

Avinandan Bose

GRADUATE RESEARCH ENGINEER · SINGAPORE MANAGEMENT UNIVERSITY

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Education

Indian Institute of Technology Kanpur(IITK)

Kanpur,Uttar Pradesh

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING

July,2018 - Dec.2021

- Cumulative Performance Index(CGPA): **9.2/10.0**
- Academic Excellence Award (20-19,20,21) : Awarded to top 10 percentile students based on annual academic performance
- CLASS OF 1990 SCHOLARSHIPS (2018) : Awarded to top three freshmen

Research Interests

1. Multi Agent Reinforcement Learning
2. Decision Making under Uncertainty
3. Game Theory and Behavioural Models
4. Distributionally Robust Optimization

Publications

Rigorously Reviewed Conference Publications

Multiscale Generative Models: Improving Performance of a Generative Model Using Feedback from Other Dependent Generative Models

Feb, 2022

CHEN CHANGYU, **AVINANDAN BOSE**, SHIH-FEN CHENG, ARUNESH SINHA

In Proceedings of 36th Association for Advancement in Artificial Intelligence (AAAI) Conference, Acceptance rate : 15%

NeurInt : Learning to Interpolate using Neural ODEs

Dec, 2021

AVINANDAN BOSE, ANIKET DAS, YATIN DANDI, PIYUSH RAI

[Paper][Extended Version]

Oral Spotlight at The Symbiosis of Deep Learning and Differential Equations (DLDE) NeurIPS Workshop

Under Review/Preprint

Conditional Expectation based Value Decomposition for Scalable On-Demand Ride Pooling

2021

AVINANDAN BOSE, PRADEEP VARAKANTHAM

[Preprint]

Under Review at International Joint Conference on Artificial Intelligence (IJCAI)

Change Point Analysis of Topic Proportions in Temporal Text Data

2021

AVINANDAN BOSE, SOUMENDU SUNDAR MUKHERJEE

[Preprint]

Under Review at Journal of Computational and Graphical Statistics(JCGS)

Scalable Distributional Robustness in a Class of Non Convex Optimization with Guarantees

2022

AVINANDAN BOSE, MAI AHN TIEN, ARUNESH SINHA

Under Review at International Conference on Machine Learning (ICML)

Stackelberg Network Interdiction under Boundedly Rational Adversary

2022

MAI AHN TIEN, **AVINANDAN BOSE**, THAHN NGUYEN, ARUNESH SINHA

Under Review at ACM Conference on Economics and Computation (EC)

Work Experience

Visiting Undergraduate Researcher, School of Information Systems

Singapore Management University

PROF. PRADEEP VARAKANTHAM, PROF.ARUNESH SINHA, PROF.MAI AHN TIEN

May.2021 - Dec.2021

- Paper on a hierarchial system of GANs to learn from feedback through other dependent GANs (Accepted AAAI 22).
- Paper on Conditional Expectation based Value Decomposition for Scalable Ride Pool Matching (Submitted ICLR 22).
- Working paper on Distributional Robustness in Stackelberg Games with Quantal Response.
- Offered Research Engineer Position, starting Jan. 2022.

- Paper on non-parametric generative models for images using Second Order Neural ODEs (Accepted DLDE NeurIPS 21 Workshop).

Research Assistant, Interdisciplinary Statistical Research Unit

Indian Statistical Institute, Kolkata

- Paper on Change Point Analysis of Topic Proportions in Temporal Text Data (Submitted JCGS)

Selected Projects

Conditional Expectation based Value Decomposition for Scalable On-Demand Ride Pooling

Singapore Management University

ADVISOR : PROF. PRADEEP VARAKANTHAM [PAPER]

May.2021-Oct.2021

- Developed a novel mechanism based on computing values in the form of conditional expectations through joint conditional probabilities for capturing dependencies on other agents actions without increasing the complexity of training or decision making.
- Mechanism can also be easily extended to Centralized Execution Fully Cooperative Large Scale Multi Agent Reinforcement Learning Tasks.
- Outperformed the current State of the Art Model by upto 9.76%.

Distributional Robustness in Discrete Choice Models

Singapore Management University

ADVISOR : PROF. ARUNESH SINHA AND PROF. MAI AHN TIEN

May.2021-Dec.2021

- Discrete Choice Models are class of non-convex fractional problems. Prior works have only developed approaches to reach a stationary point in nonconcave-convex max-min relaxed versions or global optimum in a special cases with convex risk functions.
- Reformulated the problem as a Mixed Integer Second Order Cone Program guaranteed to find the global optimum.
- Derived theoretical bounds on converging to the global optimum when using approaches to scale up such as clustering and stratified sampling.
- Applied to robustifying Stackelberg Security Games, Fairer Facility Location and Cost Planning.

Multiscale Generative Models: Improving Performance of a Generative Model Using Feedback from Other Dependent Generative Models

Singapore Management University

ADVISOR : PROF. ARUNESH SINHA AND PROF. SHIH-FEN CHENG

May.2021-Sept.2021

- Modelled a system of multiple interacting generative Models (GANs) trained in a hierarchical setup where a higher level GAN is conditioned on the output of several lower level GANs.
- Achieved training a newly arrived lower level GAN on very limited data through feedback from the pre-trained system of dependent GANs.

NeurInt : Learning to Interpolate using Neural ODEs

Dept of CSE,IITK

ADVISOR : PROF. PIYUSH RAI [PAPER]

Dec.2020-Mar.2021

- 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 resultant model as a modified Generative Adversarial Network with a nonparametric data-dependent prior for the latent code
- Benchmarked against appropriate GAN and Bidirectional GAN baselines that employ a fixed latent code prior and obtained significant improvements in image generation and interpolation

Change Point Analysis of Topic Proportions in Temporal Text Data

Interdisciplinary Statistical Research Unit,ISI, Kolkata

ADVISOR : SOUMENDU SUNDAR MUKHERJEE [PAPER]

Dec.2019,May.2020-Oct.2020

- Proposed and developed a novel efficient temporal topic model with provisions for change points to capture offline changes in topic proportions of large corpuses of temporal textual data robust to predicting false positives.
- Change Point Estimation is widely studied but has received very little attention in textual data, hence our work is among the very few available.
- Our method estimated literary era changes in 19th-20th century English Literature Data consisted with linguists works, and scientific trend changes in the field of High Energy Physics in agreement to the beliefs of the scientific community.
- Proposed work facilitates the automated detection of change points in large corpora without any domain knowledge. Our model also serves to explain changes through topic interpretability.

Other Projects

Lock-Free Parallelized SGD for Matrix Factorization

Dept of Electrical Engineering,IITK

ADVISOR : PROF.KETAN RAJAWAT[CODE] [REPORT]

Jan.2020 - Apr.2020

- Reviewed literature on Parallelized Stochastic Gradient Descent with particular focus on Matrix Factorization Tasks.
- Matrix Factorization datasets hardly ever have entries missing completely at random. Proposed a method to permute the rows and columns to identify and separate patches of high density from a seemingly sparse matrix.
- Developed a method to solve matrix factorization problems by combining ideas from HOGWILD and stratified SGD, which highly improved convergence rates on the permuted matrix in synthetic and real datasets.
- Worked on a theoretical analysis of convergence rates of the proposed method, and contrasted with existing methods.

Online Bayesian Tensor Completion for Traffic Estimation

Dept of Electrical Engineering,IITK

ADVISOR : PROF.KETAN RAJAWAT[REPORT]

Aug.2019 - Nov.2019

- Proposed a model for online prediction of estimated time of arrival for cab services via Online Variational Bayesian Subspace Filtering.

Honors & Awards

2018	All India Rank 104 , Joint Entrance Examination Advanced 200,000 candidates	India
2018	All India Rank 554 , Joint Entrance Examination Main 1.5 million candidates	India
2017	All India Rank 68 , KVPY Scholarship Indian Institute of Science and Government of India	Bangalore, India
2018	All India Rank 1 , West Bengal Joint Entrance Examination	West Bengal, India
2018	Gold Medal , Indian National Physics Olympiad (Top 35 in the nation)	Mumbai, India
2015	Gold Medal , Indian National Junior Science Olympiad (Top 35 in the nation)	Mumbai, India
2017	3rd in State, National Top 1 % , National Standard Examination in Physics	India
2017	3rd in State, National Top 1 % , National Standard Examination in Chemistry	India
2017	2nd in State, National Top 1 % , National Standard Examination in Astronomy	India
2016	3rd in State, National Top 1 % , National Standard Examination in Astronomy	India
2016	State Top 1 % , National Standard Examination in Physics	India
2014	State Top 1 % , National Standard Examination in Junior Science	India
2016	Scholar , National Talent Search Examination	India

Skills

Languages	Python, R, C, C++
Deep Learning Frameworks	PyTorch, Tensorflow, Keras, TorchGAN
Data Science Libraries	NumPy, SciPy, Pandas, Scikit-Learn, Gensim
Optimization Softwares	Gurobi, CPLEX
Utilities	Linux Shell Utilities, Git, Vim, \LaTeX , MATLAB

Course Work

Advanced Graduate Level Courses at IITK

Convex Optimization in Signal Processing and Communication A
Decision Theory and Bayesian Analysis A
Topics in Probabilistic Modelling and Inference[@]
Introduction to Machine Learning A
Stochastic Processes
Quantum Computing A
Game Theory and Mechanism Designⁱ
Statistical Simulation and Data Analysisⁱ
Algorithmic Game Theoryⁱ

Other Relevant Courses

Real Analysis and Multivariate Calculus A*
Probability and Statistics A
Fundamentals of Programming A*
Theory of Computation A
Linear Algebra and Ordinary Differential Equations
Data Structures and Algorithms A
Discrete Mathematics for Computer Science A
Advanced Algorithms
Partial Differential Equations A
Mathematical Economics A

A : Grade for exceptional performance (Top 1%)*

@ : audit

i : in progress

Activities

Reviewer

DLDE WORKSHOP

Coordinator

SPECIAL INTEREST GROUP IN MACHINE LEARNING (SIGML)

Project Mentor

ASSOCIATION OF COMPUTING ACTIVITIES (ACA)

Secretary

PROGRAMMING CLUB

NeurIPS

2021

IIT Kanpur

May. 2020 - Nov. 2021

IIT Kanpur

Jan. 2020 - Apr. 2020

IIT Kanpur

Mar. 2019 - Mar. 2020