Zhenyu Liao

Curriculum Vitae

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Male, Chinese, born in 28/08/1992.

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Education

2019	**Ph.D.**	Statistics and Machine Learning	L2S, CentraleSupélec, University of Paris-Saclay, France.
2016	**M.Sc.**	Signal and Image Processing	University of Paris-Saclay, France.
2014	**B.Sc.**	Optical & Electronic Information	Huazhong university of Science and Technology, China.

Experiences

- 2021-now: **Research Associated Professor** at School of Electronic Information and Communications, Huazhong University of Science & Technology.
- 2020-2021: **Postdoctoral Scholar** at ICSI and Department of Statistics, University of California, Berkeley, hosted by Prof. Michael Mahoney.

Awards and prizes

- 2021: Recipient of the 2021 Wuhan Youth Talent, Wuhan, China.
- 2021: Recipient of East Lake Youth Talent Program Fellowship of Huazhong University of Science & Technology, Wuhan, China.
- 2019: 2nd prize of ED STIC Ph.D. Student Award of University Paris-Saclay, France.
- 2016: Recipient of the Supélec Foundation Ph.D. Fellowship, France.

Publications

Books

1. Romain Couillet and **Zhenyu Liao**. *Random Matrix Methods for Machine Learning*. (in press) Cambridge University Press, 2022.

Papers in conference proceedings

1. Hafiz Tiomoko Ali, **Zhenyu Liao**, and Romain Couillet. Random matrices in service of ML footprint: ternary random features with no performance loss. In: *International Conference on Learning Representations (**ICLR**)*. 2022.
2. **Zhenyu Liao** and Michael W. Mahoney. Hessian Eigenspectra of More Realistic Nonlinear Models. In: *Advances in Neural Information Processing Systems (**NeurIPS**)*. 2021.
3. Michal Derezinski, **Zhenyu Liao**, Edgar Dobriban, and Michael Mahoney. Sparse sketches with small inversion bias. In: *Proceedings of Thirty Fourth Conference on Learning Theory (**COLT**)*. Vol. 134. PMLR, 15–19 Aug 2021, pp.1467–1510.
4. **Zhenyu Liao**, Romain Couillet, and Michael W. Mahoney. Sparse Quantized Spectral Clustering. In: *International Conference on Learning Representations (**ICLR**)*. 2021.
5. Fanghui Liu, **Zhenyu Liao**, and Johan Suykens. Kernel Regression in High Dimension: Refined Analysis beyond Double Descent. In: *Proceedings of The 24th International Conference on Artificial Intelligence and Statistics (**AISTATS**)*. Vol. 130. PMLR, 13–15 Apr 2021, pp.649–657.
6. **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. In: *Advances in Neural Information Processing Systems (**NeurIPS**)*. Vol. 33. Curran Associates, Inc., 2020, pp.13939–13950.
7. Michal Derezinski, Feynman T Liang, **Zhenyu Liao**, and Michael W. Mahoney. Precise expressions for random projections: Low-rank approximation and randomized Newton. In: *Advances in Neural Information Processing Systems (**NeurIPS**)*. Vol. 33. Curran Associates, Inc., 2020, pp.18272–18283.
8. **Zhenyu Liao** and Romain Couillet. On Inner-Product Kernels of High Dimensional Data. In: *2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (**CAMSAP**)*. IEEE. 2019, pp.579–583.
9. Xiaoyi Mai, **Zhenyu Liao**, and Romain Couillet. A Large Scale Analysis of Logistic Regression: Asymptotic Performance and New Insights. In: *IEEE International Conference on Acoustics, Speech and Signal Processing (**ICASSP**)*. IEEE. May 2019, pp.3357–3361.

10. Romain Couillet, **Zhenyu Liao**, and Xiaoyi Mai. Classification Asymptotics in the Random Matrix Regime. In: *The 26th European Signal Processing Conference (**EUSIPCO**)*. IEEE. Sept. 2018, pp.1875–1879.
11. **Zhenyu Liao** and Romain Couillet. The Dynamics of Learning: A Random Matrix Approach. In: *Proceedings of the 35th International Conference on Machine Learning (**ICML**)*. Vol. 80. PMLR, July 2018, pp.3072–3081.
12. **Zhenyu Liao** and Romain Couillet. On the Spectrum of Random Features Maps of High Dimensional Data. In: *Proceedings of the 35th International Conference on Machine Learning (**ICML**)*. Vol. 80. PMLR, July 2018, pp.3063–3071.
13. **Zhenyu Liao** and Romain Couillet. Random Matrices Meet Machine Learning: A Large Dimensional Analysis of LS-SVM. In: *IEEE International Conference on Acoustics, Speech and Signal Processing (**ICASSP**)*. IEEE. Mar. 2017, pp.2397–2401.

Journal papers

1. **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.
2. **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.
3. 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.

Peer reviewing activities

- Referee of European Research Council (ERC).
- External reviewer of Natural Sciences and Engineering Research Council of Canada (NSERC).
- Conferences: NeurIPS, ICML, ICLR, AISTATS, AAAI, ICC Workshop, CAMSAP.
- Journals: 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), Springer Statistics and Computing (STCO), SIAM Journal on Scientific Computing (SISC), Pattern Recognition (PR), Random Matrices: Theory and Applications (RMTA), Neural Processing Letters (NPL), PLOS ONE.

Research projects

- 2022-2024: **contributor**, National Natural Science Foundation of China, grants for "*Mathematical Foundations for Future Communications (Information Theory)*" (NSFC-12141107), ¥3M. PI: Robert C. Qiu.
- 2021-2022: **PI**, CCF-Hikvision Open Fund, *Random Matrix Theory and Information Bottleneck for Neural Network Compression* (20210008), ¥280K.
- 2021-2023: **PI**, Fundamental Research Funds for the Central Universities of China, *Large Dimensional Random Matrix Methods in Machine Learning: Theory and Practice* (No. 2021XXJS110), ¥500K.
- 2018-2021: **contributor**, NSF Research Grant, *Combining Stochastics and Numerics for Improved Scalable Matrix Computations* (NSF-1815054), $500K, PI: Michael W. Mahoney.
- 2018-2021: **contributor**, Programme d'Investissements d'avenir, *GSTATS IDEX DataScience Chair*, University of Grenoble-Alpes, €300K, PI: Romain Couillet.
- 2014-2017, **contributor**, French National Research Agency, *Random Matrix Theory for Large Dimensional Graphs* (ANR-14-CE28-0006), €300K, PI: Romain Couillet.

References

- **Prof. Romain Couillet**
  - Full Professor at University Grenoble-Alps, France
  - Holder of the UGA MIAI LargeDATA Chair, University-Grenoble-Alps, France.
  - ✉ romain.couillet@gipsa-lab.grenoble-inp.fr
- **Prof. Michael W. 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.
  - ✉ mmahoney@stat.berkeley.edu