

Zhenyu Liao

Curriculum Vitae

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📄 Male, Chinese citizen, 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'20)*. 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'20)*. 2020.
3. **Zhenyu Liao** and Romain Couillet. On Inner-Product Kernels of High Dimensional Data (invited paper to special session). In: *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP'19)*. 2019.
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'19)*. 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'18)*. 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'18)*. 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'18)*. 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'17)*. 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. Xiaoyi Mai and **Zhenyu Liao**. High Dimensional Classification via Empirical Risk Minimization: Improvements and Optimality (2019).
2. Yacine Chitour, **Zhenyu Liao**, and Romain Couillet. A Geometric Approach of Gradient Descent Algorithms in Neural Networks (2019).
3. **Zhenyu Liao** and Romain Couillet. Inner-product Kernels are Asymptotically Equivalent to Binary Discrete Kernels (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 duties

2017 Signal and system 1 lab work with **Prof. Laurent Le Brusquet**, **CentraleSupélec** 54 hours.

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