廖 振宇

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男，33 岁，中共党员

工作经历

2021-至今	**副研究员**, 华中科技大学, 电子信息与通信学院
2025-2026	**借调工作**, 中国科学技术交流中心, 欧亚与科技援外处
2020-2021	**博士后研究员**, 加州大学伯克利分校, 统计系, 合作导师：Michael Mahoney 教授

教育经历

2016-2019	**博士**, 巴黎萨克雷大学, 数学与计算机, 合作导师：Romain Couillet 教授
2014-2016	**硕士**, 巴黎萨克雷大学, 信号与图像处理, 合作导师：Romain Couillet 教授
2010-2014	**本科**, 华中科技大学, 光电信息工程

科研获奖

2025	IEEE Senior Member
2025	MATRIX-Simons Travel Grant, MATRIX, Creswick, 澳大利亚
2025	加拿大 CRM-Simons 访问教授，蒙特利尔大学 Centre de recherches mathématiques (签证原因未成行)
2024	法国 ANR-LabEx-CIMI 访问教授，图卢兹第三大学 Centre International de Mathématiques et Informatique de Toulouse (CIMI)
2023	湖北省人才计划
2021	武汉市人才计划
2021	华中科技大学东湖青年学者
2019	巴黎萨克雷大学 ED STIC 优秀博士论文
2016	巴黎萨克雷大学 Supélec Foundation Ph.D. Fellowship

学术专著

CUP Romain Couillet, **Zhenyu Liao**. Random Matrix Methods for Machine Learning. *Cambridge University Press*. 2022. DOI: 10.1017/9781009128490. ISBN: 9781009123235.

部分代表论文

会议论文

ICML 25 Chengmei Niu, **Zhenyu Liao**, Zenan Ling, and Michael W. Mahoney. Fundamental Bias in Inverting Random Sampling Matrices with Application to Sub-sampled Newton. *Proceedings of the 42nd International Conference on Machine Learning*. Vol. 267. PMLR, 2025, pp.46649–46692.

ICLR 25 Xiaoyi Mai and **Zhenyu Liao**. The Breakdown of Gaussian Universality in Classification of High-dimensional Mixtures. *International Conference on Learning Representations*. 2025.

SIGMOD 25 Jiuqi Wei, Xiaodong Lee, **Zhenyu Liao**, Themis Palpanas, and Botao Peng. Subspace Collision: An Efficient and Accurate Framework for High-dimensional Approximate Nearest Neighbor Search. *Proc. ACM Manag. Data* **3**(1) (June 2025).

EUSIPCO 24 Wei Yang, Zhengyu Wang, Xiaoyi Mai, Zenan Ling, Robert C. Qiu, and **Zhenyu Liao**. Inconsistency of ESPRIT DoA Estimation for Large Arrays and a Correction via RMT. *IEEE 32nd European Signal Processing Conference*. Aug. 2024, pp.2722–2726.

ICML 24   Zenan Ling, Longbo Li, Zhanbo Feng, Yixuan Zhang, Feng Zhou, Robert C. Qiu, and **Zhenyu Liao**. Deep Equilibrium Models Are Almost Equivalent to Not-so-deep Explicit Models for High-dimensional Gaussian Mixtures. *Proceedings of the 41st International Conference on Machine Learning*. Vol. 235. PMLR, 2024, pp.30585–30609.

ISIT 24   Yi Song, Kai Wan, **Zhenyu Liao**, Hao Xu, Giuseppe Caire, and Shlomo Shamai. An Achievable and Analytic Solution to Information Bottleneck for Gaussian Mixtures. *IEEE International Symposium on Information Theory*. July 2024, pp.2460–2465.

NeurIPS 22   Lingyu Gu, Yongqi Du, Yuan Zhang, Di Xie, Shiliang Pu, Robert C. Qiu, and **Zhenyu Liao**, "Lossless" Compression of Deep Neural Networks: A High-dimensional Neural Tangent Kernel Approach. *Advances in Neural Information Processing Systems*. Vol. 35. 2022, pp.3774–3787.

ICLR 22   Hafiz Tiomoko Ali, **Zhenyu Liao**, and Romain Couillet. Random matrices in service of ML footprint: ternary random features with no performance loss. *The Tenth International Conference on Learning Representations*. 2022.

NeurIPS 21   **Zhenyu Liao** and Michael W. Mahoney. Hessian Eigenspectra of More Realistic Nonlinear Models. *Advances in Neural Information Processing Systems*. Vol. 34. 2021, pp.20104–20117.

COLT 21   Michal Derezinski, **Zhenyu Liao**, Edgar Dobriban, and Michael W Mahoney. Sparse sketches with small inversion bias. *Proceedings of Thirty Fourth Conference on Learning Theory*. Vol. 134. Proceedings of Machine Learning Research. PMLR, 15–19 Aug 2021, pp.1467–1510.

ICLR 21   **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. Sparse Quantized Spectral Clustering. *The Ninth International Conference on Learning Representations*. 2021.

AISTATS 21   Fanghui Liu, **Zhenyu Liao**, and Johan Suykens. Kernel Regression in High Dimension: Refined Analysis beyond Double Descent. *Proceedings of The 24th International Conference on Artificial Intelligence and Statistics*. Vol. 130. Proceedings of Machine Learning Research. PMLR, 13–15 Apr 2021, pp.649–657.

NeurIPS 20a   **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. A random matrix analysis of random Fourier features: beyond the Gaussian kernel, a precise phase transition, and the corresponding double descent. *Advances in Neural Information Processing Systems*. Vol. 33. pp.13939–13950. 2020.

NeurIPS 20b   Michal Derezinski, Feynman T Liang, **Zhenyu Liao**, and Michael W Mahoney. Precise expressions for random projections: Low-rank approximation and randomized Newton. *Advances in Neural Information Processing Systems*. Vol. 33. pp.18272–18283. 2020.

EUSIPCO 18   Romain Couillet, **Zhenyu Liao**, and Xiaoyi Mai. Classification Asymptotics in the Random Matrix Regime. *The 26th European Signal Processing Conference*. IEEE. Sept. 2018, pp.1875–1879.

ICASSP 19   Xiaoyi Mai, **Zhenyu Liao**, and Romain Couillet. A Large Scale Analysis of Logistic Regression: Asymptotic Performance and New Insights. *IEEE International Conference on Acoustics, Speech and Signal Processing*. IEEE. May 2019, pp.3357–3361.

ICML 18   **Zhenyu Liao**, and Romain Couillet. On the Spectrum of Random Features Maps of High Dimensional Data. *Proceedings of the 35th International Conference on Machine Learning*. Vol. 80. PMLR, July 2018, pp.3063–3071.

ICML 18   **Zhenyu Liao**, and Romain Couillet. The Dynamics of Learning: A Random Matrix Approach. *Proceedings of the 35th International Conference on Machine Learning*. Vol. 80. PMLR, July 2018, pp.3072–3081.

ICASSP 17   **Zhenyu Liao** and Romain Couillet. Random Matrices Meet Machine Learning: A Large Dimensional Analysis of LS-SVM. *IEEE International Conference on Acoustics, Speech and Signal Processing*. IEEE. Mar. 2017, pp.2397–2401.

期刊论文

TKDE 24   Zhanbo Feng, Yuanjie Wang, Jie Li, Fan Yang, Jiong Lou, Tiebin Mi, Robert. C. Qiu, **Zhenyu Liao**. Robust and Communication-Efficient Federated Domain Adaptation via Random Features. *IEEE Transactions on Knowledge and Data Engineering* **37**(3) (2025), 1411–1424.

PRA 23   Jingcheng Wang, Shaoliang Zhang, Jianming Cai, **Zhenyu Liao**, Christian Arenz, and Ralf Betzholz. Robustness of random-control quantum-state tomography. *Phys. Rev. A* **108** (2 2023), 022408.

MCRF 23   Yacine Chitour, **Zhenyu Liao**, and Romain Couillet. A geometric approach of gradient descent algorithms in linear neural networks. *Mathematical Control and Related Fields* **13**(3) (2023), 918–945.

JSTAT 21 **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. A random matrix analysis of random Fourier features: beyond the Gaussian kernel, a precise phase transition, and the corresponding double descent. *Journal of Statistical Mechanics: Theory and Experiment* **2021**(12) (Dec. 2021), 124006.

TSP 19 **Zhenyu Liao** and Romain Couillet. A Large Dimensional Analysis of Least Squares Support Vector Machines. *IEEE Transactions on Signal Processing* **67**(4) (Feb. 2019), 1065–1074.

AAP 18 Cosme Louart, **Zhenyu Liao**, and Romain Couillet. A Random Matrix Approach to Neural Networks. *The Annals of Applied Probability* **28**(2) (Apr. 2018), 1190–1248.

科研项目

在研

2026-2029 国家自然科学基金面上项目：基于随机矩阵方法的 *Transformer* 大模型压缩：从缩放定律极限理论到动态自适应模型压缩方法（NSFC-12571561），44 万元，**主持**；Co-PI：Cosme Louart，SDS，香港中文大学（深圳）

2026-2028 华中科技大学"基础研究支持计划"数学专项项目：基于随机矩阵方法的大规模机器学习理论和方法（2025BRSXB0004），38 万元，**主持**

2025-2030 国家重点研发计划青年科学家项目：揭示大模型机理的机器学习基础理论研究（2025YFA1018600），100/300 万元，项目骨干；PI：束俊，数学与统计学院，西安交通大学

2024-2026 华为技术有限公司校企合作项目：*Algorithm and Theory of High-dimensional Dynamical Systems*（TC20240702035），80 万元，**主持**；Co-PI：凌泽南，华中科技大学电信学院

已结题

2024-2026 广东省人工智能数理基础重点实验室开放基金：基于随机矩阵方法的 *Transformer* 模型泛化理论研究（OFA00003），10 万元，**主持**；Co-PI：Jeff Yao，SDS，香港中文大学（深圳）

2023-2025 国家自然科学基金青年科学基金项目：基于随机矩阵方法的神经网络模型剪枝基础理论研究（NSFC-62206101），30 万元，**主持**

2023-2025 华为技术有限公司校企合作项目：随机矩阵理论驱动的通信理论和算法研究（TC20231122043），59 万元，**主持**

2022-2025 国家自然科学基金"面向未来通信的数学基础（信息论）"专项项目：智能反射面辅助的新型无线通信数学理论与数学技术（NSFC-12141107），300 万元，项目骨干；PI：邱才明，华中科技大学电信学院

2021-2022 中国计算机学会 CCF-海康威视斑头雁基金项目：基于随机矩阵和信息瓶颈理论的神经网络表达和压缩的研究（20210008），28 万元，**主持**；Co-PI：万凯，华中科技大学电信学院

2018-2021 NSF Research Grant, *Combining Stochastics and Numerics for Improved Scalable Matrix Computations* (NSF-1815054)，500k 美元，项目骨干；PI: Michael W. Mahoney, UC Berkeley, USA

2018-2021 法国高等教育、研究与创新部：GSTATS-IDEX DataScience Chair，300k 欧元，项目骨干；PI: Romain Couillet, U Grenoble Alpes, France

2015-2017 法国自然科学基金委：*Random Matrix Theory for Large Dimensional Graphs* （ANR-14-CE28-0006），300k 欧元，项目骨干；PI: Romain Couillet, U Paris-Saclay, France

教学改革项目

2024-2025 华中科技大学国家卓越工程师学院 2025 年"卓越工程师自主培养新范式"项目：产教融合卓越工程师国际化视野培养，3 万元，**主持**（结题）

科研服务

学会兼职 中国现场统计研究会随机矩阵理论与应用分会副秘书长，中国现场统计研究会大数据统计分会理事，中国商业统计学会人工智能分会理事，中国通信学会短距无线通信委员会秘书

评审专家 欧洲研究理事会 ERC，加拿大自然科学与工程研究委员会 NSERC，以色列科学基金会 ISF，中国国家自然科学基金委员会 NSFC

国际会议领域主席 ICML 2025-2026, NeurIPS 2025, ICLR 2025-2026, AISTATS 2026, IJCNN 2025

国际期刊 副编辑	Springer Statistics and Computing（2025 年至今）
国际会议 审稿人	ICLR, ICML, NeurIPS, SODA, AISTATS, AAAI, ECAI, IEEE-ICASSP, IEEE-CAMSAP
数学与数据 科学期刊 审稿人	SIAM Review (SIREV), Foundations of Computational Mathematics (FoCM), Physical Review X (PRX), Journal of Mathematical Physics, IEEE Trans. on Signal Processing (IEEE-TSP), Springer Statistics and Computing (STCO), SIAM Journal on Scientific Computing (SISC), Random Matrices: Theory and Applications (RMTA), Latin American Journal of Probability and Mathematical Statistics (ALEA), Annals of Applied Probability (AAP), Electronic Journal of Statistics (EJS), IEEE Signal Processing Letters (SPL), AIMS Mathematics.
机器学习和 AI 期刊 审稿人	Journal of Machine Learning Research (JMLR), IEEE Trans. on Pattern Analysis and Machine Intelligence (IEEE-TPAMI), Engineering Applications of Artificial Intelligence (EAAI), Neural Networks (NEUNET), IEEE Trans. on Neural Networks and Learning Systems (IEEE-TNNLS), Transactions on Machine Learning Research (TMLR), Pattern Recognition (PR), Neural Processing Letters (NPL)

学术活动

1. "Universality and Dynamics in High-Dimensional Learning and Inference" Workshop (together with Rishabh Dudeja, Junjie Ma, and Arian Maleki) at 2026 IEEE International Symposium on Information Theory (ISIT 2026), June 2026, Guangzhou, China.
2. Special Session (together with Dirk Slock) on "Large-Dimensional Structures and Methods for Signal Processing, Communication, and Machine Learning" at 2026 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2026), May 2026, Barcelona, Spain.
3. 2025 年大模型数理统计基础研讨会，吉林省长白山，2025 年 7 月；在线直播吸引了超过 3.5 万观众
   - 组织委员会：Pengkun Yang and Cong Fang
   - 线上回放链接：`https://www.chaspark.com/#/live/1163174208666234880`
4. 中国现场统计研究会随机矩阵理论与应用分会成立大会暨学术交流会，吉林省长春市，2025 年 1 月
   - 组织委员会：Jeff Yao, Shurong Zheng, Jiang Hu and Dandan Jiang
   - 线上回放链接：`https://www.chaspark.com/#/live/1094710761221922816`
5. **General co-chair** of 10th EAI International Conference on loT as a Service (EAI IoTaaS 2024), Wuhan, China, 2024
6. 华中科技大学-巴黎萨克雷大学2022 联合研讨会 "数据科学中的数学奥秘"
   - 吸引超过 **40 000** 名相关领域的科研人员、老师和同学参与
   - 线上回放链接：`https://www.bilibili.com/video/BV1G8411b7ir/`
7. 1st Workshop in High-dimensional Learning Dynamics (HiLD) at ICML 2023, Honolulu, Hawaii
   - 组织委员会：Mihai Nica, Courtney Paquette, Elliot Paquette, Andrew Saxe, and René Vidal
   - 报告嘉宾：Sanjeev Arora, SueYeon Chung, Murat A. Erdogdu, Surya Ganguli, and Andrea Montanari

──────── ## 推荐人

邱才明	华中科技大学电子信息与通信学院院长，IEEE Fellow。Email: caiming@hust.edu.cn
Michael Mahoney	Associate Adjunct Professor at Department of Statistics, UC Berkeley, CA, USA. Director of the UC Berkeley FODA (Foundations of Data Analysis) Institute, Berkeley, CA, USA. Email: mmahoney@stat.berkeley.edu
Romain Couillet	Full Professor at University Grenoble-Alps, France. Holder of the UGA MIAI LargeDATA Chair, University-Grenoble-Alps, France. Email: romain.couillet@gipsa-lab.grenoble-inp.fr