Parth Pundalik Pai | **22B3305**
Mechanical Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 07/11/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	8.88
Intermediate	DPUE	The Learning Centre PU College, Mangalore	2022	95.33%
Matriculation	KSEEB	Vidya Bharati School, Bhatkal	2020	98.72%

Pursuing a **Minor** degree in **Data Science** and **Artificial Intelligence** from C-MInDS, IIT Bombay

Scholastic Achievements

- Received an **AP** grade in the MS101 course, achieved by only **7 individuals** out of **600+** students *(2023)*
- Granted a **Change of Branch** awarded to **31/1300+** students for excellent academic performance *(2023)*
- Ranked in the **Top 0.35 percentile** out of **0.94Mn+** candidates in **JEE Mains** examination *(2022)*
- Among the **Top 2.13 percentile** out of **0.16Mn+** candidates in **JEE Advanced** Examination *(2022)*
- Secured a place in the **Top 5 percentile** out of **50k+** candidates in **KVPY SX** examination *(2022)*
- Obtained Karnataka **State Rank 46** among **216k+** candidates appeared for **KCET** examination *(2022)*

Key Technical Projects

Guidance Navigation and Controls System | *Student Satellite Program* *(May'23 - Nov'23)*
Part of a 40+ member team with the vision of making IIT Bombay a centre of excellence in space technology
Attitude Determination and Controls Subsystem

- Designed and executed the **Model Predictive Control (MPC)** algorithm in MATLAB by using the **Prediction horizon, Control horizon** and Tuned the MPC parameters to minimize the cost function
- Implemented the algorithm using **Receeding horizon** technique yeilding the new Predicted state
- Developed **LU decomposition** algorithm with Partial Pivoting, **QR decomposition** using Householder reflections, the **Gram-Schmidt Process**, and **Cholesky decomposition** for matrices in MATLAB
- Applied **Singular Value Decomposition** and **Rank Approximation** Algorithm for large matrices

ML Based Movie-Recommendation System | *Course Project* *(Oct'23 - Nov'23)*
Course: Staistical Machine Learning and Data Mining | Guide: Prof. Asim Tewari *IIT Bombay*

- Preprocessed a dataset of **44k+** movies and created embeddings using transformer's **AutoTokenizer**
- Used **bert-based-uncased** model from Huggingface to convert the descriptions into text embeddings
- Implemented **Cosine Similarity** measure to compare the prompt embeddings with existing embeddings
- Created an interactive app environment using **gradio** to output the **top 5** best recommended movies

ML based Analysis of external flow around Air-Foil | *Course Project* *(Feb'24 - May'24)*
Course: Applied Data Science and Machine Learning | Guide: Prof. Alankar Alankar *IIT Bombay*

- Implemented the **Computer Vision** approach to generate **Streamline plot** using **1Mn+** datapoints
- Established the **Streamline Density** to predict the Pressure Coefficient using Neural Networks method
- Implemented **Random Forest** model to optimise Camber value & angle of attack with R^2 value of **0.95**

Breakout Genius - AI game master using RL | *Season of Code 2023* *(May'23 - July'23)*
Built a Reinforcement Learning game master to play Atari games *WnCC, IIT Bombay*

- Created **Atari Breakout Game** environment using **OpenAI's gym** for agent-environment interaction
- Incorporated **epsilon-greedy strategy** in the model for effective exploration-exploitation tradeoff
- Implemented **Frame Stacking** to handle temporal dependencies and simplify the state-space complexity
- Tested a pre-trained PyTorch model of **9Mn** steps obtaining a reward of **9.0** in the generated video file

Language Translation model using NLP | *Learner's Space 2023* *(June'23 - July'23)*
English to Italian Translation model using Natural Language Processing *UGAC, IIT Bombay*

- Split the dataset using **sklearn's** train_test_split and created embeddings using **AutoTokenizer** function
- Implemented the **Helinski-NLP** model for translation, used **sacrebleu** score for evaluating the model
- Fine-tuned the model by training it for **19k** steps and brought down the training loss from **1.29** to **1.04**
- Created an interactive app environment using **gradio** to test the new **fine-tuned** model for transaltion

Other Projects

RL based stock trading strategy optimization | *Finsearch 2024* *(June'24 - Present)*
Reinforcement Learning based stock price prediction *Finance Club, IIT Bombay*

- Conducted a detailed study of RL algorithms such as **Q Learning** and **Policy Gradient Methods**
- Successfully applied the **DQN** algorithm in the Inverted Pendulum setting and achieved the set goal
- Orchestrated a custom environment and a **reward function** designed specially for stock market scenario
- Using the **DDPG** algorithm to implement an RL agent for making **trading decisions and strategies**

Music Generation using RNNs and LSTMs | *Season of Code 2024* *(May'24 - Present)*
Melody generation using LSTM networks given a seed *WnCC, IIT Bombay*

- Preprocessed the **Deutsch folk songs** from **ESAC** dataset and encoded into **time-series** representation
- Trained an **LSTM** Neural network using **tensorflow** and decoded the generated melodies into MIDI notes
- Implemented the model architecture on **larger dataset** and **larger mapping** file for more variation

Custom GPT using Shakespeare text | *Self Project* *(May'24)*

- Implemented and fine-tuned a custom **Generative pre-trained transformer** model for text generation
- Integrated **Self-attention** mechanism along with **residual connections** for efficiency and faster training
- Designed training routines with **dropout** regularization optimizing the hyperparameters for **3000** iterations
- Successfully trained a model with **10.78 Mn+** parameters and reduced validation loss from **4.23 to 1.48**

Transfer Learning & Object Detection using ResNet50 | *Self Project* *(Jul'24)*

- Performed object detection on the **CIFAR-10 dataset** which consists of **60,000** color images in **10** different classes, with 6,000 images per class using **Tensorflow** and **Keras** libraries in Python
- Achieved a test accuracy of **91.06%** and an F1 Score of **0.9109** by implementing the **ResNet50** architecture using TensorFlow on the dataset, with the model accurately predicting from a total of **10 classes**

Technical Skills

Programming	Python | C++ | Arduino | MATLAB
Softwares	GitHub | Fusion 360 | Linux | LaTeX
Packages	PyTorch | Transformers | Scikit-learn | Numpy | Pandas | Matplotlib | Keras

Key Courses Undertaken

Math Courses	Linear Algebra | Differential Equations | Differential Calculus | Integral Calculus
CS Courses	Computer Programming and Utilization | Randomized Algorithms* | LaTeX†
ML Courses	Programming in Data Science | Statistical Machine Learning and Data Mining Introduction to Machine Learning | Applied Data Science and Machine Learning
Other Courses	Estimation on Lie Groups | Economics | Introduction to Makerspace

**currently in Summer of Science 2024, † completed in Learner's Space 2024*

PORs and Mentorship

Class Representative | *First year B.S. Mathematics* *(Nov'22 - June'23)*

- Addressed the issues of batchmates, catering to their academic needs and creating a positive and **conducive atmosphere** resulting in notable **academic growth** and success within the student community
- Served as a member of the **Mathematics Association Council**, IIT Bombay by actively involving in organizing and planning the traditional day, department trip with utmost dedication and sincerity

Mentor | *Season of Code 2024, Web and Coding Club* *(May' 23 - Present)*

- Mentored a group of **10+** students in the topic of **Future forecasting using Time series analysis**
- Guided the mentees in clearing their conceptual doubts and compiling good resources for their learning

Extracurricular Activities

- Won **Gold Medal** in Stageplay at 6th **Inter-IIT Culturals Meet** held at **IIT Kharagpur** *('23-24)*
- Among the **top 20%** teams in Internation Quant Challenge hosted by **WorldQuant BRAIN** *('24)*
- Mentored a group of **5** students in **Summer of Science 2024** conducted by MnP club, IIT Bombay('24)
- Completed the **Junior Degree** in Hindustani Classical **Vocals** issued by **KSEEB**, Karnataka *('13-15)*
- Professionally trained in Indian Classical **Flute** after a year-long training under NSO-Culturals *('22-23)*
- Participated in the **Versova Beach Cleaning** programme hosted by **Abhyuday, IIT Bombay** *('24)*
- Bagged the **Best Outgoing Student** award in Class 10th owning to overall allround excellence *('19-20)*