

# Aniket Das

UNDERGRADUATE, MATHEMATICS AND ELECTRICAL ENGINEERING, IIT KANPUR

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EDUCATION      **Indian Institute of Technology Kanpur, India**      *Aug' 17 - Jun' 22 (Expected)*  
*Undergraduate (BS and BTech)*  
*Double Major in **Mathematics** and **Electrical Engineering***  
**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)

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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

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

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

- 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. Nambodiri, 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, L<sup>A</sup>T<sub>E</sub>X, Amazon Mechanical Turk

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## 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