Hanna Sophia Wutte

PH.D. IN MATHEMATICS · M.SC. IN FINANCIAL MATHEMATICS · M.SC. IN QUANTITATIVE FINANCE

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Personal Profile

PhD in Mathematics from ETH Zurich. My research focuses on deep learning and its use in mathematical finance, with an emphasis on understanding deep learning algorithms and leveraging them in pricing and hedging complex derivatives, and in portfolio management. Prior to that, I completed **two M.Sc. programs in Financial Mathematics** and **Quantitative Finance**. I have working experience as a **junior data scientist** in the Department of Advanced Analytics of the Raiffeisen Bank International AG.

RESEARCH FIELDS

Deep Learning, Reinforcement Learning, Uncertainty Quantification of Neural Networks, Deep Portfolio Optimization, Deep Pricing of Passport Options, Deep Hedging.

Education

ETH Zurich — *Zurich, Switzerland*
Ph.D. in Mathematics — *Oct 2018 - June 2023*
- Stochastic Finance Research Group
- Advisor: Prof. Josef Teichmann, Ph.D.

Vienna University of Economics and Business — *Vienna, Austria*
M.Sc. in Quantitative Finance | passed with distinction — *Sept 2016 - Sept 2018*
- Top student of the 2016–2018 cohort
- Grade point average weighted by ECTS credits **1.00** (scale 1=best, 5=worst)

Technical University of Vienna — *Vienna, Austria*
M.Sc. in Mathematics | passed with distinction — *Oct 2015 - Jan 2018*
- Specialised in Financial Mathematics
- Grade point average weighted by ECTS credits **1.06** (scale 1=best, 5=worst)

Technical University of Vienna — *Vienna, Austria*
B.Sc. in Mathematics | passed with distinction — *Oct 2012 - Sept 2015*
- Specialised in Financial and Insurance Mathematics
- Grade point average weighted by ECTS credtis **1.34** (scale 1=best, 5=worst)

Experience

Jul 2023 — **Financial Mathematics Team Challenge at University of Cape Town**, Team Leader — *Cape Town, South Africa*
- Leading a team of 3 master students to develop a research project on *Physics-Informed Neural Networks for Option Pricing and Hedging*
- Winner of the team challenge. (link)
- Programming Languages: Julia

Sep 2017 - Jun 2018 — **Raiffeisen Bank International AG**, Junior Data Scientist — *Vienna, Austria*
- Department of Advanced Analytics
- Development of ML-powered loan-sale-signal-system (Random Forest, Elastic Net, NN)
- Programming Languages: R, Python

Dec 2015 - Mar 2017 — **Raiffeisen Bank International AG**, Freelancer — *Vienna, Austria*
- Department of Investment Finance
- Maintenance and development of VBA applications for the European Recovery Program
- Programming Languages: VBA

Aug 2014 — **Valida Industrie Pensionskasse AG**, Internship — *Vienna, Austria*
- Actuarial Department
- Data synchronization and data editing for the calculations of reserves for pensions

Technical Skills

Programming languages **Python (advanced)**, **R (advanced)**, Julia (familiar), VBA (familiar)
(ML-)Libraries PyTorch, Tensorflow, Numpy, Scikit-learn, Pandas
Miscellaneous Git, LaTeX

Professional Activities, Leadership, and Non-profit

Conference Organization

Sep 2022 **EPFL-ETHZ joint summer school MLSTATS 2022**, Co-organizer *Saignelegier, Switzerland*

- Summer school on theory, methodology, and practice in statistical machine learning
- Responsibilities: scholarship application review, event organization

Networking

Sep 2021 - now **ETH AI Center**, Associated PhD Student *Zurich, Switzerland*

- Presentation of research at yearly ETH + X AI summit

Non-profit

2018 - 2022 **Club Alpbach Zurich**, President (2020), Vice President (2018-2019, 2021-2022) *Zurich, Switzerland*

- Non-profit association; granting scholarships to attend the European Forum Alpbach
- Responsibilities: scholarship application review, sponsor acquisition, event organization

Peer Review

2022 **International Conference on AI in Finance (ICAIF 2022)**, Reviewer
2022 **Quantitative Finance**, Reviewer
2019 **Journal of Machine Learning Research (JMLR)**, Reviewer
2019 **Neural Networks**, Reviewer

Publications

For a full updated list of my publications see Google Scholar. *These authors contributed equally to the paper.

Journal Publications

A deep learning model for gas storage optimization (pdf)
Nicolas Curin, Michael Kettler, Xi Kleisinger-Yu*, Vlatka Komaric, Thomas Krabichler*, Josef Teichmann, **Hanna Wutte***
Decisions in Economics and Finance pp. 1021–1037. 2021

Conference Publications

NOMU: Neural Optimization-based Model Uncertainty (pdf) (Git)
Jakob M Heiss*, Jakob Weissteiner*, **Hanna Wutte***, Sven Seuken, Josef Teichmann
Proceedings of the 39th International Conference on Machine Learning , ***ICML'22***, Baltimore, USA, 2022

Pre-prints under Submission

Machine Learning-powered Pricing of the Multidimensional Passport Option (pdf) (Git)
Josef Teichmann, **Hanna Wutte***
arXiv preprint arXiv:2307.14887. 2023

How (Implicit) Regularization of ReLU Neural Networks Characterizes the Learned Function – Part II: the Multi-D Case of Two Layers with Random First Layer (pdf)
Jakob Heiss*, Josef Teichmann, **Hanna Wutte***
arXiv preprint arXiv:2303.11454. 2023

How Infinitely Wide Neural Networks Can Benefit from Multi-task Learning – an Exact Macroscopic Characterization (pdf)
Jakob Heiss*, Josef Teichmann, **Hanna Wutte***
arXiv preprint arXiv:2112.15577. 2021

How Implicit Regularization of ReLU Neural Networks Characterizes the Learned Function – Part I: the 1-D Case of Two Layers with Random First Layer (pdf)
Jakob Heiss*, Josef Teichmann, **Hanna Wutte***
arXiv preprint arXiv:1911.02903. 2019

Presentations

Conference and Workshop Talks

Sep 2023	**Invited Talk**, Deep Dynamic Decision Making in Mathematical Finance • WPI-Workshop: Stochastics, Statistics, Machine Learning and their Applications to Sustainable Finance and Energy Markets	*Vienna, Austria*
Aug 2023	**Invited Talk**, Robust Utility via a GAN Approach • 10th International Congress on Industrial and Applied Mathematics (ICIAM23)	*Tokyo, Japan*
Jul 2022	**Contributed Talk**, NOMU: Neural Optimization-based Model Uncertainty • International Conference on Machine Learning (ICML'22) (talk)	*Baltimore, USA*
Jun 2022	**Contributed Talk**, NOMU: Neural Optimization-based Model Uncertainty • Oxford ETH Workshop 2022	*Zurich, Switzerland*
May 2022	**Invited Talk**, Machine Learning-powered Pricing of the Multidimensional Passport Option • World Online Seminars on Machine Learning in Finance	*Virtual*
Oct 2020	**Invited Talk**, Uncertainty Bounds For Neural Networks • New Challenges in the Interplay between Finance and Insurance	*Virtual*
Nov 2019	**Invited Talk**, Learning from Random Strategies in Stochastic Optimal Control - An Approach to Price the Multidimensional Passport Option • Vienna-Zurich symposium for young researchers in Financial Mathematics and related fields	*Vienna, Austria*
Sep 2019	**Contributed Talk**, Randomized Shallow Neural Networks and their Use in Understanding Gradient Descent • Vienna Congress on Mathematical Finance (VCMF 2019)	*Vienna, Austria*
Sep 2019	**Contributed Talk**, Randomized Shallow Neural Networks and their Use in Understanding Gradient Descent • OEMG Conference 2019	*Dornbirn, Austria*

Seminars at Universities

Dec 2019	**Invited Talk**, How Implicit Regularization of Neural Networks Affects the Learned Function • Seminar on "Data Analysis and Modeling"	*Freiburg, Germany*
Apr 2019	**Invited Talk**, Randomized Shallow Neural Networks and their Use in Understanding Gradient Descent • Vienna Seminar in Mathematical Finance and Probability	*Vienna, Austria*

Events

Oct 2021	**Invited Booth + Poster**, Implicit Regularization • ETH AI+X Summit 2021	*Zurich, Switzerland*

Scholarships and Awards

2018	**Scholarship for participation at the European Forum Alpbach 2018** Awarded by the Austrian Federal Ministry of Transport, Innovation and Technology
2018	**Excellence scholarship Vienna University of Economics and Business** Awarded by the Austrian Federal Ministry of Science and Research
2017	**Excellence scholarship Vienna University of Economics and Business** Awarded by the Austrian Federal Ministry of Science and Research
2016	**Excellence scholarship Technical University of Vienna** Awarded by the Austrian Federal Ministry of Science and Research
2015	**Excellence scholarship Technical University of Vienna** Awarded by the Austrian Federal Ministry of Science and Research

Theses

2018	**Master Thesis**, On Variable Selection of the Elastic Net in Presence of Multicollinearity • Advisor: Prof. Kurt Hornik, Ph.D.	(pdf)
2017	**Master Thesis**, Energy Futures • Advisors: Prof. Thorsten Rheinländer, Ph.D., Univ. Ass. Paul Krühner, Ph.D.	(pdf)
2015	**Bachelor Thesis**, Calculating the Value at Risk using Copulas • Advisor: Martin Predota, Ph.D.	

Teaching

University Courses

2023	**Head Teaching Assistant**, Wahrscheinlichkeitstheorie und Statistik	*ETH Zurich*
2021	**Head Teaching Assistant**, Stochastik	*ETH Zurich*
2020	**Project Supervision**, Machine Learning in Finance	*ETH Zurich*
2019	**Teaching Assistant**, Mathematical Foundations of Finance	*ETH Zurich*
2019	**Head Teaching Assistant**, Wahrscheinlichkeit und Statistik	*ETH Zurich*
2018	**Teaching Assistant**, Stochastik	*ETH Zurich*
2018	**Teaching Assistant**, Optimization	*WU Vienna*
2017	**Teaching Assistant**, Statistics I	*WU Vienna*
2016	**Teaching Assistant**, Risk Management in Finance and Insurance	*TU Vienna*

(Co-)Supervised Theses

2022	**Master Thesis of Sebastian Schein**, Feature Learning in Infinite-Width Neural Networks	*ETH Zurich*
2022	**Master Thesis of Sven Rosenthal**, On the Inductive Bias Towards Multi-Task Learning of L2-Regularized ReLU Networks	*ETH Zurich and University of Zurich*
2022	**Semester Thesis of Aurelio Dolfini**, ML-based Uncertainty Quantification on Real World Data	*ETH Zurich*
2020	**Master Thesis of Marius Högger**, Bayesian Optimization with Neural Networks	*University of Zurich*

Languages

German	Native
English	Business fluent
French	Fluent
Russian	Basics