Antoine **Wehenkel**

RESEARCH SCIENTIST · MACHINE LEARNING

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PERSONAL STATEMENT

"We know the past but cannot control it. We control the future but cannot know it." Claude Shannon

I am a **Post-doctoral researcher** at Apple, my research targets useful and accurate uncertainty quantification for sensitive tasks, as found in various medical and scientific domains. I design and apply algorithms that leverage domain knowledge in various forms, e.g., equations, numerical simulations, or independence assumptions, for uncertainty quantification in low-data regimes. I am an engineer excited both by the theoretical foundations and real-world impact of Machine Learning.

WORK EXPERIENCE

Post-doctoral Researcher
Apple, Health AI Team (Zürich)
11/2022 - Now
Extending simulation-based inference algorithms for biomarkers prediction from full-body hemodynamics simulators. Two papers as first author in preparation and main organizer of SynS & ML at ICML 2023.

Research Intern
Apple, Health AI Team (Zürich)
11/2021 - 09/2022
Physics Informed Machine Learning. A publication as a first author published at TMLR.

Applied Scientist Intern
Amazon Web Services (remote)
Summer 2021
Worked within Codeguru AI team. Defined and developed a project applying deep learning (graph neural networks) to automatic program analysis. Secured an offer for a returning internship.

EDUCATION

Ph.D. in Machine Learning - *ULiège, Liège*
10/2018 - 10/2022
Advisor: Professor Gilles Louppe
Research interests: generative modeling, deep learning and simulation-based inference.
Teaching assistant: Deep Learning, Introduction to Artificial Intelligence.

Master in Computer Engineering - *ULiège, Liège*
09/2016 - 06/2018
Summa Cum Laude
Teaching assistant: Data Structures & Algorithms, Electric Measurements.

Exchange student in the Master in Data Science - *EPFL, Lausanne*
09/2017 - 06/2018
Average score: 5.8/6 - 97%
Teaching assistant: Electronic.

Bachelor in Engineering - *ULiège, Liège*
09/2013 - 06/2016
Magna Cum Laude

PERSONAL RESEARCH PROJECTS

Automating signal processing with physical simulations
2022 - Now
Antoine Wehenkel - Jörn-Henrik Jacobsen, Jens Behrmann, Ozan Senner, Marco Cuturi
Designing algorithms that leverage numerical simulations to enable accurate uncertainty quantification in low-data regimes. Applications to prediction of cardiovascular biomarkers from non-invasive biosignals.
Research project initiator, 2 first-author papers (in prep.), organizer of SynS & ML at ICML 2023.

Deep Learning for inverse problems in Science
2018 - 2022
Antoine Wehenkel - Gilles Louppe
Advancing simulation-based inference by exploring new means for implementing more effectively inductive bias into deep generative models.
Co-authored 7 papers, 3 at top Machine Learning conferences and 4 at workshops (2 spotlights).

Parameter estimation of transmission lines from synchrophasor measurements
2017 - 2018
Antoine Wehenkel - Arpan Mukhopadhyay, Mario Paolone, Jean-Yves Le Boudec
Estimation of transmission lines parameters noisy phasors measurements with sparse non-convex optimisation.
Graded 6/6 as a master's thesis at EPFL and published in an international journal.

An algorithmic approach for harvesting renewable energy with electric vehicles
2016 - 2017
Antoine Wehenkel - Antoine Dubois, Raphael Fonteneau, Damien Ernst
Development of optimisation algorithms for the integration of Electric vehicle fleets in the electrical network.
This project was done in collaboration with Engie company and led to a scientific publication.

SELECTED PUBLICATIONS

Simulation-based Inference for Cardiovascular Models
Wehenkel A, Behrmann J, Senner O, Miller A, Sapiro G, Cuturi M, Jacobsen JH
Pre-print.

Robust Hybrid Learning With Expert Augmentation
Wehenkel A, Behrmann J, Hsu H, Sapiro G, Louppe G, Jacobsen JH
Transactions on Machine Learning Research, 2023.

Diffusion Priors In Variational Autoencoders
Wehenkel A, Louppe G
Workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models at ICML 2021.

Graphical Normalizing Flows
Wehenkel A, Louppe G
International Conference on Artificial Intelligence and Statistics (AISTATS) 2021.

Neural Empirical Bayes: Source Distribution Estimation and its Applications to Simulation-Based Inference
Vandegar M, Kagan M, Wehenkel A, Louppe G.
International Conference on Artificial Intelligence and Statistics (AISTATS) 2021.

Unconstrained monotonic neural networks
Wehenkel A, Louppe G.
Neural Information Processing Systems (NeurIPS/NIPS) 2019.

Parameter Estimation for Three Phase Untransposed Short Transmission Lines from Synchrophasor Measurements
Wehenkel A, Mukhopadhyay A, Le Boudec JY, Paolone M.
IEEE Transactions on Instrumentation and Measurement. 2020 Jan 23.

SKILLS

- ***Theoretical background***: Deep Learning, Machine Learning, Optimisation, and Statistics.
- ***Programming***: Python, Git, Bash, PHP, Javascript, Java, Matlab, C++ and C.
- ***Libraries***: PyTorch, Scikit-Learn, Numpy, Pandas, D3, Matplotlib.
- ***Communication***: Technical writing, Latex, HTML/CSS, data vizualization, teaching.
- ***Languages***: French (native), English (professional proficiency).

TALKS

- *The Symbiosis between Deep Probabilistic and Scientific Models* . Gen U 2022, Copenhagen. 09/2022
- *Normalizing Flows and Bayesian Networks*. CogSys seminar (DTU). Remote. 10/2020
- *Normalizing Flows for Probabilistic Modeling and Inference*. Montefiore (ULiège) journal club, Liège. 04/2020
- *Neural Likelihood-Free Inference*. GRAPPA (UvA) journal club, Amsterdam. 10/2019
- *Unconstrained Monotonic Neural Networks*. Benelearn 2019, Brussels. 11/2019

REVIEWING

- *Conferences*: PMAPS2020, NeurIPS (2020-21-23), ICLR (2021-22-23), AISTATS (2021-22-23), ICML (2021-22-23).
- *Workshops*: ML4PS (at NeurIPS, 2020-21-22), EBM (at ICLR, 2021), INNF+ (at ICML, 2021).
- *Journals*: TMLR (since 2022)

AWARDS

- Best PhD Thesis award from AIM (2023) - 3500€
- Outstanding reviewer award for ICLR2021 - Awarded to the top 10% reviewers.
- FNRS Research Fellowship (2018 - 2022) - Around 100 awardees in Belgium each year.
- Best Master's thesis awards from AIM and from AILg (2018) - One award for 40 candidates - 850€
- Ranked 1st the "Kaggle in class" machine learning course competition (ULiège, 2016 and 2018) - 64 teams.
- Physics award for outstanding student (2013) - One award for more than 150 students.
- Physics award at Belgian Olympiad (2012 and 2013) - Top-5 among hundreds of students in Belgium.

REFEREES

- Gilles Louppe (g.louppe@uliege.be) - Ph.D. advisor.
- Jörn-Henrik Jacobsen - Manager at Apple.

References

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[2] Arnaud Delaunoy, Joeri Hermans, François Rozet, Antoine Wehenkel, and Gilles Louppe. Towards reliable simulation-based inference with balanced neural ratio estimation. *Neural Information Processing Systems 2022*, 2022.

[3] Antoine Dubois*, Antoine Wehenkel*, Raphael Fonteneau, Frédéric Olivier, and Damien Ernst. An app-based algorithmic approach for harvesting local and renewable energy using electric vehicles. In *Proceedings of the 9th International Conference on Agents and Artificial Intelligence (ICAART 2017)*, 2017.

[4] Jonathan Dumas, Colin Cointe, Antoine Wehenkel, Antonio Sutera, Xavier Fettweis, and Bertrand Cornélusse. A probabilistic forecast-driven strategy for a risk-aware participation in the capacity firming market. *IEEE Transactions on Sustainable Energy*, 13(2):1234–1243, 2021.

[5] Jonathan Dumas, Antoine Wehenkel, Damien Lanaspeze, Bertrand Cornélusse, and Antonio Sutera. A deep generative model for probabilistic energy forecasting in power systems: normalizing flows. *Applied Energy*, 305:117871, 2022.

[6] Maciej Falkiewicz, Naoya Takeishi, Imahn Shekhzadeh, Antoine Wehenkel, Arnaud Delaunoy, Gilles Louppe, and Alexandros Kalousis. Calibrating neural simulation-based inference with differentiable coverage probability. *Neural Information Processing Systems 2023*, 2023.

[7] Joeri Hermans, Arnaud Delaunoy, François Rozet, Antoine Wehenkel, Volodimir Begy, and Gilles Louppe. A crisis in simulation-based inference? beware, your posterior approximations can be unfaithful. *Transactions on Machine Learning Research*, 2022.

[8] Arthur Pesah*, Antoine Wehenkel*, and Gilles Louppe. Recurrent machines for likelihood-free inference. In *MetaLearn Workshop @ NeurIPS2018*, 2018.

[9] Thibaut Théate, Antoine Wehenkel, Adrien Bolland, Gilles Louppe, and Damien Ernst. Distributional reinforcement learning with unconstrained monotonic neural networks. *Neurocomputing*, 534:199–219, 2023.

[10] Maxime Vandegar, Michael Kagan, Antoine Wehenkel, and Gilles Louppe. Neural empirical bayes: Source distribution estimation and its applications to simulation-based inference. In *International Conference on Artificial Intelligence and Statistics 2021*, 2020.

[11] Nicolas Vecoven, Damien Ernst, Antoine Wehenkel, and Guillaume Drion. Introducing neuromodulation in deep neural networks to learn adaptive behaviours. *PloS one*, 15(1):e0227922, 2020.

[12] Antoine Wehenkel. *Inductive Bias In Deep Probabilistic Modelling*. PhD thesis, ULiège-University of Liège, Liège, Belgium, October 2022.

[13] Antoine Wehenkel and Gilles Louppe. Unconstrained monotonic neural networks. In *Neural Information Processing Systems 2019*, volume 33, 2019.

[14] Antoine Wehenkel and Gilles Louppe. Graphical normalizing flows. In *International Conference on Artificial Intelligence and Statistics*, volume 2021, pages 37–45. PMLR, 2020.

[15] Antoine Wehenkel and Gilles Louppe. You say normalizing flows i see bayesian networks. In *INNF+ Workshop @ ICML2020*, 2020.

[16] Antoine Wehenkel and Gilles Louppe. Diffusion priors in variational autoencoders. In *INNF+ Workshop @ ICML2021*, 2021.

[17] Antoine Wehenkel, Arpan Mukhopadhyay, Jean-Yves Le Boudec, and Mario Paolone. Parameter estimation of three-phase untransposed short transmission lines from synchrophasor measurements. *IEEE Transactions on Instrumentation and Measurement*, 69(9):6143–6154, 2020.

[18] Antoine Wehenkel, Jens Behrmann, Hsiang Hsu, Guillermo Sapiro, Gilles Louppe, and Jörn-Henrik Jacobsen. Robust hybrid learning with expert augmentation. *Transactions on Machine Learning Research*, 2023.

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