Zhenyu Liao

Curriculum Vitae

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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.

Publications

Papers in conference proceedings

1. **Zhenyu Liao**, Romain Couillet, and Michael W Mahoney. Sparse Quantized Spectral Clustering. In: *The Ninth International Conference on Learning Representations (ICLR)*. 2021.
2. **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.
3. 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.
4. **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.
5. 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.
6. 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.
7. **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.
8. **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.
9. **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*. (under review) 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. Fanghui Liu, **Zhenyu Liao**, and Johan AK Suykens. Kernel regression in high dimension: Refined analysis beyond double descent. *arXiv preprint arXiv:2010.02681* (2020).
4. Xiaoyi Mai and **Zhenyu Liao**. High Dimensional Classification via Regularized and Unregularized Empirical Risk Minimization: Precise Error and Optimal Loss. *arXiv preprint arXiv:1905.13742* (2020).
5. **Zhenyu Liao** and Romain Couillet. Inner-product Kernels are Asymptotically Equivalent to Binary Discrete Kernels (2019).
6. Yacine Chitour, **Zhenyu Liao**, and Romain Couillet. A Geometric Approach of Gradient Descent Algorithms in Neural Networks (2019).

Tutorials and invited talks

- Invited talk on "Performance-complexity Trade-off in Large Dimensional Spectral Clustering", STA 290 Seminar, Department of Statistics, University of California, Davis, 2021.
- 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 and X. Mai), *The 26th European Signal Processing Conference (EUSIPCO'18)*, Roma, Italy, 2018.

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

- External reviewer of Natural Sciences and Engineering Research Council of Canada (NSERC).
- Conferences: NeurIPS, ICML, ICLR, AISTATS, AAAI, CAMSAP.
- Journals: Journal of Machine Learning Research, IEEE Trans. on Pattern Analysis and Machine Intelligence (IEEE-TPAMI), IEEE Trans. on Signal Processing (IEEE-TSP), NPL, PLOS ONE.

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