Century Excellent Talents Support Program", one recommended member of the International Statistical Institute, one "Board of Directors" of the International Pan-Statistics Association, one winner of the "Fok Ying-Tong Young Teacher Award", 1 person of the "Yunnan Science and Technology Leaders", 3 persons of "provincial sudden" or "provincial stickers", 2 persons of "Yunnan high-level imported talents", 3 persons of "Yunnan 100 people plan", 18 Young distinguished persons of "Yunnan 10,000 people plan", 3 contacted experts of Yunnan provincial party committee, 4 persons of "Yunnan young and middle-aged academic and technical leaders", 2 reserve talents of "Yunnan young and middle-aged academic and technical leaders", and 3 "Yunnan Distinguished Teachers". It has formed a faculty team led by high-level talents such as academicians, Changjiang Scholars, Distinguished Young Scholars, experts of "National Thousand Plan", and Yunnan high-level scientific and technological talents. It has laid a solid foundation in order to effectively improve the level of teaching and research, enhance core competitiveness, and promote "Double Top - class" Construction.

In the past five years, the research work of the school has achieved fruitful results and has obtained a number of research results that have great influence at home and abroad, including 12 monographs and nearly 800 research papers; and undertaken 60 national projects, such as the National Outstanding Youth Science Fund, the key projects of National Natural Science Foundation, the general, youth and special projects of National Natural Science Foundation, National Social Science Fund, and more than 10 horizontal projects for Yunnan Provincial Bureau of Statistics, Kunming Municipal Bureau of Statistics, and China Railway Second Institute. We also won 4 second prizes and 3 third prizes at the provincial and ministerial level.

At present, there are 811 undergraduates, 410 graduate students, and 57 doctoral students in the school. The school attaches great importance to the cultivation of students, actively encourages teachers to carry out teaching reforms and teaching seminars, actively seeks ways to improve the teaching and research environment, actively organizes and guides students to participate in in-class and out-of-class scientific and technological innovation activities, and strives to cultivate students' awareness, ability, and teamwork spirit of science and technology innovation, cultivate students' practical application ability through multiple channels. In recent years, we have won numerous awards in the National College Students' Mathematical Modeling, American College Students' Mathematical Modeling, the "Challenge Cup" College Students' Science and Technology Competition, and the College Students' Innovation and Entrepreneurship Competition. The school has trained a large number of potential mathematics and statisticians for the society, and some have become well-known scholars, professors or doctoral advisors as well as leaders or experts at all levels.

Introduction to the School of Mathematics and Statistics (Chinese)

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School of Mathematics and Statistics,Yunnan University

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云南大学数学与统计学院成立于2005年12月，她的前身数学系创建于1934年，统计系创建于1989 年，是中国大学历史悠久的数学系和统计系之一，大学数学教学部创建于2018年。许多著名数学家，如：熊庆来、何鲁、华罗庚、陈省身、何衍璇、王世魁、庄圻泰等都曾在云南大学数学系任教，他们都曾为云南大学数学学科的建设和发展做出了卓越的贡献。

多年来，在学校的关心和支持下，在学院全体师生的共同努力下，学院现已发展成为一个集教学、科研和社会服务于一体的研究教学型学院。学院开设有数学与应用数学、信息与计算科学、统计学、数据科学与大数据技术、数理基础科学班国家数理基地班（数学）5个全日制本科专业；拥有数学、统计学2个一级学科博士学位授权点，数学、统计学2 个一级学科硕士学位授权点，数学、统计学2个博士后科研流动站，数量经济学硕士学位授权点、应用统计硕士专业学位授权点以及大数据统计硕士学位授权点；形成了完整的本- 硕-博以及博士后的人才培养体系。其中，概率论与数理统计、基础数学均为省级重点学科，“统计学”被列为学校“双一流大学”重点建设学科；数学与应用数学、统计学均为首批国家级一流本科专业建设点，信息与计算科学为省级一流本科专业建设点；“数学分析（I）”、“应用回归分析”均为国家级一流课程；《应用回归分析》教材获首届全国优秀教材奖（高等教育类）二等奖，2021年获第九届云南省高等教育教学成果奖一等奖1项。

学院现有“徐宗本院士工作站”，“云南省高等院校研究生教育创新联合培养基地”，“中央与地方共建高校特色优势学科实验室– 云南大学统计建模与数据集成实验室”，“云南省统计建模与数据分析重点实验室”、“云南省高校统计与信息技术重点实验室”，“云南省复杂数据统计推断方法研究创新团队”、“云南大学运筹学省创新团队（培育）”、“云南省云岭高层次创新创业团队”、“云南省高校计算理论与应用科技创新团队”、“云南省高校信息与计算科学专业教学团队”，建有40余个校外专业实习实训基地。

经过几代人的努力，数学与统计学院现已形成以近代分析、代数、微分方程、组合最优化与算法理论和数理统计为代表的5个具有明显优势和特色的、稳定的研究方向；形成了一支以中青年教师为核心，职称、年龄、学历、专业学缘结构合理的、优势明显的师资队伍。现有专职教职工80 人（专任教师71人），其中教授18人，副教授或高级实验师32 人，讲师21 人，具有博士学位的教师51人，双聘院士2 人、兼职教授8 人。教育部“长江学者奖励计划”特聘教授1人、讲座教授2 人，“国家杰出青年科学基金”获得者1 人，国家特聘教授1 人，国家百千万人才工程暨有突出贡献中青年专家1 人，国家自然科学基金委数学天元基金学术领导小组成员1人，教育部高等学校统计学类专业教学指导委员会委员1人，教育部“新世纪优秀人才支持计划”入选者1 人，国际数理统计学会会士1人，国际统计学会推选会员1 人，国际泛华统计协会“Board of Directors”1 人，霍英东青年教师奖获得者2 人，云南省科技领军人才1人，“省突”或“省贴”3 人，云南省“高端引进人才”2 人，云南省“百人计划”入选者3 人，云南省“万人计划”青年拔尖人才18人，云南省委联系专家3人，云南省中青年学术和技术带头人4人，云南省中青年学术和技术带头人后备人才2人，云南省教学名师3人。10多人在国家级、省级学会担任理事长、副理事长、常务理事等职务。

近5年来，学院教学科研工作硕果累累，取得了一批在国内外都有较大影响的教学和科研成果，包括12部教材/专著和近800多篇教学/科研论文；承担了国家杰出青年科学基金、国家自然科学基金重点项目、国家自然科学基金面上、地区、青年及专项，以及国家社科基金等国家级项目60余项，承接云南省统计局、昆明市统计局、中铁二院等单位委托的横向项目10 余项；获省部级科研奖励二等奖4 项、三等奖3 项。

学院现有全日制在校本科生811人，硕士研究生410 人，博士研究生57人。先后与英国普利茅斯大学签署联合培养博士研究生项目，与美国、英国、加拿大等国家，以及中国的香港、台湾等地区的高水平大学建立实质性合作，每年有多名研究生赴相关高校联合培养或交流研修。历年来，毕业生就业率均保持在99% 以上，向北

京大学、南开大学等高校输送博士生、硕士生200 余人。近年来，学院学生在全国研究生数学建模竞赛、全国大学生市场调查与分析大赛、全国大学生统计建模大赛、美国大学生数学建模竞赛、“互联网+”大学生创新创业大赛、“挑战杯”全国大学生课外学术科技作品竞赛等学科竞赛中屡获大奖。学院设有“萧文灿先生数学教育基金”，每二年评选1名讲座教授，给予20 万元奖励；每年评选2 名优秀教师，每名给予5万元奖励；每年评选5名学生，每名给予2 万元奖励。学院主办的“云南大学女生节”、“数学文化周”等系列活动已成为学校的品牌活动，为社会培养了大批具有潜力的数学、统计工作者，更有一些已经成为知名学者、教授或博士生导师以及各级领导或专家。

在新的历史起点上，全院师生将继续践行“自尊、致知、正义、力行”的云大校训，加强人才培养，强化专业特色鲜明、国内影响显著的教学研究型学院建设!