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, Université Paris-Saclay, France.
2016	**M.Sc.**	Signal and Image Processing	CentraleSupélec & University Paris-Sud, France.
2014	**B.Sc.**	Electronic Engineering	University Paris-Sud, France.
2014	**B.Sc.**	Optical & Electronic Information	Huazhong university of Science and Technology, China.

Experiences

➤ 2020-now: **Postdoctoral Scholar** at Dept. of Statistics, UC Berkeley, hosted by Prof. Michael Mahoney.

➤ 2016-2019: **Ph.D. Research Scholar and Teaching Assistant** at L2S, CentraleSupélec, Université Paris-Saclay, France, advised by Prof. Romain Couillet and Prof. Yacine Chitour.

Awards and prizes

➤ 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.

Tutorials and invited talks

➤ Invited talk on "Dynamical aspects of learning linear neural networks", The Fields Institute for Research in Mathematical Sciences, *Second Symposium on Machine Learning and Dynamical Systems*, 2020.

➤ Invited talk on "Random matrix advances in large dimensional machine learning", Shanghai University of Finance and Economics, *Random Matrices and Complex Data Analysis Workshop*, Shanghai, 2019.

➤ Invited talk on "Random matrix viewpoint of learning with gradient descent", DIMACS, *Workshop on Randomized Numerical Linear Algebra, Statistics, and Optimization*, Rutgers University, 2019.

➤ Invited talk on "Recent advances in random matrix theory for machine learning and neural nets", workshop of the Matrix series on "*Random matrix theory faces information era*", Kraków, Poland, 2019.

➤ Invited talk on "Dynamical aspects of deep learning" (with Y. Chitour), *Séminaire d'Automatique du plateau de Saclay of iCODE institute*, Paris, France, 2019.

➤ Invited talk on "Recent advances in random matrix for neural networks", *Workshop on deep learning theory*, Shanghai JiaoTong University, China, 2018.

➤ Tutorial on "Random matrix advances in machine learning and neural nets" (with R. Couillet), *The 26th European Signal Processing Conference (EUSIPCO'18)*, Roma, Italy, 2018.

Publications

Papers in conference proceedings

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. In: *The 34th Conference on Neural Information Processing Systems (NeurIPS)*. 2020.

2. Michał Dereziński, Feynman Liang, **Zhenyu Liao**, and Michael W Mahoney. Precise expressions for random projections: Low-rank approximation and randomized Newton. In: *The 34th Conference on Neural Information Processing Systems (NeurIPS)*. 2020.

3. **Zhenyu Liao** and Romain Couillet. On Inner-Product Kernels of High Dimensional Data (invited paper to special session). In: *2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*. IEEE. 2019, pp.579–583.

4. 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.

5. Romain Couillet, **Zhenyu Liao**, and Xiaoyi Mai. Classification Asymptotics in the Random Matrix Regime (invited paper to special session). In: *The 26th European Signal Processing Conference (EUSIPCO)*. IEEE. Sept. 2018, pp.1875–1879.

6. **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.

7. **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.

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

2. 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.

Submitted papers

1. Romain Couillet and **Zhenyu Liao**. *Random Matrix Advances in Large Dimensional Machine Learning*. (submitted to) Cambridge University Press, 2021.

2. Michał Dereziński, **Zhenyu Liao**, Edgar Dobriban, and Michael W Mahoney. Sparse sketches with small inversion bias. *arXiv preprint arXiv:2011.10695* (2020).

3. **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. Sparse quantized spectral clustering. *arXiv preprint arXiv:2010.01376* (2020).

4. Fanghui Liu, **Zhenyu Liao**, and Johan AK Suykens. Kernel regression in high dimension: Refined analysis beyond double descent. *arXiv preprint arXiv:2010.02681* (2020).

5. Xiaoyi Mai and **Zhenyu Liao**. High Dimensional Classification via Empirical Risk Minimization: Improvements and Optimality. *arXiv preprint arXiv:1905.13742* (2019).

6. **Zhenyu Liao** and Romain Couillet. Inner-product Kernels are Asymptotically Equivalent to Binary Discrete Kernels (2019).

7. Yacine Chitour, **Zhenyu Liao**, and Romain Couillet. A Geometric Approach of Gradient Descent Algorithms in Neural Networks (2019).

Ph.D. thesis

Z. Liao, "A Random Matrix Framework for Large Dimensional Machine Learning and Neural Networks", CentraleSupélec, University Paris-Saclay, September 2019.

Peer reviewing activities

➤ Conferences: NeurIPS (2019-2020), ICML (2019-2020), ICLR (2021), AISTATS (2021), AAAI (2020-2021), CAMSAP (2019).

➤ Journals: Journal of Machine Learning Research, IEEE Trans on Signal Processing, NPL, PLOS ONE.

Teaching

2017   Signal and system 1 lab work   with Prof. Laurent Le Brusquet, CentraleSupélec.

References

➤ **Prof. Romain Couillet**
  – Full Professor at CentraleSupélec, University Paris-Saclay, Paris, France.
  – Holder of the UGA IDEX GSTATS DataScience Chair, University of Grenoble-Alpes, France.
  – ✉ romain.couillet@gipsa-lab.grenoble-inp.fr

➤ **Prof. Yacine Chitour**
  – Full Professor at Pairs-Sud, University Paris-Saclay, Paris, France.
  – Director of the iCODE institute, University Paris-Saclay, Paris, France.
  – ✉ yacine.chitour@l2s.centralesupelec.fr

➤ **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.
  – ✉ mmahoney@stat.berkeley.edu