JOHANN **BREHMER**

Machine learning researcher with a particle physics background

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WORK EXPERIENCE

Moore-Sloan Data Science Postdoctoral Researcher 09/2017 – now

Center for Data Science, New York University, USA

- Developed machine learning algorithms for inference in models described by computer simulations, using deep (convolutional) neural networks, probabilistic programming, new loss functions, and Bayesian statistics
- Turned these algorithms into an open-source Python library, and applied them to extract meaningful scientific insights from complex datasets in particle physics and cosmology
- Developed a new type of flow-based generative neural network
- Led interdisciplinary and international research teams, supervised students, managed projects from idea to publication / release

Research and Teaching Assistant 07/2014 – 08/2017

Heidelberg University, Germany

- Developed new statistical metrics that can guide the design of particle physics measurements, and studied the phenomenology of the Higgs boson
- Taught at undergraduate and graduate level

Summer Student 06/2012 – 09/2012

CERN, 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, Germany

- Graduated summa cum laude (best possible)

Master of Science in Physics 02/2012 – 06/2014

Heidelberg University, Germany

- Proposed a new data analysis strategy for particle physics experiments
- Won the university's Otto Haxel prize for best thesis
- Graduated with 1.0 (best possible)

Bachelor of Science in Physics 09/2008 – 02/2012

Heidelberg University, Germany

- Developed a numerical simulation tool for particle physics
- Was awarded the prestigious German Studienstiftung scholarship
- Won Erasmus stipend to study at Imperial College London, UK, for one year
- Graduated with 1.0 (best possible)

Abitur 06/2007

Ökumenisches Gymnasium Bremen, Germany

- Graduated with 1.0 (best possible)

RESEARCH RESULTS

Publications bit.ly/jb-pub

13 first-author publications in top peer-reviewed journals including Phys Rev Lett and PNAS

4 workshop papers at NeurIPS, ICML

24 publications in total, 1700 citations

Talks bit.ly/jb-talk

15 invited talks (25 total) at international conferences / seminars in several fields

Keynote speaker at ACAT 2019

Software bit.ly/jb-madm

Lead developer of the open-source Python library MadMiner, now used in several cutting-edge research efforts

Research community engagement

Organizer of workshops and seminars with up to 150 participants

Reviewer for NeurIPS, ICML, PRL, ...

SKILLS

Programming

5 years experience designing, developing, and maintaining Python software

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

Machine learning

Deep learning (convolutional neural networks, graph neural networks), probabilistic / generative models (normalizing flows, VAEs), reinforcement learning

PyTorch, scikit-learn; TensorFlow basics

Statistics and data science

Probability theory, frequentist / Bayesian statistics (MCMC, variational inference), data processing, visualization

NumPy, SciPy, pandas, Matplotlib

Writing and communication

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

LaTeX

Languages

German (native), English (fluent)