Peter Sorrenson

Heidelberg, Germany
+49 176 29366768
peter.sorrenson@gmail.com

github.com/psorrenson
psorrenson.github.io
scholar.google.com/citations?user=894uGm4AAAAJ

Professional Summary

New graduate in Machine Learning specializing in generative models, with experience in their design, theory, and application to particle physics. Strong background in mathematics, physics, and PyTorch programming. Excited to transition into an industry role to contribute to impactful AI solutions and bring ML innovations to real-world applications.

Education

SEP 2020 - JAN 2025 (expected)

Heidelberg University, Germany – *PhD in Physics (Machine Learning Focus)*

- Thesis: *Free-Form Flows: Generative Models for Scientific Applications*
- Focused on the design and application of generative models for science.
- 6 published papers and 2 under review.

APR 2017 - JUL 2020

Heidelberg University, Germany – *Master's in Physics*

- Thesis: *Nonlinear Independent Component Analysis and Invertible Neural Networks*
- Resulting research presented as a spotlight talk (top 15% of accepted papers) at ICLR 2020.
- Thesis awarded the top possible grade (1.0).

FEB 2013 - FEB 2016

University of Auckland, New Zealand – *Bachelor's in Physics and Mathematics*

- Awarded "Best in Class" in five courses.

Research Experience

Free-Form Flows

- Designed a novel generative model class that removes architectural constraints from normalizing flows while retaining their benefits. Also applicable to data on manifolds.
- Led the development of the theoretical foundation, efficient training methods, and contributed experimental results.
- Outcome: Three publications at top conferences:
    - *Free-Form Flows: Make Any Architecture a Normalizing Flow*, AISTATS 2024.
    - *Lifting Architectural Constraints of Injective Flows*, ICLR 2024.
    - *Learning Distributions on Manifolds with Free-Form Flows*, NeurIPS 2024.

JetCLR: Contrastive Learning for Particle Jets

- Applied SimCLR contrastive learning techniques to particle jets from the Large Hadron Collider (LHC), in order to create a representation space for downstream tasks like jet classification and anomaly detection.
- Originated the project idea, led model implementation, and proposed architectural and training improvements to enhance performance.
- Outcome: Published in SciPost Physics (2022): *Symmetries, Safety, and Self-Supervision* and presented a related workshop paper at NeurIPS 2021 (Machine Learning and the Physical Sciences Workshop).

General Incompressible-flow Networks (GIN)

- Designed a specialized normalizing flow for disentanglement, with theoretical guarantees.
- Outcome: Published at ICLR 2020 (spotlight presentation): *Disentanglement by nonlinear ICA with general incompressible-flow networks (GIN).*

Technical Skills

- Programming Languages: Python, C, C++, MATLAB.
- Machine Learning Frameworks: PyTorch, TensorFlow.
- Tools and Libraries: NumPy, SciPy, Scikit-learn, Matplotlib, Pandas.
- Specialized Knowledge: Generative models, normalizing flows, contrastive learning, representation learning, Riemannian geometry.
- Mathematics & Statistics: Linear algebra, probability, optimization, differential geometry.
- Other Tools: Git, Jupyter Notebooks, LaTeX.

Publications

- *Free-Form Flows: Make Any Architecture a Normalizing Flow*, AISTATS 2024.
- *Lifting Architectural Constraints of Injective Flows*, ICLR 2024.
- *Learning Distributions on Manifolds with Free-Form Flows*, NeurIPS 2024.
- *A Normalized Autoencoder for LHC Triggers*, SciPost Physics, 2023.
- *Symmetries, Safety, and Self-Supervision*, SciPost Physics, 2022.
- *Better Latent Spaces for Better Autoencoders*, SciPost Physics, 2021.
- *Disentanglement by nonlinear ICA with general incompressible-flow networks (GIN)*, ICLR 2020.
- *Jet Diffusion versus JetGPT—Modern Networks for the LHC* (under review)
- *Learning Distances from Data with Normalizing Flows and Score Matching* (under review)

Total citations: 400.