Puranjay Datta

Curriculum Vitae

(+91) 8879113248
puranjaydatta@gmail.com

Education

2019 – 2024 **Btech&Mtech**, *Electrical Engineering, Indian Institute of Technology, Bombay* ***CGPA 9.34***.

2019 – 2024 **Minor**, *Computer Science, Indian Institute of Technology, Bombay* .

2018 Secured **All India Rank 132** in Kishor Vaigyanic Protsahan Yojana **(KVPY)** and awarded fellowship

2019 Among **top 300** selected for Indian National Olympiads in Chemistry **(INChO)**

2019 **Intermediate**, *Ratanbai Walbai Junior College, Maharashtra, India 93.07%*.

2017 **Matriculation**, *Smt Sulochanadevi Singhania School, Mumbai, India 97%*.

Research Interests

Multiarm Bandits, Reinforcement Learning, Markov Chains, Stochastic Control, Game Theory

Research Experience

Autumn '23 **Hierarchical Inference using Online Learning**

Guide *Sharayu Moharir* | *Master's Thesis*

- Formulated a **hierarchichal deep learning inference** at edge with a non uniform loss function
- Analyzed the learning rate **doubling trick** of **adaptive hedge** to track optimal rate for both experts
- Adapted the **Chow's rule** to an online learning setup involving **2D continuous** experts
- Surveyed literature pertaining to **Online Recursive Weighting** involving a non convex **Lipschitz loss**

Summer '23 **Transfer learning in NVIDIA isaacgym**

Guide *Hatem Abou Zeid* | *MITACS University of Calgary*

- Explored how the body shape of a **humanoid** impacts its motion using **NVIDIA's isaacgym**
- Analyzed different shapes in the **MuJoCo** simulator which influenced the different **reward** components
- Studied the application of **Adversarial Motion Priors** in training humanoid agents using motion datasets, investigating transfer learning to another task using **one-shot transfer learning**

Spring '23 **Networked Fairness in Cake Cutting**

Guide *Swaprava Nath* | *CS6002 Advanced Game Theory*

- Pioneered a novel approach to **cake-cutting with networked agents** for **envy-free allocations**
- Extended existing algorithm for **binary trees**, incorporating an extra edge at level 1
- Devised **moving-knife algorithms** for envy-free allocations on **cycle networks** up to 6 nodes and size 3 cliques connected by a bridge using **Austin Cut** and **Brams Taylor Zwicker** procedure

Spring '23 **Enhancing the Neurips Reconnaissance Blind Chess Agent**

Guide *Shivaram Kalyanakrishnan* | *CS748 Advances in Intelligent and Learning Agents*

- Developed a **Replay Buffer** to assess blunders and move scores to highlight Fianchetto bot's limitations
- Tested the **opponent modeling strategy** by training the weights of the meta-expert LCzero engine
- Adapated a new scoring system based on **Q value of position** with a policy rollout for move scores

Work Experience

Summer '22 **Evaluation of methods in base-band to generate efficient predistorted signal for Power Amplifier**

Guide *Jawaharlal Tangudu* | *Texas Instruments*

- Studied about **Generalized Memory Polynomial** model for Digital Predistortion of Power Amplifiers
- Implemented **Iterative Learning Control(ILC)** to identify the parameters of the digital predistorter
- Tried to improve the results of using the **Vector Switched Models(VSM)** by using **Volterra kernels**
- Compared the traditional Memory Polynomial Model with ILC based on metrics like **ACLR and SNR**

Key Projects

Spring '23 **Training a Generative model for Weak Supervision**

Guide *Sunita Sarawagi* | *CS726 Advanced Machine Learning*

- Trained using **Snorkel**, a generative model to capture the relationships among **labeling functions**
- Experimented on salary prediction, twitter sentiment analysis where a **discriminative model** like logistic regression, recurrent neural network was trained on these labels which improved the accuracy

Autumn '22 **Wavelets in Convolutional Neural Network**

Guide *Vikram M Gadre* | *EE678 Wavelets*

- Developed a sparse neural network combining **LSTM and wavelets** for predicting atmospheric profile
- Implemented **Level-2 decomposition** with **separate k-band, v-band** training to improve the accuracy

Summer '21 **Micro-doppler and Radar Signal Processing**

Guide *Prof Vikram M Gadre, Shrikant Sharma*

- Researched about **bessel decomposition** of micro-doppler signals, estimation of **side band frequency**
- Tested different nonlinear equation solvers like **least square, root music, and annihilation filter**

Autumn '22 **Grouped Multiarm Bandits**

Guide *Prof Sharayu Moharir*

- Performed literature survey on **PAC** algorithms for best arm identification **multiarm bandit**
- Modified the **UCB/LCB** conditions to adapt to the grouped bandits with a minimum constraint
- Analyzed **stopping time complexity** of **D tracking** variant against **Hardness** measure

Spring '22 **Temperature Control using Pulse Width Modulator**

Guide *Prof Kushal Rajanikant Tuckley* | *EE-344 Electronic Design Lab*

- Created a PCB layout using **Eagle** software that was translated into a physical **working prototype**
- analyzed the negative feedback design Enhanced the user interface by creating a dynamic display of temperature sensor i.e **Negative Temperature Coefficient Thermistor** using **Arduino**.

Scholastic Achievements

2023 Secured **Department Rank 7** in the batch of 70 students(Electrical Engineering Dual Degree).

2019 Secured **All India Rank 460** in **IIT JEE-Advanced** out of 245,000 candidates.

2019 Achieved **All India Rank 300** in **JEE Mains** out of 1.14 million candidates.

2018 Secured **All India Rank 132** in Kishor Vaigyanic Protsahan Yojana (KVPY) and awarded fellowship.

2019 Awarded Certificate of Merit for being among the **Statewise top 1%** in the **NSEC**.

Position of Responsibility

Spring '23 **NPTEL Digital Signal Processing and its Applications, IIT Bombay**

Guide *Vikram Gadre* | *IIT Bombay*

- Prepared **solution** for **tutorial** problems and final examination based on **Z-transform, FFT, Filters**
- Addressed **queries** on an **online forum**, providing assistance to a total of **4558 enrolled students**
- Assisted Prof Vikram Gadre in an **online YouTube doubt session**, addressing students' queries

Autumn '23 **Teaching Assistant**

Guide *Sharayu Moharir* | *EE325 Probability and Random Processes*

- Responsible for **proctoring exams** and **grading** answer scripts for $200+$ **Electrical Sophomores**

Technical Skills

Programming C++, Embedded C, Python, Julia, Matlab, VHDL, Assembly Language, MIPS

Libraries Matplotlib, NumPy, Pandas, LaTeX, Tensorflow, OpenCV, Scikit-learn, OpenAI Gym, PyTorch, IsaacGym

Others Git, Docker, skrl, MuJoCo, HTML, CSS, Javascript, Bootstrap, Quartus, AutoCAD, SageMath

Relevant Coursework

Electrical Engineering Communication Systems, EM Waves, Analog Circuits, Digital Systems, Probability and Random Processes, Signal Processing, Electronic Devices & Circuits, Microprocessors, Wavelets

Computer Science Data Structures and Algorithms, Logic for Computer Science, Design and Analysis of Algorithms, Game Theory and Algorithmic Mechanism Design, Advances in Intelligent and Learning Agents

Probability & Statistics Introduction to Stochastic Optimization, A First Course in Optimization, Markov Chains and Queuing Systems, Introduction to Stochastic Control

Extracurricular Activities

- Won **silver medal** twice in **Chess Inter Hostel General Championship** in IIT Bombay.
- **Engineered manually** controlled bot capable of negotiating obstacles in **XLR8 Competition**
- Represented my Hostel in **Table Tennis Inter-Hostel** General Championship in IIT Bombay

Other Projects

Autumn'21 **Automatic test pattern generation and logic minimizer**

- Implemented **PODEM (Path-Oriented Decision Making)** to detect **stuck-at faults** using dfs
- Implemented the **Espresso** heuristic logic minimizer, utilizing **irredundant and reduce** logic operations

Spring'21 **Bank Queue Simulator on 8051 microprocessor**

- Simulated a dynamic bank queue with 4 counters using **embedded C** and **UART communication** on a **Pt-51 microcontroller** board which emulated customer and teller actions based on key presses
- Implemented the key press using **Timer, serial interrupt (RI and TI flag), and LCD commands**

Autumn'22 **Optimal Strategy in Cricket**

- Implemented **Howard's policy iteration, Linear programming** to compute the optimal policy
- Computed the best strategy for the batsman by formulating the last over of cricket as an **MDP**

Spring'22 **Cryptography and Security Applications**

- Compared side-channel attack **Differential Power Analysis** with **Phase-waveform** matching
- Implemented Phase correlation to identify offset in **power trace** after attenuating noise using filters

Spring'22 **Computer Vision-Optical Flow**

- Tested the **Lucas Kanade Optical flow** on edge cases showcasing its strengths and weakness
- Surveyed blogs on Corner detection**(Harris and Shi Tomasi)** and precipitation nowcasting applications