

JOHANN BREHMER

Researcher at the intersection of machine learning and physics

EXPERIENCE

Center for Data Science, New York University

Moore-Sloan postdoctoral researcher

09/2017 – now

New York, NY, USA

- Developed machine learning algorithms for statistical inference in models described by computer simulations
- Turned these algorithms into a widely used open-source Python library
- Applied this research to particle physics problems, enabling up to 90% more efficient measurements of the fundamental properties of nature
- Introduced first-ever scalable method to analyze satellite images for the almost imperceivable effects of Dark Matter clumps, based on deep convolutional networks and Bayesian statistics
- Designed a new type of flow-based generative neural network, enabling state-of-the-art performance in density estimation, manifold learning, and inference tasks
- Led interdisciplinary and international research teams, supervised students, managed projects from idea to publication / release

Heidelberg University

Graduate research and teaching assistant

07/2014 – 08/2017

Heidelberg, Germany

- Pioneered statistical metrics to guide particle physics experiments
- Discovered new aspects of the phenomenology of the Higgs boson (the elementary particle discovered in 2012, Nobel Prize 2013)
- Taught undergraduate and graduate physics students

CERN

Summer student

06/2012 – 09/2012

Geneva, Switzerland

- Won the prestigious CERN summer student programme scholarship
- Designed and deployed a neural network-based signal-noise classifier for the LHCb experiment, used in hundreds of analyses

EDUCATION

PhD in Physics

Heidelberg University

07/2014 – 08/2017

Heidelberg, Germany

- Graduated summa cum laude (best possible)

Master of Science in Physics

Heidelberg University

02/2012 – 06/2014

Heidelberg, Germany

- Graduated with 1.0 (best possible)
- Won Otto Haxel prize for best thesis (out of 150)

Bachelor of Science in Physics

Heidelberg University

09/2008 – 02/2012

Heidelberg, Germany

- Graduated with 1.0 (best possible)
- Won the competitive (top 0.5%) German Studienstiftung scholarship

Visiting student

Imperial College

09/2010 – 07/2011

London, UK

Abitur

Ökumenisches Gymnasium

06/2007

Bremen, Germany

- Graduated with 1.0 (best possible)

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SKILLS

Programming

Python, git, Docker, SLURM; C++ basics

- 5 years experience designing, developing, maintaining Python software

Machine learning

PyTorch, scikit-learn

- Deep learning: convolutional neural networks, graph neural networks, ...
- Probabilistic and generative models: normalizing flows, VAEs
- Reinforcement learning
- Unsupervised learning, density estimation, anomaly detection

Statistics and data science

NumPy, SciPy, pandas, Matplotlib

- Frequentist / Bayesian statistics: hypothesis tests, confidence sets, MCMC, variational inference
- Data processing & visualization

Communication

LaTeX

- Technical writing
- Presentations to experts and non-experts, teaching

Languages

- German (native), English (fluent)

ACCOMPLISHMENTS

Publications

see bit.ly/jb-pub

- 13 first-author publications in top peer-reviewed journals (PRL, PNAS...)
- 4 workshop papers at NeurIPS, ICML
- 24 publications overall, cited 1700 times

Talks

see bit.ly/jb-talk

- 16 invited talks (26 total) at international conferences / seminars
- Keynote speaker at ACAT 2019

Software

see bit.ly/jb-madm

- Lead developer of the open-source Python library MadMiner

Leadership

- Organizer of workshops and seminars with up to 150 participants