# Zhenyu Liao
## Curriculum Vitae

April 2020

⌂ https://zhenyu-liao.github.io
✉ zhenyu.liao@berkeley.edu
▤ Male, Chinese citizen, born in 28/08/1992.
◆ Office 475, 367 Evans Hall, Department of Statistics, University of California, Berkeley, CA 94720, USA.

## 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

➤ 2020: Recipient of Chinese Government Award for Outstanding Self-Finance Students Abroad, France.

➤ 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 "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 and X. Mai), *The 26th European Signal Processing Conference (EUSIPCO'18)*, Roma, Italy, 2018.

# Publications

## Papers in conference proceedings

1. **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.

2. 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.

3. 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.

4. **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.

5. **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.

6. **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.

## Communications in French

1. **Zhenyu Liao** and Romain Couillet. Une analyse des méthodes de projections aléatoires par la théorie des matrices aléatoires. In: *Colloque GRETSI*. Sept. 2017.
2. **Zhenyu Liao** and Romain Couillet. Compréhension théorique des comportements non linéaires dans les grands réseaux de neurones. In: *Colloque GRETSI*. Aug. 2019.

## 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).
4. **Zhenyu Liao**, Romain Couillet, and Michael Mahoney. Exact Asymptotics of High Dimensional Random Fourier Features: Beyond Gaussian Kernel and a Data-distribution Free Double Descent (2020).

## 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

➤ Neural Information Processing Systems (**NeurIPS**)
➤ International Conference of Machine Learning (**ICML**)
➤ AAAI Conference on Artificial Intelligence (**AAAI**)
➤ International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (**CAMSAP**)
➤ IEEE Transactions on Signal Processing (**IEEE-TSP**)
➤ Neural Processing Letters (**NPL**)

## 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