Julian M. Urban, Ph.D.

Research Scientist, Machine Learning

Postdoctoral Associate at **MIT**

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SUMMARY

Computational physicist with 6 years of experience in designing artificial intelligence models and stochastic sampling algorithms for the simulation of complex systems and associated statistical analysis of large datasets. Pioneering applications of modern machine learning and probabilistic modeling techniques in numerical quantum field theory research with a focus on generative deep neural network architectures and Gaussian process regression. Leading and contributing to scientific software projects in several interdisciplinary collaborations, ranging from the development of reference libraries for statistical inference methods to the implementation of highly parallelized simulation code deployed on exascale HPC platforms with thousands of GPU nodes.

EXPERTISE

Conceptual	AI/ML, probabilistic modeling, statistical inference, stochastic processes, MCMC algorithms, molecular dynamics simulations, numerical optimization
Programming	Proficient: scientific Python (numerical / ML libraries including PyTorch, NumPy, SciPy) Basics: C++, Bash, PHP, SQL, Mathematica
Technologies	GNU/Linux, HPC scheduling (Slurm, PBS), AIMHub, Git, Jupyter, Emacs, Mattermost
Languages	English, German (native)

ACADEMIC POSITIONS

2022 - current	**Postdoctoral Associate**, Center for Theoretical Physics	**MIT**
2021 - 2022	**Research Affiliate**, Laboratory for Nuclear Sciences	**MIT**
2020 - 2022	**Research and Teaching Assistant**, Institute for Theoretical Physics	**U Heidelberg**
2013 - 2015	**Laboratory Assistant**, Kirchhoff Institute for Physics	**U Heidelberg**

EDUCATION

2018 - 2022	**Ph.D.**, Machine learning for computational quantum field theory	**U Heidelberg**
2015 - 2018	**M.Sc.**, Machine learning for computational quantum field theory	**U Heidelberg**
2012 - 2015	**B.Sc.**, Detector physics for collider experiments	**U Heidelberg**

NON-ACADEMIC WORK

2010 - 2013	**Software Developer**, Web/Database Applications	**DLI Trier**

SELECTED PUBLICATIONS

arXiv:2203.01243	*Flow-based density of states for complex actions*	**Phys.Rev.D**
arXiv:2107.13464	*Reconstructing QCD spectral functions with Gaussian processes*	**Phys.Rev.D**
arXiv:2003.01504	*Towards novel insights in lattice field theory with explainable machine learning*	**Phys.Rev.D**
arXiv:1811.03533	*Reducing autocorrelation times in lattice simulations with generative adversarial networks*	**Mach.Learn.Sci.Tech.**

INVITED TALKS

11/2023	**Workshop**, Large-scale lattice QCD simulation and application of machine learning	**U Tsukuba**
9/2023	**Conference**, European network for particle physics, lattice field theory and extreme computing	**HU Berlin**
5/2023	**Seminar**, Institute for Nuclear Theory	**U Washington**
3/2023	**Seminar**, Applied Mathematics	**UC Berkeley**

MISCELLANEOUS

Contributor	Found and fixed a high priority issue in `torch.distributions.von_mises.VonMises`	**GitHub/PyTorch**
Organizer	Organized an interdisciplinary workshop on Machine Learning and the Renormalization Group	**ECT* Trento**
Mentor	Advised students on five Bachelor's and four Master's thesis projects during Ph.D.	**U Heidelberg**