Aryan Agal

Contact Information

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Research Interests

Computer Vision, Adversarial Learning, Generative Adversarial Networks, Robustness of Deep Learning Systems, Model Predictive Control, Scheduling, Optimization, Image Processing

Education

Indian Institute of Technology - Bombay, India
Senior Undergraduate (4th Year) in 5 year program
B.Tech.+MTech. in Energy Science and Engineering (July '16 - Present)
CPI (Overall) **8.25/10.0** after 6 semesters
Completed a minor in the Department of **Computer Science and Engineering**.

On an exchange in the 7th semester of study at the Swiss Federal Institute of Technology, Lausanne (EPFL), Switzerland

Academic Honors

- Awarded **AP**(Advanced Performer) grade for exceptional performance in First Course in Optimization (Fall '18) and Computer Programming and Utilization (Spring '17).
- Secured **All India Rank 1960** in **JEE Advanced 2016** among 150,000 candidates
- Achieved **99.69** percentile in **JEE Main 2016** among 1.5 million candidates

Research Projects

Machine Learning for Raman Spectroscopy (Ongoing) Fall '19
Guided by Prof. Martin Jaggi - Machine Learning and Optimization Laboratory(EPFL)

- Working on G-Peak detection and Tube Type Detection problems in Raman Spectra, collaborating with Transport at Nanoscale Interfaces Laboratory, EMPA Zürich.
- Applying deep convolutional models with dilated architectures to achieve competitive accuracies on the above problems.
- Established baseline accuracies using tuned Logistic Regression and created a sklearn API for a Thresholding Classifier.

Predicting Atomic Properties from a Crystal Structure Descriptor Fall '19
Chair of Computational Condensed Matter Physics (EPFL) - **Report**

- Experimenting with machine learning to predict material properties for binary molecules using a our own rotationally invariant, symmetric descriptor.
- Applied neural networks and LightGBM to predict formation energies and conducting nature. Established baselines with Linear and Logistic Regression.
- Achieved an accuracy of 90.2% for conducting nature and RMSE of 0.83 eV/atom for formation energies, thereby successfully demonstrated our descriptor provides a simple and reliable way to describe binary materials.

Model Predictive Control on a Quadcopter(Ongoing) Fall '19
Course Project - Model Predictive Control (EPFL)

- Experimenting with horizon lengths, optimization objectives and hard/softe constraints to make a recursively feasible model predictive control for a decomposed, linearized quadcopter system.
- Working towards 8 second settling time in a 2 metre radius and 45 degree yaw.

Mixed Integer Linear Programming in Unit Commitment Spring '19
Guided by Prof. Zakir Rather (IIT Bombay) - **Report**

- Studied the unit commitment problem and did a literature survey on the different approaches to solving the unit commitment problem
- Formulated and linearized multiple physical constraints to make them compatible with the MILP solver
- Implemented a GUI program outputting unit schedule (using MILP) for input of unit data (with constraints) and the forecasted energy demand.

Digital Photography with Flash and No-Flash Image Pairs Fall '18
Prof. Amit Sethi (IIT Bombay) - Course project - **Report**

- Implemented "Digital Photography with Flash and No-Flash Image Pairs" (Petschnigg et al.) for detail transfer, white balance, continuous flash adjustment, etc.
- Coded from-scratch bilateral filtering and two of it's practical applications- in digital flash photography and in cartoonification of images.

Work Experience

Standard Chartered Summer '19
Risk Internship - Collections Strategy Team

Personal Loans(X)

- Monitored performance of the **Collections & Recoveries Framework (CRF)** of Personal Loans (X) accounts, working with multiple teams in 3 different cities.
- Fixed implementation issues in the CRF by shifting the focus of calling and SMS intensity towards the intention of the CRF, improving the targeted value by 20%.
- Reduced 600+ redundant calls being made by officers, saving time and money.

Personal Loans(Pre-X)

- Formulated a CRF for Pre-X accounts based on previous 3 months performance data to streamline the efforts of collections team and to mitigate delinquency inflow.
- Operationalized the CRF over 5 departments of bank to target **8000** risky accounts thus aiming to stop a value of **INR 20 million** from flowing into delinquency.
- Documented the official process flow and presented the document along with our analytical insights to the Head of Risk, Standard Chartered India.

Personal Loans(MARSHALL)

- Designed the **Allocation Strategy & Treatment Plan** for 60 days past due (DPD) accounts.

Policy

- Created a **dashboard** to summarize credit cards sourcing performance based on last 4 years data

Key Courses

- **Computer Science** Machine Learning, Computer Programming and Utilization, Computer Networks, Convex Optimization, Data Structures and Algorithms
- **Mathematics & EE** Model Predictive Control, Optimal Control, First Course in Optimization, Image Processing, Controls and Instrumentation, Numerical Analysis, Probabilistic Models, Matrix Computations
- **Energy Science** Power Generation and System Planning, Mechanics of Materials, Material Sciences for Energy Applications, Transport Phenomena etc.
- **Others** Data Analysis and Interpretations, Economics, Engineering Drawing

Development Projects

Image Processing Assignments Fall '18
Prof. Amit Sethi (IIT Bombay) - Course Assignment - Image Processing **Report**

- Built an image editor with intensity channel transforms for histogram equalization, gamma transform, log transform, Blur, Sharpening, Negation etc. each from scratch while using vectorization to improve performance.
- Built an image restoration program. Undertook a literature survey on image restoration techniques and implemented direct inverse filtering, truncated inverse filtering, Weiner filter de-blurring and Gamma filter de-blurring.

Finite Difference Numerical Solution of Navier-Stokes Equations Spring '18
Prof. Manaswita Bose (IIT Bombay) - Course Project - Transport Phenomena **Report**

- Solved the Navier-Stokes equation for an incompressible fluid, using discretized domain approximations.
- Derived and defined vorticity and stream function equations; applied finite difference approximations.
- Wrote MATLAB code for iterative solution of the Elliptic equation obtained by applying discrete boundary conditions to a 2-Dimensional, lid-driven, square cavity flow.

Enigma - MoodIndigo Express December '17
Team Creatives
Mood Indigo, IIT Bombay

- Developed an online cryptic clue hunt game, on the **MEAN stack**, with **Monk**, **Jade** and **Sass**.
- Worked on **NodeJS** backend, providing secure **REST APIs** with **CRUD** functions on a **MongoDB** database.

Electronics and Robotics Club Website May '17 - June '17
Institute Technical Council
IIT Bombay

- **Developed** a website for club activities and including technical blog posts, tutorials, and event reflections.
- Implemented the website with Jekyll, to make website easier to contribute to, with posts in **Markdown**.
- Setup **auto-deployment** on **TravisCI**, a Continuous Integration provider available in the GitHub marketplace.

Smart Mirror May '17 - June '17
Institute Technical Summer Project

- Fabricated a setup for interactive display of day-to-day information on a mirror using a **Raspberry Pi** and an LCD screen. Video and Report.
- Localized and implemented the MagicMirror framework based on **Electron** which is a JavaScript framework, on the RaspberryPi and customized the CSS styling of displayed elements.
- Presented the project as part of the annual **Tech and RnD Expo** of IIT-B

Main and Beta Websites May '17 - August '17
Team Creatives
Mood Indigo '17, IIT Bombay

- Contributed in development of Main and Beta Websites of Mood Indigo '17 based on **AngularJS** Framework. Uses **Sass** scripting for styling and **BrowserSync** integration for ease of development.

- Implemented a music player using **angular-soundmanager2** and scroll-based animations using **Skrollr.js**
- Made the beta website cross-compatible through addition of responsive elements to it.

Other Experience

- **Instruction:** Instructor at multiple sessions of Institute Technical Council, IIT Bombay, including Git, GitHub, Arduino, RPi. Instructor for the Python summer course, under UGAC, IITB.
- **MOOCs:** Certified, with a **100%** grade in courses of Neural Networks and Deep Learning, Improving Deep Neural Networks, Structuring Machine Learning Projects and Convolutional Neural Networks, as part of the deeplearning.ai specialization by Andrew Ng on Coursera.
- **Electronics:** Created an ESP8266 speaker attachment to wirelessly transmit music to a speaker; wrote a python server to sample and stream any audio file. Developed an autonomous Arduino bot functioning as a Line Follower, Wall Follower, Maze Path Finder and a wrestler. Actively participated in Electronics Club sessions and made Xylobands and Audio Amplification circuits.
- **Competitive Coding:** Applied basic algorithms to solve questions on multiple websites like SPOJ, Codechef, HackerEarth and HackerRank. Currently holds SPOJ rank #**8074** worldwide as of 26th March 2018.
- **Wrestle.AI:** Developed an **Arduino based bot** acting as a Line Follower, Wall Follower, Maze Path Finder and a wrestler; interfaced the Arduino with an **ultrasound** sensor and self-made **infrared** sensors
- **Client Server Chat Application** *Course Project, Prof. Mythili Vutukuru*
  Created a **multi-client server program** using concepts of **Socket Programming** in C++ with **epoll**
- **Hackathons:** Part of one in top 3 teams of **Microsoft code.fun.do** AI for social Good Online Challenge
- **Journalism:** Co-guide to a team of Panelists as Article Lead on "Department Sneak Peek", Insight Freshman Newsletter(FN), 2018, directing article content and structure. Panelist on the "Sophomore PoRs"article, FN 2017; interviewed multiple PoR holders regarding their work and provided content.
- **Community Work:** Co-organized a diabetes detection camp as part of CURED (Can U Really Escape Diabetes) at the Siddhivinayak Temple premises, Mumbai (a Tech-Fest 2016 initiative).
- **NSS:** Completed a year long course in the National Social Service, while promoting sustainability, organizing cleanliness drives and spreading awareness on going cashless for the ill-informed.

Technical Skills

Programming	C++, C, Java, Python, LaTeX, Bash
Web Development	HTML, CSS, Bootstrap, JavaScript, jQuery, Jekyll, Django, MEAN Stack
Tools/Software	Keras, Android Studio, Git, gnuplot, MATLAB, GNU Octave, AutoCAD, Arduino, Raspberry Pi

Positions of Responsibility

Convener, Electronics and Robotics Club April '17 - May '18
IIT Bombay

- Working with a 10 member team, to boost the institute's Electronics & Robotics culture through hackathons, bootcamps, lectures, competitions and group discussions like the upcoming series "How Things Work"

- Organized and mentored in XLR8, participated in by 500 freshmen and mentored 50+ bots in the competition.
- Managed and spoke at a four day spread boot camp on Arduino, Image Processing, PID theory, Basic Electronics, Motors and Raspberry Pi attended by 400 enthusiasts across the institute

Coordinator, Mood Indigo '17 April '17 - May '18
Team Creatives, IIT Bombay

- Web Coordinator for Asia's Largest College Cultural Festival with a footfall of **1.5 lakhs**, hosting **230**+ events
- Developing websites, apps, portals for Mood Indigo '17 that receive over **6.5 million** hits yearly
- Managing a team of over **50 organizers** to conduct and execute events in Mood Indigo '17

Mentorship Experience

Volunteer, Web and Coding Club April '17 - May '18
IIT Bombay

- Conducting events like hackathons, workshops, reflections, etc. of one of the largest programming clubs in India.
- Assisted in organizing several events, bootcamps and talks including ones on Git, Python and GitHub.
- Monitored 'Seasons of Code' projects in Summer of '17 & cofounded the GSoC Incubation Cell of IIT Bombay

Technical Mentor
from IIT Bombay, for new IIT's

- Mentored students of IIT Goa in their summer-long project, on making a robotic arm.
- Guided students of IIT Dharwad in microcontroller programming, and taught them the basics of Arduino in a hands-on session.