# 廖 振宇

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## 工作经历

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| 2021-至今 | **副研究员**, 华中科技大学, 电子信息与通信学院. |
| 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

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| 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. |
| 2010-2014 | **本科**, 华中科技大学, 光电信息工程. |

## 科研获奖

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| 2021 | 湖北省武汉市"武汉英才"优秀青年人才 |
| 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

**ICLR** 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.

**MCRF** Yacine Chitour, **Zhenyu Liao**, and Romain Couillet. A geometric approach of gradient descent algorithms in linear neural networks. *Mathematical Control and Related Fields* (2022).

**JSTAT** **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.

**NeurIPS** **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** Michal Derezinski, **Zhenyu Liao**, Edgar Dobriban, and Michael 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** **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. Sparse Quantized Spectral Clustering. *The Ninth International Conference on Learning Representations*. 2021.

**AISTATS** 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** **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** 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.

**CAMSAP** **Zhenyu Liao** and Romain Couillet. On Inner-Product Kernels of High Dimensional Data. *2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing.* IEEE. 2019, pp.579–583.

**IEEE-TSP** **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.

**EUSIPCO** 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** 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** **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** **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.

**AAP** 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.

**ICASSP** **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.

## 科研项目

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**

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

2021-2024 中国中央高校基本科研业务费专项资金资助（No. 2021XXJS110）：高维随机矩阵方法在机器学习模型中的理论和应用，50 万元，**主持**

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 CFF-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

## 科研服务

外部审稿人 欧洲研究理事会European Research Council (ERC)，加拿大自然科学与工程研究委员会 NSERC

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| 审稿人或 PC | NeurIPS, ICML, ICLR, AISTATS, AAAI, CAMSAP, Journal of Machine Learning Research (JMLR), IEEE Trans. on Pattern Analysis and Machine Intelligence (IEEE-TPAMI), IEEE Trans. on Signal Processing (IEEE-TSP), IEEE Trans. on Neural Networks and Learning Systems (IEEE-TNNLS), Transactions on Machine Learning Research (TMLR), Springer Statistics and Computing (STCO), SIAM Journal on Scientific Computing (SISC), Pattern Recognition (PR), Random Matrices: Theory and Applications (RMTA), Latin American Journal of Probability and Mathematical Statistics (ALEA), Neural Processing Letters (NPL), PLOS ONE |

## ━━━━━ 推荐人

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| **邱才明教授** | 华中科技大学电子信息与通信学院院长，IEEE Fellow。Email: caiming@hust.edu.cn |
| **Prof. 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 |
| **Prof. 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 |