Tim Dockhorn

405 Erb Street W, Apt. 205, Waterloo, ON N2L 1W7

timdockhorn@gmail.com https://timudk.github.io https://github.com/timudk

EDUCATION

University of Waterloo and Vector Institute **Waterloo/Toronto, ON**
PhD in Computer Science *Since May 2020*
Main advisor Yaoliang Yu, co-supervisor Iain Murray

University of Waterloo **Waterloo, ON**
MMATH in Applied Mathematics *Graduation: December 2019*
GPA: 97/100

Technical University of Munich **Munich, Germany**
BSc in Engineering Science *Graduation: December 2017*
German university grading system: 1.4/4.0 (top five percent of graduation cohort)

RESEARCH

Density Deconvolution with Normalizing Flows **ICML Workshop INNF+ 2020**
Tim Dockhorn, James Ritchie*, Yaoliang Yu, Iain Murray*
A short note on estimating a probability density function given only noise-corrupted samples and the noise statistics. We resort to (amortized) variational inference as using Normalizing Flows in the deconvolution setting leads to an intractable likelihood function. Our PyTorch implementation can be found here: `https://github.com/bayesiains/density-deconvolution`.

Generative Modeling with Neural Ordinary Differential Equations **Master's thesis**
Tim Dockhorn
In this thesis, I review key concepts that are important to understand NeuralODEs and Continuous Normalizing Flows. I present a variety of new results, both of theoretical and empirical nature. One highlight being the introduced tolerance schedulers that save up to 50% of training costs for Continuous Normalizing Flows. This work was supervised by Sander Rhebergen and Hans De Sterck.

A Discussion on Solving Partial Differential Equations using Neural Networks **Preprint**
Tim Dockhorn
A discussion on solving PDEs using neural networks in an unsupervised fashion. The neural network is trained by minimizing the residual of the PDEs over points in the numerical domain using a Quasi-Newton optimizer. As a highlight, I present numerical results for the steady Navier–Stokes equations. The Tensorflow implementation can be found here: `https://github.com/timudk/SPDENN`.

Turbulence modeling for large eddy simulation of incompressible flows using high-order discontinuous Galerkin methods **Bachelor's thesis**
Tim Dockhorn
In this thesis, I explore how to model turbulent flows for high-order discontinuous Galerkin methods. I found that basic turbulent models, like the Smagorinsky model, do not suffice to stabilize the discontinuous Galerkin scheme and that additional numerical dissipation is required. This work was supervised by Niklas Fehn and Wolfgang Wall.

* Indicates equal contribution

EXPERIENCE

Research Assistant - University of Waterloo *Jan 2020 - Apr 2020*
I assisted Yaoliang Yu with research on Adaptive Rejection Samplers and Simulation-Based Inference.

Teaching Assistant - University of Waterloo *Since Jan 2018*
So far, I TAed the following courses: Introduction to Machine Learning, Optimization for Data Science, Numerical Analysis, Calculus 1&2, Linear Algebra 1&2, Algebra

Teaching Assistant - Technical University of Munich *Oct 2015 - Sep 2016*
I TAed the following courses: Engineering Mechanics 1&2.

Research Internship - Mechanics and High Performance Computing Group *Feb 2017 - Apr 2017*
I implemented features like cell death, cell growth and cell exit in a quantitative model for early atherosclerotic plaques.

Industry Internship - Munich Composites *Aug 2014 - Sept 2014*
In this internship, I helped in research and production of carbon fiber reinforced polymers using Munich Composites patented braiding technology.

AWARDS

- David R. Cheriton Graduate Scholarship, two-year scholarship awarded on the basis of scholastic excellence and research potential (20,000 CAD)

PROJECTS AND INVOLVEMENTS

WATonomous - Perception team *May 2019 - August 2019*

- Implementation of three dimensional object detection algorithms.

WATonomous - Prediction team *Sept 2018 - Dec 2018*

- Responsible for tracking objects and predicting the future locations of the tracked objects using Kalman filtering techniques.

Smart doorbell (Python) *June 2018 - July 2018*

- Facial recognition system that tells you who is standing in front of your door and allows you to pass on personalized messages if you are not at home.
- Based on deep neural network in combination with Clarifai's face embedding model and triplet loss introduced in Schroff et al.

Markov chain Monte Carlo method (Python) *Feb 2018 – Apr 2018*

- Implementation of famous random walk Metropolis algorithm; see Andrieu et al.
- Theoretical background in form of presentation and report.

ADDITIONAL

- Programming Languages: Python, C++, C, MATLAB, SQL
- Relevant coursework: Theory of Deep Learning, Advanced Bayesian Computing, Optimization for Data Science, Reinforcement Learning, Machine Learning, Uncertainty Modeling, Stochastic Processes
- Fluent in English and German, learning Spanish
- I love every sport that involves a ball, enjoy to play chess and the guitar, and am passionate about hiking and exploring nature
- My team won at uwEnergyHacks – a hackathon focused on energy-related problems; submission: `https://github.com/timudk/uwEnergyHacks/`