

Soufiane Hayou

Department of Mathematics, National University of Singapore

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SUMMARY

I am a *PTA Assistant Professor of Mathematics* at the National University of Singapore. I obtained my PhD in Statistics & Machine learning at the University of Oxford where I was advised by Arnaud Doucet and Judith Rousseau. Before starting my PhD, I graduated from Ecole Polytechnique in France with a major in Applied Mathematics.

EDUCATION

University of Oxford

PhD in Statistics & Machine Learning. Supervised by A. Doucet and J. Rousseau.

Thesis: Wide Deep Neural Networks.

Oxford, United Kingdom

2017 – 2021

Pierre et Marie Curie University (Paris VI)

MSc. in Probability and Financial Mathematics with Distinction.

Courses: stochastic calculus, stochastic control, portfolio optimization (Markowitz's theory), point processes, high frequency trading, derivatives pricing.

Paris, France

2016 – 2017

Ecole Polytechnique

MSc. in Applied Mathematics and Engineering Diploma with Distinction.

Courses (Major): Markov chains, stochastic calculus and martingales, Fourier analysis, statistical analysis and model selection.

Courses (Minor): macroeconomics, microeconomics, sociology, political science.

Paris, France

2013 – 2017

Classes Préparatoires

Intensive program leading up to nationwide entrance examinations to the «Grandes Ecoles».

Rabat, Morocco

2011 – 2013

AWARDS AND ACHIEVEMENTS

- 2018 : Best master thesis in quantitative finance (prize given annually by Natixis Foundation)
- 2017 - 2021 : ESPRC fellowship grant
- 2017 - 2021 : RCUK fellowship grant (St John's College)
- 2013 - 2017 : Egide grant (awarded by the French Ministry of Foreign Affairs)
- 2011 : Maroc Telecom excellence grant
- 2011 : Moroccan government excellence scholarship

RESEARCH

Research Interests.....

Deep Learning Theory, Bayesian Neural Networks, Uncertainty in Deep Learning, Model Compression, Optimization, Interplay between Neural Networks and Stochastic processes.

Publications and Preprints.....

1. Regularization in ResNet with Stochastic Depth. NeurIPS 2021. *Soufiane Hayou, Fadhel Ayed.*
2. The Curse of Depth in Kernel Regime. NeurIPS 2021 ICBINB workshop. *Soufiane Hayou, Arnaud Doucet, Judith Rousseau.*
3. Stochastic Pruning: Fine-Tuning, and PAC-Bayes bound optimization (2021, Preprint). *Soufiane Hayou, Bobby He, Gintare Karolina Dziugaite.*

4. Robust Pruning at Initialization. ICLR 2021. *Soufiane Hayou, Jean-Francois Ton, Arnaud Doucet, Yee Whye Teh.*
5. Stable ResNet. AISTATS 2021 (Oral presentation). *Soufiane Hayou, Eugenio Clerico, Bobby He, George Deligiannidis, Arnaud Doucet, Judith Rousseau.*
6. On the Impact of the Activation function on Deep Neural Networks Training. ICML 2019. *Soufiane Hayou, Arnaud Doucet, Judith Rousseau.*
7. Mean-field Behaviour of Neural Tangent Kernel for Deep Neural Networks (2020, submitted). *Soufiane Hayou, Arnaud Doucet, Judith Rousseau.*
8. On the Overestimation of the Largest Eigenvalue of a Covariance Matrix, 2017 (Bloomberg). *Soufiane Hayou.*
9. Cleaning the Correlation Matrix with a Denoising AutoEncoder, 2017 (Bloomberg). *Soufiane Hayou.*

Academic services.....

- o Reviewing for conferences: NeurIPS, ICML, ICLR, AISTATS.
- o Reviewing for journals: Journal of Computational and Graphical Statistics.

TEACHING

Lecturer.....

Foundations of Machine Learning (DSA5102X, graduate, 100+ enrolled students)

Department of Mathematics, NUS

Semester 1, 2021-2022

The module introduces the theory and methods of machine learning, including the description of modern algorithms, their theoretical basis, and the illustration of their applications to real-world problems. Major topics include:

- o *Supervised learning*: linear models, kernel methods, support vector machine, decision trees, random forest, boosting, neural networks, universal approximation, deep learning, recurrent neural networks, stochastic gradient algorithms, statistical learning theory.
- o *Unsupervised learning*: dimensional reduction, clustering and manifold learning.
- o *Reinforcement learning*: Markov decision processes, bellman equations.

Advanced Topics in Machine Learning (DSA5202, graduate)

Department of Mathematics, NUS

Semester 2, 2021-2022

In this module, we discuss several advanced topics in Machine Learning including (but not limited to) Bayesian inference and model selection, hyper-parameters tuning, initialization, sample complexity etc.

Class tutor and Teaching assistant.....

Advanced Simulation Methods (SC5, undergraduate)

Department of Statistics, University of Oxford

Hilary term, 2020-2019

I was a class tutor for this course by Prof George Deligiannidis.

This module sheds light on advanced simulation methods which include inversion methods, transformation methods, rejection sampling, importance sampling, variance reduction, Markov chains, Gibbs sampling, the Metropolis-Hastings algorithm, reversible MCMC, Hidden Markov models and Sequential Monte Carlo.

Bayesian Inference and MCMC methods (SC7, graduate)

Department of Statistics, University of Oxford

Hilary term, 2018-2019

I was a TA for this course by Prof Geoff Nicholls.

This module is a collection of advanced topics in Bayesian inference, including Markov Chain Monte Carlo, Decision theory, Approximate Bayesian Computation, Reversible Markov Chain Monte Carlo and Dirichlet processes.

EXPERIENCE

National University of Singapore

Peng Tsu Ann Assistant Professor of Mathematics

Singapore

July 2021 – Current

- o Teaching two courses: Foundations of Machine Learning, Advanced Topics in Machine Learning.

University of Oxford*Class Tutor and Teaching Assistant*

- Advanced simulation methods (third year undergraduates in Statistics)
- Bayesian Inference and MCMC methods (graduates in Statistics)

Oxford, UK
*February 2018 – Current***G-Research***Quantitative Research Intern*

- Built a robust estimator of the correlation matrix with a Neural Network model
- Built a Neural Network model for robust portfolio construction

London, UK
*July 2019 – September 2019***Bloomberg LP***Quantitative Research Intern*

- Proved theoretically that the empirical correlation matrix overestimates the largest eigenvalue as the dimension of the problem grows
- Created a Machine Learning model for cleaning the spectrum of the correlation matrix using a Denoising Autoencoder

New York, USA
*March 2017 – August 2017***J.P. Morgan***Quantitative Research Intern*

- Adjusted a Stochastic model for interest rate products
- Designed an Initial Margin pricer for interest rate swaps

London, UK
*April 2016 – September 2016***Kantox***Quantitative Research Intern*

- Optimized Margin requirements for FX forwards

Barcelona, Spain
*June 2015 – September 2015***SNECMA***Part-time Research Intern*

- Optimized SNECMA's storage system of aircraft engines

Paris, France
*September 2014 – April 2015***SKILLS**

Coding and Machine Learning frameworks

- Programming languages: Python, C++
- Python packages: Numpy, Scipy, Pandas, Seaborn
- Machine learning (Python): PyTorch, Tensorflow, JAX

Languages

- French: native
- Arabic: native
- English: fluent