P Balasubramanian
Computer Science & Engineering
Indian Institute of Technology Bombay

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B.Tech.
Gender: Male
DOB: 2/22/2002

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2024	8.04
Intermediate	CBSE	P.S.B.B.S.S School KK Nagar	2020	98.20%
Matriculation	CBSE	P.S.B.B.S.S School KK Nagar	2018	98.80%

Pursuing **Honours** in **Computer Science** and a **Minor** in **ML and Data Science** from CMInDS

Scholastic Achievements

- Secured **All India Rank 308** in Joint Entrance Examination Advanced among **1.5 Lakh** candidates *['20]*
- Present in the **top 0.5%** in Joint Entrance Examination Mains among **0.85 million** candidates *['20]*
- Two time Recipient of the Kishore Vaigyanik Protsahan Yojana **KVPY Fellowship** (Both SA & SX Stream) *['20]*
- Scored **412/450** Marks in **BITSAT** (Birla Institute of Technology and Science Admission Test) *['20]*
- Scored among the **top 1%** and was qualified for the **Indian National Chemistry Olympiad(INChO)** *['20]*
- Awarded National Talent Search Examination **NTSE** Scholarship by the Government of India *['18]*

Key technical projects

International Aerial Robotics Competition *[Oct'21- Present]*

UMIC, IIT Bombay | Association for Unmanned Vehicle Systems International Foundation (AUVSI)

- Developing a system of Autonomous Quadcopters for the **Longest Running** Aerial Robotics Competition
- Working as a **Sr. Machine Learning Engineer** in Project AeRoVe, an **interdisciplinary** team of **25+** students
- Employed a pipeline for a custom-dataset of more than **3K+** images collected by the drone to speed-up annotation
- Achieved accuracy(**mAP**) of **95.6%** on **YOLOv4** & **85.6%** on **YOLOv4-tiny** models for custom object detection
- Surveyed literature on object detection and tracking, including **R-CNN**, **Fast R-CNNs**, **YOLOv3**, **YOLOv4**, **SORT** and **DeepSORT** to enhance localisation accuracy and ensure smooth autonomous flight of the drone
- Ideated direction vector estimation on 3D Point Cloud data using **RANSAC** Segmentation & Clustering with **PCL**
- Reduced inference time by **300%** by optimizing detection models by building serialized **TRTengines** in C++ using the Nvidia TensorRT library while deploying custom-YOLOv4 models on **Nvidia Jetson Xavier NX**

Deep Reinforcement Learning for Stock Trading *[Apr'21 - Jul'21]*

Seasons of Code-'21 | Web and Coding Club (WnCC)

- Trained an intelligent agent to actually trade in the markets, by using various reinforcement learning methods
- Investigated the concepts involved in **Tabular Methods** like Markov Decision Processes, Monte Carlo Methods, Dynamic Programming, Temporal-Difference learning for solving **Reinforcement Learning problems**
- Scrutinized research papers and implemented **PPO** (Proximal Policy Gradient), an Actor-Critic RL algorithm
- Explored classic control problems such as **Cartpole & Acrobat-v1** environments in the **OpenAI-Gym** library
- Examined and backtested **quant trading** strategies like mean-reversion, pair-trading on **Quantconnect** platform
- Learnt and tried **Technical** and **Fundamental** analysis techniques and methodologies from Zerodha Varsity

Arcface: Deep Face Recognition Model *[Aug'21 - Present]*

GNR638 Course Project | Guide: Prof.Biplab Banarjee

- Surveyed literature on **face recognition** including **DeepFace, FaceNet, SphereFace ,CosFace** and the State-of-the-Art Arcface paper to learn discriminative feature vectors and implement **few-shot** face recognition
- Implemented **Arcface Layer** from scratch and used transfer learning with **ResNet50** architecture as backbone feature extractor in **TensorFlow** to get highly discriminative features and acheived a verification acc. of **93.2%**
- Trained the Arcface model on the **LFW** (Labeled Faces in the Wild) dataset of **350+** people with **1.4K+** images
- Designed experiment and analysed results to compare Adam & SGD and determine the best **optimizer** for training
- Estimated the **distance threshold** and evaluated various distance metrics for optimal model performance
- Deployed the model using python based **Flask** micro web framework with a frontend UI designed with HTML and CSS to upload images and view results. Ajax and **JavaScript** was used for frontend-backend communication

DRDO'S UAV-Guided UGV Navigation Challenge *[Mar'22 - Apr'22]*

Project AeRoVe | Inter-IIT Tech Meet 10.0

- Won **3rd** place in DRDO's navigation challenge among **12** IITs at the **InterIIT Tech Meet** representing IITB
- Developed a combination of an Unmanned Ground Vehicle (UGV) and a guiding Unmanned Aerial Vehicle (**UAV**) autonomously capable of mapping and navigating snow covered mountainous terrain solely using **drone feedback**
- Experimented with various **keypoint detection** algorithms on images to find the pose and heading of the UGV
- Combined CV techniques such as **Canny Edge Detection**, **Sobel Filters**, **Blurring**, **Adaptive Thresholding** and **Countour Detection** with ML algorithms to get **99%+** precision in the location and direction of UGV
- Implemented a DNN for **Terrain Semantic Segmentation** to derive waypoints for control and navigation

ASME STUDENT DESIGN CHALLENGE 2021 *[Jan '21 - Apr'21]*

UMIC, IIT Bombay | American Society of Mechanical Engineers (ASME)

- International Student Design Challenge focusing on efficient energy capture, storage and use in robotics
- Secured **4th position WORLDWIDE** in the **World Finals** stage of the competition amongst **30+** teams
- Worked in the **Mechanical** subsystem to build a bot to carry a **5 kg** payload powered by a single AAA battery
- Designed the robot and made a 3D **CAD** model in **Fusion360** and analyzed the mechanical feasibility of the design
- Engineered circuit to charge super-capacitor and battery using a solar panel and wind turbine under **60** seconds

Other projects

Car Price Prediction Model *[Jun'21]*

Self Project

- Trained a **Random Forest Regressor** with test set **RMSE of 1.31** to predict resale value of cars using **sk-learn**
- Deployed model using **Flask & Jsonify** libraries and created front-end interface using **HTML** to get input data

Image Handling and Processing *[Sep'21 - Nov'21]*

CS215 Course Project | Guide: Prof. Suyash Awate

- Scripted Python code to plot the closest representations of RGB images of fruit using **PCA** and generate new images which are representative of the dataset, by randomly sampling these representations
- Performed **Multivariate Gaussian** fitting to the MNIST dataset, to identify the modes of variation (PCA)

Hactoberfest 2021 *[Oct'21]*

Self Project

- Hacktoberfest is a monthlong celebration of **open source** software by DigitalOcean, Intel and Deepwrite
- Contributed **5 PRs** which were inspected and merged to 4 different repositories maintained by WNCC IIT Bombay

ASR Role Playing Seminar *[Jan'22-Apr'22]*

CS753 Course Project | Guide: Prof.Preethi Jyothi

- Presented a **seminar talk** on a paper on Audio-Visual Video Parsing discussing the task, method and experiments
- Implemented End-to-End Neural Speaker **Diarization** which partitions audio input according to speaker identity
- **Reviewed** a paper titled Learning Audio-Visual Dereverberation and analysed the pros & cons of the model
- Prepared a poster for the **BERT-ASR** paper highlighting the main ideas of the paper visually with minimal text
- Compiled a scientific report on the paper titled **Mask-CTC** explaining the architecture & training method used
- Used Kaldi ASR and Coqui deep-learning toolkits to train and make **ASR** and **STT** systems in regional languages

Leadership Roles

Manager, Project AeRoVe | UMIC IIT Bombay *[May'22 - Present]*

UMIC is a student technical team that promotes and adheres to the idea of innovation and techno-preneurship

- Managing a team of 22, responsible for gaining sponsorships and establishing a strong social media presence
- **Moderating** and **channeling** information between the Core team members and the Non-Core team members
- Managing a budget of **₹1.5+ million** and responsible for procuring required equipment for the technical team
- Conducted a 3-phase recruitment drive for the biz-team and shortlisted **5** candidates out of **70+** total applicants
- **Mentoring** and training **2** freshman students in the Machine Learning & Computer Vision subsystem of AeRoVe

Coordinator, Project AeRoVe | UMIC IIT Bombay *[Jan'21 - May'22]*

Team of 25+ students working on autonomous ground & aerial vehicles competing internationally

- Member of the team in charge of planning, organizing and publicizing events under the Innovation Cell
- Spearheaded **2** technical recruitment drives to induct members from a pool of **200+ UG** applicants for core team
- Mentored a team of **5** freshmen recruits in the **S.T.A.R** Program to ideate and solve complex-robotics projects

Technical Skills

Programming Languages	Python, C, C++, Java, Bash, URDF, Xacro
ML & Data Science	TensorFlow, PyTorch, TensorRT, OpenCV, Numpy, Pandas, Scipy, scikit-learn
Frameworks	Git, LaTeX, Arduino, ROS, Gazebo, Kaldi ASR, Coqui STT, Fusion360
Web Development	HTML, CSS, Bootstrap, Javascript, Django, Flask

Key courses undertaken

Computer Science	Data Structures and Algorithms, Software Systems Lab, Discrete Structures, Computer Networks, Design and Analysis of Algorithms, Operating Systems*, Compilers**
ML/DL & Statistics	ML for Remote Sensing II, Automatic Speech Recognition, Foundations of Intelligent & Learning Agents*, Artificial Intelligence*, Data Analysis and Interpretation, Machine Learning Specialization$^{\$}$, Deep Learning Specialization$^{\$}$, Fundamentals of Reinforcement Learning$^{\$}$

** To be completed by Dec '22* *** To be completed by Apr '23* *$^{\$}$ Online Courses*

Extra-Curricular Activities

- **Mentored** two teams of young scientific minds in the **TrailBlazHER Innovation Challenge** 2021
- Trained for 9 years in Alan-Thilak Shito Ryu **Karate** and **Silambattam** and received a **Black-belt**
- Placed **2nd** in galaxy **Science Quiz** twice and won the Mind Storm Quiz at IIT Mardras' **Forays** Mathfest
- Completed a 10 level **Robotics** course and graduated with distinction in Programming from Kidobotikz
- Attended a **6** week long summer program on Game Theory in **Duke Univ's TIP** at Shiv Nadar University Noida