Aniruddha **Sundararajan**

Indian Institute of Technology Madras

aniruddha12321@gmail.com | s-aniruddha.github.io | s-aniruddha | Aniruddha-sundararajan

Education

Indian Institute of Technology Madras — *Jul 2018 - Present*
Dual Degree (B.Tech Engineering Physics & M.Tech Data Science) — CGPA: **9.25**/10

Kola Saraswathi Vaishnav Sr. Sec. School — *Apr 2017 - May 2018*
Class XII, CBSE — Score: **483**/500

National Public School, Chennai — *Apr 2015 - May 2016*
Class X, CBSE — CGPA: **10**/10

Scholastic Achievements

2022 **335/340** in Graduate Record Examination: 170 Quantitative & 165 Verbal
2020 **Recipient of the IIT Madras Young Research Fellowship** for a funded undergraduate research project
2018 **All India Rank 1741** (among top 0.7 percentile) in Joint Entrance Examination Advanced 2018
2017 **5/5** in 3 Advanced Placement Exams: Calculus BC, Physics C: Mechanics, and Physics C: Electricity & Magnetism
2017 **800/800** in 3 SAT Subject Tests: Math 2, Physics, & Chemistry

Experience

Thesis Project
Aug 2022 - Present
Research project with Prof. Balaraman Ravindran, IIT Madras — Reinforcement Learning

- **Option-Indexed Hierarchical RL:** We learn an affinity function between options and the items present in the environment. This allows us to effectively reuse a large library of pre-trained options (lifelong learning setting) in zero-shot generalization at test time by restricting goal-directed learning to only those options relevant to the task at hand
- Ideated and implemented a co-occurrence-based representation for options to match them to tasks efficiently.
- Submitted our work to the **Autonomous Agents and Multiagent Systems Conference 2023** under Learning and Adaptation.
- Explored academic literature on MDP Homomorphisms, Equivariant Neural Networks, and incorporating symmetries into Model-based RL.

Amazon
Feb 2022 - Jul 2022
Applied Scientist Intern — Machine Learning for Finance

- Worked in the Accounts Payable team of Amazon, responsible for making timely payments from Amazon to vendors.
- Developed a novel unsupervised multivariate anomaly detection technique using flexible negative sampling.
- Built a cancellation propensity model based on Gradient Boosted Trees to predict the probability that an invoice might be canceled and prevent erroneous payments, leading to potential savings ranging from 100k$ to 20M$.
- Submitted 2 papers on variants of this technique to Amazon's internal Machine Learning conference (AMLC).
- Received a full-time job offer based on my performance in the internship.

Texas Instruments
May 2021 - Jul 2021
Digital & Signal Processing Engineer Intern — Automotive Ethernet

- Performed system modeling and signal level simulation of a 10 Mbps automotive ethernet in MATLAB.
- Proposed an architecture spec for PHY layer of the ethernet that met the IEEE 802.3cg standard for 10BaseT1S.
- Received a full-time job offer based on my performance in the internship.

IITM Young Research Fellow
Sep 2020 - Jul 2021
Research project with Prof. Avhishek Chatterjee, IIT Madras — Error Control Coding

- **Achieving near-capacity performance in queue-channel systems with waiting-time dependent errors**: Designed error control coding schemes that make bits/qubits robust to noise in queue-channel systems with waiting-time dependent errors.
- Used Python and Mathematica to perform simulations of the channel, implement my convolution-based encoder and Maximum a Posteriori decoder from scratch, and validate the scheme's performance in terms of bit error rates.
- Learned various research skills like reading, writing, and presenting academic work through the YRF's research readiness program.

Projects

How does Batch Normalization help optimization?
Jul 2022 - Nov 2022
Course project with Prof. Uday Khankhoje, IIT Madras — Optimization

- Reproduced experimental results from the research paper "How Does Batch Normalization Help Optimization?" by Santurkar et al., which proposed the landscape smoothening effect of the BatchNorm technique as a novel explanation for its effectiveness.

- Developed an academic poster and presented it to the Electrical Engineering Department of IIT Madras.

Using summaries to improve review sentiment classification
Jan 2021 - May 2021

Course project with Prof. Avhishek Chatterjee, IIT Madras — Deep Learning

- Developed a novel hierarchical classification-based approach to perform review sentiment classification. The first-stage BiGRU-based classifier leveraged short summaries of the review text, which capture the essential sentiment features, to predict if the review is positive (score 3-5) or negative (score 1-2). Subsequent BiGRU models perform finer classification based on the first classifier's prediction using the full review text.
- Tested the architecture on the Sports and Outdoors dataset from Amazon 5 cores repository. Achieved performance close to the then state-of-the-art (**51%** balanced accuracy and **44%** macro F1 score) despite having far fewer trainable parameters.

Estimation of the bilinear form y*f(A)x for Hermitian matrices
Jul 2020 - Nov 2020

Course project with Prof. Andrew Thangaraj, IIT Madras — Linear Algebra

- Reproduced numerical results from the research paper "Estimation of the bilinear form y*f(A)x for Hermitian matrices" by Fika et al.
- Estimated bilinear forms of f(A) without explicitly calculating f(A) by extrapolating the moments y*f(A)x. Verified the accuracy of the estimations using MATLAB simulations.

Build a modern computer from first principles: From Nand to Tetris
May 2019 - Aug 2019

Coursera course project — Computer Architecture

- **Part I**: Built the hardware part of a fully functioning general-purpose modern computer starting from logic gates.
- **Part II**: Built a modern software hierarchy that can translate and execute object-based, high-level languages on a bare-bone computer hardware platform. Implemented a virtual machine and a compiler for a Java-like programming language (Jack).

Teaching Experience

Physics Lab Teaching Assistant
Aug 2022 - Present

- Currently working as a teaching assistant for the Physics Preparatory Lab course, which is offered to help underprivileged first-year students prepare for their studies at IIT Madras.

Programming Club Coordinator
Mar 2019 - Jun 2020

- Worked as a coordinator in the CΦ Programming Club of IIT Madras.
- Conducted educative sessions in data structures and algorithms for students from all disciplines. Authored questions for the institute-wide programming contests run by the club on online platforms.

Skills

Programming	Python, C++, C
Analysis	MATLAB, Mathematica
Frameworks & Tools	Scikit-learn, TensorFlow, Keras, PyTorch, Pandas, PySpark, AWS EC2, AutoCAD, LTspice, LaTeX
Languages	Tamil, English (108 in TOEFL iBT)

Relevant Coursework

Math	Probability, Statistics & Stochastic Processes, Linear Algebra, Multivariable Calculus
Data Science	Machine Learning, Deep Learning, Data Analytics, Big Data Lab
Computer Science	Programming & Data Structures, Discrete Mathematics for CS, Optimization
Engineering Physics	Quantum Computation & Information, Statistical Physics, Mathematical Physics
Electrical Engineering	Information Theory, Communication systems, Digital Signal Processing, Digital Systems

MOOCs

2022 Introduction to Operations Research
2022 Design and Analysis of Algorithms
2020 Deep Learning Specialization (5 courses)
2020 CS-191x Quantum Mechanics and Quantum Computation
2020 Digital Signal Processing
2019 Build a Modern Computer from First Principles: From Nand to Tetris Parts I & II
2019 Programming, Data Structures and Algorithms Using Python
2018 DAT208x: Introduction to Python for Data Science