JOHANN **BREHMER**

Researcher at the intersection of machine learning and physics

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EXPERIENCE

Center for Data Science, New York University 09/2017 – now
Moore-Sloan postdoctoral researcher *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 with state-of-the-art performance in density estimation, manifold learning, inference, and generative tasks
- Led interdisciplinary and international research teams, supervised students, managed projects from idea to publication / release

Heidelberg University 07/2014 – 08/2017
Graduate research and teaching assistant *Heidelberg, Germany*

- Introduced 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 06/2012 – 09/2012
Summer student *Geneva, Switzerland*

- Won the competitive 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 07/2014 – 08/2017
Heidelberg University *Heidelberg, Germany*

- Graduated summa cum laude (best possible)

Master of Science in Physics 02/2012 – 06/2014
Heidelberg University *Heidelberg, Germany*

- Graduated with 1.0 (best possible), won Otto Haxel prize for best thesis

Bachelor of Science in Physics 09/2008 – 02/2012
Heidelberg University *Heidelberg, Germany*

- Won the prestigious German Studienstiftung scholarship
- Graduated with 1.0 (best possible)

Visiting student 09/2010 – 07/2011
Imperial College *London, UK*

Abitur 06/2007
Ökumenisches Gymnasium *Bremen, Germany*

- Graduated with 1.0 (best possible), won Karl-Nix-Stiftung award

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 / 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 testing, 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