Parth Pundalik Pai

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Education

Indian Institute of Technology Bombay, Mumbai, India CGPA: 8.78/10.0
Bachelors in Mechanical Engineering with Minor in Data Science and Machine Learning Nov'22 - May'26 (expected)

The Learning Centre PU College, Mangalore, India CGPA: 9.53/10.0
Higher Secondary Education in Physics, Chemistry and Mathematics July'20 - Aug'22

Scholastic Achievements

- Received an **AP** grade in the MS101 course, achieved by only **7 individuals** out of **600+** students. *(2023)*
- Achieved a **Change of Branch** to the department of **Mechanical Engineering** (B.Tech) among **31** out of **1300+** students owing to excellent academic performance *(2023)*
- Secured **Karnataka State Rank 46** among **216k+** candidates who appeared for **KCET** examination *(2022)*
- Procured **99.65** Percentile in **Joint Entrance Examination Mains** among **0.94M+** candidates all across India *(2022)*
- Among **Top 2.13** percentile out of **0.16M+** candidates in **Joint Entrance Examination Advanced** *(2022)*
- Qualified for the **State level** Mathematics and Science Talent Search examination organized by **Karnataka Rajya Vijnana Parishat (KVRP)** *(2019)*

Key Technical Projects

Mapping and Obstacle Avoidance of Underwater Vehicle *(Jan'24 - Present)*
Guide: Prof. Leena Vacchani, Department of Systems and Control Engineering *IIT Bombay*

- Mounted the **Front-Looking Sonar** in the vehicle to give map of the surroundings using **Octomaps**
- Devising many obstacle-avoidance algorithms like **3D VFH+** and **Tangent Bug** to the vehicle

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** package, NumPy and Pytorch
- Built a **DQNAgent** class having Convolutional Neural Networks to return relevant **q-values** and **sample-actions**
- Recorded **mean rewards** and **Temporal Difference(TD) losses** while training the model using Adam Optimiser
- Tested a pre-trained PyTorch model for **9M** steps and rendered the animation to output the gameplay as a 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*

- Built Language Translation model from English to Italian using **transformers, pipelines, and tokenizers**
- Preprocessed and tokenized data, splitting into 80-20 training and testing sets using **AutoTokenizer** and fine-tuned it
- Evaluated the accuracy of the model using **sacrebleu** score to check word matchings and hence give appropriate score
- Created an interactive app environment using **gradio** and tested the pre-trained model saved in Google drive

Machine Learning Based Movie-Recommendation System | ME781 Course Project *(Nov'23)*
Guide: Prof. Asim Tewari, Department of Mechanical Engineering *IIT Bombay*

- Preprocessed data and created embeddings using **AutoTokenizer** and saved it using **HuggingFace** repo
- Used **bert-based-uncased** model from Huggingface to convert the given prompt into embeddings
- Used **Cosine Similarity** to compare existing embeddings with the prompt embeddings to give top 5 recommendations.
- Created an interactive app environment using **gradio** and tested the model to give movie recommendations

Mountain Cargo Challenge | MS101 Makerspace Course Project *(May'23 - June'23)*
Guide: Prof. Ankit Jain and Prof. Dinesh. K. Sharma *IIT Bombay*

- Developed an autonomous Line-follower robot that can climb inclines up to **30 degrees** with a payload of **300 grams**
- Incorporated **3 IR sensors** into an Arduino UNO microprocessor, enabling it to **detect and track line**
- Crafted an operationally efficient design with a low COM by carefully selecting the position of the payload container
- Appreciated as one of the best MS101 bots among a batch of **600+** students and awarded certificates

Other Projects

ML based Analysis of external flow around Air-Foil | ME228 Course Project *(Feb'24 - Present)*

Guide: Prof. Alankar Alankar, Department of Mechanical Engineering *IIT Bombay*

- Implementing **Neural-Network** based approach to establish relation between **Pressure coefficient** and **Flow Velocity**
- Using **Computer Vision** approach to estimate pressure coefficient using the **Streamline Plots**
- Optimising value of camber, angle of attack and thickness of foil to achieve **Minimum Drag** and **Maximum lift**

Computational Linear Algebra | IITB Student Satellite Program *(Apr'23)*

A 50+ member student team with the vision of excelling in space technology *IIT Bombay*

- Explored the math behind various matrix decompositions like **LU,QR,Cholesky** and **SV** decompositions
- Implemented algorithms for **LU decomposition** with Partial Pivoting, **QR decomposition** using Householder reflections, the Gram-Schmidt Process, and **Cholesky decomposition** in **MATLAB**
- Developed a code to compute **Rank Approximation** and eigenvalues of a matrix using **Power Method**

Differential Geometry | MA113 Course Project *(Jan'23)*

Guide: Prof. Sudhir Ghorpade, Department of Mathematics *IIT Bombay*

- Taught the topics related to curves in higher dimensions like **curvature**, **torsion** intuitively using **vector calculus**
- Used **Serret-Frenet equations** to prove the **Fundamental Theorem of Space-Curves** and applied them on basic examples like circle and helix

Relevant Courses Undertaken

Mathematics and Computing:	Linear Algebra, Differential Equations, Differential Calculus, Integral Calculus Computer Programming and Utilization, Estimation on Lie Groups*
AI and DS:	Statistical Machine Learning and Data Mining, Programming in Data Science, Introduction to Machine Learning*,Applied Artificial Intelligence and Data Science*
Mechanical Engineering:	Fluid Mechanics*, Kinematics and Dynamics of Machines* Solid Mechanics and Strength of Materials, Thermodynamics Makerspace, Manufacturing Processes 1*, Structural Materials Fluid Mechanics Lab*,Manufacturing Practice Lab* Solid Mechanics Lab
Other Courses:	Introduction to Classical Physics, Introduction to Quantum Physics, Chemistry, Biology, Design Thinking and Innovation*, Introduction to Management

(* - to be completed by May 2024)

Key Technical Skills

Programming Languages	C++ | Python | LaTeX
Python Libraries	PyTorch | Pandas | Matplotlib | Numpy | SciPy | Transformers | OpenAI's gym
Software	Autodesk Fusion 360 | MATLAB | ROS | Gazebo

Positions of Responsibility

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

- Handled classroom administration and mediated with professors for the smooth running of courses
- Organised Fresher's Party, Traditional Day, and Department Trip conducted by **Mathematics Association**
- Streamlined the doubts by making relevant **discussion groups** on online platforms.

Extracurricular Activities

- Won **Gold Medal** in 75 Minutes Stageplay at 6th **Inter-IIT Culturals Meet** held at **IIT Kharagpur, India** *('23-24)*
- Performed in **Dharohar**, Flagship event conducted by **Roots**, the Classical and Folk Arts club of IIT Bombay *('23-24)*
- Completed the **Junior Degree** in Hindustani Classical **Vocals** issued by **KSEEB**, Karnataka *('13-15)*
- Professionally trained to play Hindustani Classical **Flute** after a year-long training under NSO-Culturals *('22-23)*
- Bagged the **Best Outgoing Student** award in Class 10th owning to overall excellence *('19-20)*