RUPESH RAJ | 19EE38025

ELECT.ENGG. SIGNAL PROCESSING AND MACHINE LEARNING(M.Tech Dual 5Y)
MINOR in COMPUTER SCIENCE & ENGG. (B.Tech 4Y)
MICRO SPL. in ARTIFICIAL INTELLIGENCE AND APPLICATIONS

EDUCATION

Year	Degree/Exam	Institute	CGPA/Marks
2024	M.TECH Dual Degree 5Y	IIT Kharagpur	9.00 / 10
2019	CBSE	Sarala Birla Public School,Ranchi	92.6%
2017	CBSE	Sarala Birla Public School,Ranchi	10 / 10

INTERNSHIPS

Predicting Neurological Recovery from Coma|IIT Kharagpur — May'23-Jul'23

Supervisor:Prof Nirmalya Ghosh,IIT Kharagpur

- Analyzed the EEG and ECG signals of over **1000** adult patients with almost **50000** hours of data post **ROSC** after suffering cardiac arrest
- Studied and extracted several relevant clinical features from **time,frequency** and **spatial** domains for improving the prognostic accuracy
- Identified biomarkers in the time-synchronized ECG and EOG channels for filtering out the bad epochs in the respective EEG channels
- Selected top features using **Recursive Feature Elimination** and **Mutual Information Score** and trained a **Random Forest** and **XGBoost** classifier to classify the patients into poor and good outcome
- Predicted the outcome at time instants of 12,24,48 and 72 hours after ROSC and achieved maximum accuracy of **89%** at 72h.

NLP Research Intern|ISB Hyderabad — May'21-Jul'21

Supervisor:Prof Deepak jena,ISB Hyderabad

- Performed analysis and comparison on **20K+** patents filed by companies in India to understand and promote the adoption of green tech
- Achieved an accuracy of **92.1%** by designing transformer-based(**Bert, Ernie**) classifiers to identify the green patents on **IPO** dataset
- Implemented fine tuning of classification model on **6.5 Million** patents of **PATSTAT** database to train into green vs. non-green tech
- Discovered 50+ key metrics driving companies to invest in green tech and validated the results with **USPTO** and **PATSTAT** patent data.

PROJECTS

Automated Detection of Epileptic Seizures in EEG signals — Mar'23-Apr'23

Supervisor:Prof Sudipta Mukhopadhyay,IIT Kharagpur

- Worked on two publicly available EEG dataset one by **University of Bonn,Germany(UBonn)** and other by **Childrens Hospital Boston-MIT**
- Applied **Discrete Wavelet Transform** to the signals and decomposed them into different frequency bands for **Multi- Resolution Analysis(MRA)**
- Evaluated the impact of varying wavelet families and decomposition levels on model performance, optimizing the selection for analysis
- Obtained the relevant features and suitable **mother wavelet** for both datasets for classification into **pre-ictal**,**ictal** and **post-ictal** states
- Trained a **SVM** model and hypertuned its parameters using **GridSearchCV** and achieved a maximum accuracy of **98.75%** and **93.38%** on Bonn and MIT dataset respectively.

Unsupervised EEG Artifact Detection and Correction — Aug'23-Present

Masters-Thesis Project / Supervisor:Prof Nirmalya Ghosh,IIT Kharagpur

- Working on the subset of the **TUEG** dataset **TUAR** having annotations of different EEG artifacts with data of over 300 subjects
- Reviewed the different artifact patterns and their origins and extracted a wide range of quantitative features for automated detection
- Implemented various outlier detection algorithms icluding **HBOS**,**LOF** and **ABOD** for identifying the potentially malignant epochs
- Preprocessed the **I-CARE** dataset with the above trained model to improve the prediction of **Cerebral Performance Category(CPC)** score
- Proposed an **encoder-decoder** structure to eliminate isolated artifact segments and filled gaps by interpolating neighboring data samples.

YOLO Object Detection|Self Project — Jan'23

- Implemented You Only Look Once**(YOLO)** algorithm for the task of object detection for self-driving cars on the **drive.ai** dataset
- Processed the images through a **CNN** architecture to generate encodings containing information pertaining to anchor boxes
- Perfromed non-max suppression using **Intersection Over Unoin(IoU)** thresholding to eliminate redundant bounding boxes.

SKILLS AND EXPERTISE

Programming Languages/Databses: C|C++|Python|PostgreSQL
Libraries/Frameworks: Numpy|Pandas|Matplotlib|Scikit-Learn|SciPy|TensorFlow|Keras|MNE|PyOD|NeuroKit2
Softwares: Jupyter Notebook|Google Colab|MATLAB|LT Spice|MS Office|Sublime|EEG Lab

COURSEWORK INFORMATION

IIT Kharagpur: Machine Learning for Signal Processing|Deep Learning Foudations and Applications|Linear-Algebra for AI- ML|Convex Optimization in Control and Signal Processing|Digital Signal Processing|Statistical Signal Processing|Biomedical System Engineering and Automation|Probability and Stochastic Processes|Linear Systems and Control|Embedded Systems|Foundations of Entrepreneurship
MOOCs:Deep Learning Specialization(Coursera)|Machine Learning A-Z(Udemy)|SQL Bootcamp(Udemy)

AWARDS AND ACHIEVEMENTS

- Achieved a rank of **1125** in JEE Advanced,2019 and a percentile of **99.85%** in JEE Mains,2019 out of approx **1M** candidates
- Cleared both stages of Kishore Vaigyanik Protsahan Yojana (**KVPY**) 2018-19(AIR-**512**) and **NTSE** 2016 and got scholarship
- Cleared Regional Mathematics Olympiad(**RMO**),2016 and secured a rank under top **1%** in Junior Science Olympiad(**NSEJS**),2016
- Cleared first stages of National Standard Examination in Astronomy(**NSEA**),Physics(**NSEP**) and Chemistry(**NSEC**)

EXTRA CURRICULAR ACTIVITIES

- Dedicated volunteer at **'Be Local for Vocal'**, actively advocating and promoting indigenous products to help the **'Make in India'** initiative
- Organized and volunteered for a blood donation camp at Patel Hall of Residence for an orphanage on the eve of **Sardar Patel Jayanti**

!Self declared by the student, CDC could not verify the relevant documents