Anubhav Goel | Curriculum Vitae

Contact Information

Department of Computer Science
The University of Texas at Austin
Austin, Texas, USA

+1 737-222-8175
anubhavgoel026@gmail.com
https://anubhavgoel26.github.io

Research Interests

Reinforcement Learning, Fairness in Machine Learning, Systems and System Design

Education

The University of Texas at Austin, Austin, Texas
Master of Science, Computer Science
Indian Institute of Technology (IIT) Bombay, Mumbai, India
Dual Degree (B.Tech+M.Tech), Electrical Engineering

- **Minor** in Computer Science and Engineering
- **Cumulative Performance Index (CPI)**: 9.35/10.00

Academic Achievements

- Awarded **Academic Excellence** for ranking first in Dual Degree specialization
- Awarded the **JN Tata Scholarship** for pursuing higher studies
- Awarded the **Excellence in Teaching Assistantship** for graduate level course Image Processing
- Awarded the **Erasmus Scholarship** as a part of funding for a Semester Exchange Program to **Technical University Denmark (DTU)** based on exceptional academic performance
- Awarded Change of Branch for exceptional academic performance in first year
- Recipient of **KVPY Fellowship** with an **All India Rank 264** in 2017 (KVPY is a Fellowship in Basic Sciences, initiated by the Department of Science and Technology, Govt. of India)
- **NTSE** Scholar (National Talent Search Exam conducted by NCERT, Govt. of India) since 2015

Research Projects

- **One Class Classification** July'21 - Dec'21
  Guide: Prof. Suyash Awate, CSE, IIT Bombay
  - Implemented a Deep Robust One Class Classification network motivated by the fact that typical data lies on low dimensional manifold, by adaptively generating adversarial points
  - Applying a **Gaussian Mixture Model** to perform clustering in a low-dimensional space
  - Used Generative Modelling to encode the latent space and detect anomalies along with Expectation Maximization to increase the data likelihood
- **Chance Constrained Markov Decision Process** July'21 - Dec'21
  Guide: Prof. Vivek Borkar, EE, IIT Bombay
  - Used a Markov Decision Process framework to model probabilistic constraints as **Risk Sensitive loss** and a novel Primal Dual scheme to minimize the average cost while ensuring non-violation of probabilistic constraints
  - Implemented a **policy gradient** based reinforcement learning scheme using function approximation to parametrize policies for opportunistic scheduling in fading channels
  - Applied the scheme to randomly generated Markov Decision Processes to observe its behaviour

- **Deep Learning Strategies for Reconstructing Undersampled RS fMRI** July'20 - Dec'20
  Guide: Prof. Suyash Awate, CSE, IIT Bombay
  - Integrated **Bayesian Framework** to model Epistemic and Aleatoric Uncertainty with existing Deep Learning techniques and applied it to DC-CNN and U-Net architectures
  - Implemented a three-stage architecture with end-to-end learning which performs reconstruction in k-space and performs quality enhancement in the spatiotemporal domain
  - Used a combination of Robust Loss, which models the heavier-tailed distribution for physiological noise and Bayesian Loss, which maximizes aposteriori probability of reconstruction
- **3D Scene Reconstruction Using Multiple-View Geometry** Feb'21 - May'21
  Guide: Prof. Anders Dahl and Prof. Vedrana Dahl, Technical University of Denmark
  - Applied the Zhang model to perform camera calibration using checkerboard images to work with handheld devices with unknown intrinsic camera parameters and non-standard datasets
  - Extracted **SIFT features** from multiple views and performed feature matching by implementing **FLANN matcher** to establish a Homography using **RANSAC algorithm** for outlier removal
  - Used Linear algorithms to calculate Essential and Projection Matrices and applied Triangulation along with K-means Clustering to calculate the final 3D coordinates of the points in space

Work Experience and Other Projects

- **Corporate and Investment Banking Analytics** May'20 - Aug'20
  McKinsey & Co.
  - Worked in the development of a big data processing pipeline used for generating critical insights about the performance of leading global banks and develop future investment strategies
  - Worked with teams across different countries and backgrounds to automate strategy analysis methods across equity and debt products
  - Offered a referral to join as a full-time Associate to work on critical data insights
- **Transaction Advisory Services** Nov'18 - Jan'18
  Ernst & Young LLP
  - Analysed current fiscal and economic status including infrastructure development in Indian states
  - Studied economic parameters to develop an Infrastructure Investment Plan for state governments
- **Financial Appraisal of Infrastructure Projects** May'18 - July'18
  RITES Ltd.
  - Developed an Annuity model for a railway project including profit and loss account, balance sheet and cash flow statement to evaluate its financial viability in terms of Return on Equity
  - Studied sensitivity of the model to costing variables and other financial parameters including debt-equity ratio, depreciation, tax and financing fee and projected traffic
- **Conditional Style GAN** Autumn'20
  Course Project: Advanced Machine Learning, Guide: Prof. Amit Sethi
  - Implemented conditional variant of StyleGAN to perform style transfer on FFHQ datasets
  - Mapped Speech Commands dataset to MEL spectrograms and used conditional StyleGAN to perform style transfer in audio domain and evaluated its performance using FID scores
- **Neural Net Engine** May'19 - July'19
  Guide: Prof. Virendra Singh
  - Designed a Neural Net for Face Detection in a Video Surveillance system on an FPGA board
  - Optimized memory requirements of MTCNNs for use in resource-constrained environments
- **Rendering and Animation using OpenGL** Autumn'20
  Course Project: Computer Graphics, Guide: Prof. Parag Chaudhuri
  - Used Keyframing and Interpolation along with Phong lighting model and texture mapping in a Hierarchical modeling framework to create a 30 second animation film

- **Spanning Tree Protocol and Learning Bridges** Autumn'20
  Course Project: Computer Networks, Guide: Prof. Varsha Apte
  - Implemented the distributed spanning tree algorithm and the algorithm for learning forwarding tables in bridges according to IEEE 802.1D standards
- **Processor Design** Autumn'19
  Course Project: Microprocessors, Guide: Prof. Virendra Singh
  - Designed a 6-stage pipelined microprocessor with forwarding, hazard control and branch prediction and implemented a CISC processor (subset of 8085 ISA) using VHDL on Altera FPGA board
- **Non-Photorealistic Rendering** Autumn'19
  Course Project: Digital Image Processing, Guide: Prof. Suyash Awate
  - Used edge detection and mean shift segmentation with cel shading to obtain toonified images

Technical Skills

Programming	C++, C, Bash, Python, Java, R, CMake, OpenGL, VBA, VHDL
Software	PyTorch, Matplotlib, TensorFlow, MATLAB, Vagrant, Git, LaTeX, OpenCV

Selected Courses

- **Computer Science:** Machine Learning, Theoretical Machine Learning, Advanced Image Processing, Computer Vision, Computer Graphics, Digital Image Processing, Design and Analysis of Algorithms, Data Structures and Algorithms, Network Security, Computer Networks, Operating Systems
- **Advanced EE Courses:** Advanced Probability and Random Processes, Advanced Machine Learning, Markov Chains and Queuing Systems, Optimization, Advanced Data Analysis and Statistical Modelling, Graph Theory, Stochastic Optimization
- **Core EE Courses:** Digital Signal Processing, Data Analysis and Interpretation, Control Systems, Digital Communications, Microprocessors, Linear Algebra

Teaching and Mentorship Experience

- **Teaching Assistant for MIS382N Advanced Machine Learning:** Served as a graduate teaching assistant for the graduate Machine Learning course at McCombs School of Business under Prof. Joydeep Ghosh *Fall '22*
- **Teaching Assistant for EE769 Introduction to Machine Learning:** Served as an undergraduate teaching assistant for a batch of 300 students assisting the professor with conducting vivas and evaluations *Spring '22*
- **Teaching Assistant for EE610 Image Processing:** Served as an undergraduate teaching assistant for a batch of 150 students assisting the professor with smooth functioning of the course, contributing to the content matter and course resources as well as assisting in conducting the evaluation of the course
  Awarded Excellence in Teaching Assistantship award *Fall '21*
- **Teaching Assistant for MA207 Differential Equations II:** Served as an undergraduate teaching assistant for a batch of 20 sophomores, conducting weekly tutorial sessions, doubt sessions and grading answer sheets *Fall '20*
- **Department Academic Mentor:** Mentored **6 sophomores** on a one-to-one basis to ensure a smooth transition to the department as well as assisted on numerous aspects including academics and extracurriculars *Fall '21*