

廖振宇

☎ (+86)-131-6415-1928
✉ zhenyu_liao@hust.edu.cn
🌐 <https://zhenyu-liao.github.io/>
男, 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 Dereziński, **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 Dereziński, 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

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）

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**

2024-2026 华为拉格朗日数学与计算研究中心合作项目： *Algorithm and Theory of High-dimensional Dynamical Systems*（TC20240702035），80 万元，**主持**

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，核心成员

2021-2023 湖北省重点研发计划项目：新一代工业互联网网络关键技术研究（2021BAA037），100 万元，核心成员

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**

2021-2024 广西省重点研发计划项目：交通路网重要节点主动安全防控智能一体化成套技术研究与产业化（桂科 AB21196034），500 万元，核心成员

2018-2021 NSF Research Grant, *Combining Stochastics and Numerics for Improved Scalable Matrix Computations* (NSF-1815054), 500k 美元，核心成员

2018-2021 法国高等教育、研究与创新部：GSTATS-IDEX DataScience Chair, 300k 欧元，核心成员

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，核心成员

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**

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

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

国际会议领域主席 ICML 2025, 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), 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
- 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.
 - 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>
 - 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>
 - **General co-chair** of 10th EAI International Conference on IoT as a Service (EAI IoTaaS 2024), Wuhan, China, 2024
 - 华中科技大学-巴黎萨克雷大学2022 联合工作坊“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/>
 - 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