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Aniket Das

Undergraduate, Mathematics and Electrical Engineering, IIT Kanpur

Education

Indian Institute of Technology Kanpur, India — *Aug' 17 - Jun' 22 (Expected)*
*BTech in **Electrical Engineering** and*
*BS in **Mathematics** (Double Major)*
GPA: 9.1/10 (5 Semesters)

Aalto University, Finland
Year-long Academic Exchange in Aalto University School of Science — *Jan' 20 - Jan' 21*
GPA: 4.8/5.0 (2 Semesters)

Research Interests

Optimization, High Dimensional Statistics, Approximate Inference, Gradient-based MCMC, Continuous Time Deep Learning, Generative Models

Publications

Yatin Dandi, **Aniket Das**, Soumye Singhal, Vinay P. Namboodiri, Piyush Rai "Jointly Trained Image and Video Generation using Residual Vectors" *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2020* [Paper]

Avinandan Bose*, **Aniket Das***, Yatin Dandi*, Piyush Rai "NeurInt : Learning to Interpolate through Neural ODEs" *International Conference on Computer Vision 2021 (ICCV'21)* [Under Review]

Aniket Das, Prateeti Mukherjee, Debashis De "Missing Data Imputation at Edge through Continuous-Discrete Bayesian Filtering of Stochastic Differential Equations" *Information Fusion* [Under Review]

Avik Pal*, **Aniket Das*** "TorchGAN: A Flexible Framework for GAN Training and Evaluation" *Journal of Open Source Software (JOSS)* [Under Review] [Preprint]

** indicates equal contribution*

Work Experience

Research Assistant, IIT Kanpur
Prof. Piyush Rai, CSE, IIT Kanpur — *Mar '19 - Present*

- Previous work involved development of probabilistic generative models for joint image and video generation and the design of a non-parametric generative model for images parameterised by Second Order Neural ODEs
- Currently working to develop an extension of the Model Agnostic Meta Learning (MAML) algorithm for meta-learning of continuous time dynamical systems, and deriving theoretical guarantees for the same
- Also investigating results from SDE theory to improve the performance of Stochastic Gradient MCMC algorithms

Research Assistant, Aalto University
Dr. Markus Heinonen and Prof. Harri Lahdesmaki, Aalto University — *Mar '20 - Sep'20*

- Worked on the development of approximate inference and adversarial learning algorithms for continuous-time generative models governed by Ordinary and Stochastic Differential Equations
- Particular focus on Adversarial Learning of Second Order ODE based generative models for high dimensional time series, and Bayesian Inference in SDE models

Selected Projects

Nonparametric Models for Image Generation and Interpolation
Prof. Piyush Rai, IIT Kanpur *Oct '20 - Mar '21*

- Developed a generative model for images that learns a distribution of smooth continuous-time interpolation trajectories for a given source-target pair, and generates images by subsampling random interpolation curves drawn from the trajectory distribution
- Parameterised the conditional distribution of interpolation trajectories with Probabilistic Second Order Neural ODEs and formulated the overall model as a modified Generative Adversarial Network with a nonparametric data-dependent noise prior
- Benchmarked against appropriate GAN and Bidirectional GAN baselines that employ a fixed noise prior and obtained significant improvements in image generation and interpolation
- Work is submitted to the *International Conference on Computer Vision (ICCV) 2021*

Probabilistic Models for Joint Image and Video Generation
Prof. Piyush Rai and Prof. Vinay P. Namboodiri, IIT Kanpur: [Paper] *Mar '19 - July '19*

- Developed a hierarchical probabilistic model for joint image and video generation that generates a summary frame for the video, and models individual frames by adding residual vectors to the summary frame representation at each timestep
- Developed an analogous hierarchy for models that disentangle content from motion by adding a residual content vector to the content summary representation at every timestep
- Designed VAE and GAN variants of the proposed models and observed significant improvements in both image and video generation when benchmarked against appropriate baselines
- Paper published at the *Winter Conference on Applications of Computer Vision (WACV) 2020*

Other Projects

Continuous-Discrete Kalman Filtering for Stochastic Differential Equations
Prof. Simo Sarkka, Aalto University [Code] [Report] *Feb '20 - Apr '20*

- Studied the theory of Brownian Motion, Continuous-time Markov Chains, Stochastic Differential Equations (SDEs), Ito Calculus and the Fokker Planck PDE
- Investigated the continuous-time Bayesian Filtering problem for SDEs, and studied the Kushner-Stratonovic and Zakai Equations for likelihood calculation in SDE models
- Studied and implemented exact and approximate Kalman Filters for various Continuous-Discrete State Space Models

TorchGAN: A Flexible Framework for GAN Training and Evaluation
Independent Open Source Project : [Code] [Docs] [Preprint] *Dec'18 - Sep'19*

- Developed a lightweight customizable PyTorch framework for training and evaluation of Generative Adversarial Networks (GANs)
- Wrote efficient implementations of various GAN models, losses, evaluation metrics and stability enhancement features and designed a customizable framework for effortlessly extending them
- Project hosted on Github has over 1200 stars. Paper is currently submitted to the *Journal of Open Source Software (JOSS)*

Relevant Coursework

Computer Science	Introduction to Programming, Data Structures and Algorithms, Advanced Algorithms*, Toolkit for Theoretical Computer Science
Machine Learning and Statistics	Optimization in ML*, Kernel Methods and Learning Theory*, Probabilistic ML, Bayesian Filtering and State Space Models*, Statistical Signal Processing, ML for Signal Processing, Probability and Statistics
Mathematics	Functional Analysis*, Measure Theory*, Real Analysis, Stochastic Processes, Linear Algebra and ODE, Dynamical Systems*, Partial Differential Equations*, Complex Variables, Scientific Computing

* *indicates course done at Aalto University*

Skills

Languages: *Proficient*: Python, C, C++ *Familiar*: Julia, Octave
Data Science Libraries: NumPy, Pandas, Pillow, Scipy, Scikit-Learn, Gensim
Deep Learning Frameworks: Pytorch, Tensorflow, Flux.jl
Utilities: Linux Shell, Git, Vim, LaTeX, Amazon Mechanical Turk

Mentorship Roles

Coordinator, Special Interest Group in Machine Learning
IIT Kanpur *Sept. '19 - Sept. '20*

- Responsible for delivering and conducting talks on current research and special topics in Machine Learning, and promoting student research in ML

Project Mentor, Topics in Functional Analysis and Measure Theory
Stamatics, IIT Kanpur *Mar. '21 - Present*

- Mentoring a group of ten students on measure theory and functional analysis, with particular focus on applications in Machine Learning Theory (primarily Kernel Methods)

Project Mentor, Probabilistic Machine Learning
Programming Club, IIT Kanpur *May. '19 - July '19*

- Mentored a group of fourteen freshmen on Probabilistic Machine Learning and its applications
- Conducted lectures, authored weekly assignments and mentored projects on Bayesian Matrix Factorization, Black Box VI and Auto Encoding VB, Stepwise and Incremental EM, and SVI