RAJA KUMAR | **190110070**
Metallurgical Engineering and Materials Science | **Dual Degree (B.Tech. + M.Tech.)**
Centre for Digital Health | **Gender: Male**
Indian Institute of Technology Bombay | **DOB: 15/02/2000**

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2024	8.35

Publications

- **Raja Kumar**, Ganesh Ramakrishnan, Kshitij Jadhav and Venkatapathy Subramanian et al. *SEAMLESS: Semi-Supervised Classification of Medical Images Using the Segment Anything Model and Data Programming.* Under Review: IEEE/CVF Winter Conference on Applications of Computer Vision (**WACV**), 2024
- Kishan Maharaj, Ashita Saxena, **Raja Kumar**, Abhijit Mishra, Pushpak Bhattacharyya et al. *Eyes Show the Way: Harnessing Gaze Features for Hallucination Detection.* Under Review: Empirical Methods in Natural Language Processing (**EMNLP**), 2023

Research Experience

Early Prediction of Mental Health Conditions from Social Media Text *(Jul 2023 - Present)*

Advisor : Prof. Pushpak Bhattacharyya | Mtech. Thesis

- Employed **Sentence Transformer** to analyze social media text data for predicting the emergence of **mental states**
- Devised and executed a **cosine similarity** strategy to examine social media posts , monitoring shifts in mental states
- Tuned **Llama 2** model on mental health text of depression subreddit, improving predictions with domain knowledge

Semi-Supervised Medical Image Classification: SAM and Data Programming *(Jan 2023 - May 2023)*

Advisor : Prof. Kshitij Jadhav | Research Project

- Devised a semi-supervised method to count **lymphocytic** cells in WSI patches using **Segment Anything Model**
- Implemented a pipeline for image segmentation and classification, resulting in **0.75 F1** score using 800 segments
- Demonstrated superiority of the pipeline over **ResNet18** in medical image classification, with limited training data

Depression Severity Prediction using text transcript and NLP techniques *(Jan 2023 - May 2023)*

Advisor : Prof. Pushpak Bhattacharyya | Research Project

- Implemented depression severity prediction in transcripts using embeddings: **Glove, Word2Vec, BERT**
- Evaluated model performance using cross-entropic test loss, with BERT-based model achieving F1-score of **0.90**
- Conducted live demo of the system to predict depression severity in texts using **Hugging Face hub** and **gradio**

Professional Experience

Assert AI | *Computer Vision and AI Intern* *(May 2022 - July 2022)*

AI solutions for surveillance and Monitoring

- Developed a method for food **grain quality** assessment: contour detection for separation, **SVM** for**89%** accuracy
- Deployed customized **YOLOv4** models for surveillance tasks leveraging the **Nvidia Jetson** series GPU accelerators
- Generated tailored datasets and trained **YOLOv4** models for diverse object detection and classification scenarios

Key Technical Projects

Riddle Solving *(Autumn Sem 2022)*

Instructor : Prof. Pushpak Bhattacharyya | Course : Deep Learning for NLP

- Achieved an accuracy rate of 52.6% on a riddle-solving task using the **Riddlesense** data with the **ALBERT** model
- Observed an increase in accuracy of fine-tuned model from 52.6% to **65.1%** by masking incorrect predicted option
- Contributed to dataset curation by converting **1021 English** riddles from the Riddlesense dataset to **Hindi** Language

Compare Deep Learning and Image Processing Method for Shadow Removal *(Autumn Sem 2021)*

Instructor : Prof. Amit Sethi | Course : Image Processing

- Implemented a deep learning model, specifically Stacked Conditional Generative Adversarial Networks (**SCGANs**), to tackle the challenging task of jointly detecting and removing shadows from documents in the **ISTD** dataset
- Applied **k-means** clustering to equalize global and local shadow background, eliminating shadows from documents
- Used **Water Filling** algorithm to remove shadows from images, treating them as topographic surfaces

Implementation of Image Quilting for Texture Synthesis and Transfer *(Autumn Sem 2021)*

Instructor : Prof. Ajit Rajwade | *Course : Fundamentals of Digital Image Processing*

- Thoroughly analyzed the algorithm discussed in the paper - **Image Quilting** for Texture Synthesis and Transfer
- Obtained convincing results by implementing the algorithm and evaluated my model on the final output images

Liquid Warping GAN with Attention: A Unified Framework for Human Image Synthesis *(Autumn Sem 2021)*

Instructor : Prof. P Balamurugan | *Course : Deep Learning: Theory and Practice*

- Successfully reproduced a state-of-the-art human image synthesis framework, including human **motion imitation**, **appearance transfer**, and novel **view synthesis**, by replicating the algorithm described in the research paper

Generative Image Inpainting with Contextual Attention *(Autumn Sem 2020)*

Instructor : Prof. Biplab Banerjee | *Course : Machine learning for Remote Sensing 2*

- Successfully reproduced and implemented a state-of-the-art image inpainting model, leveraging the coarse-to-fine network architecture, **contextual attention** layer, and Global and Local **GAN**-based discriminator

Using ML to predict stock price movements *(June-July 2021)*

FINSEARCH Competition | *Finance Club, IIT Bombay*

- Collaborated in a team of 4 to study **time series forecasting**, its components and other technical terms related to it
- Deliberated upon the theory and implementation of **AR**, **ARIMA** and **LSTM** models used for time series forecasting
- Implemented ML models in Python to predict stock price movements to get **RMSE** of **121** on ARIMA, **151** on LSTM

Supervised Sentiment Analysis *(July 2021)*

Self Project

- Applied machine learning techniques to classify tweets on the Twitter dataset from **NLTK** corpus, utilizing **Naive Bayes** Classifier and **Logistic Regression** Classifier to achieve an accuracy of over **99%** on the testing dataset
- Trained a Recurrent Neural Network (**RNN**) on Tweet Emotion dataset, successfully classifying tweets into one of six emotional categories (love, sadness, joy, surprise, fear, anger) with an accuracy of **86%** on the testing dataset

Positions of Responsibility

Head Teaching Assistant | *Introduction to Public Health Informatics* *(August 2023 - Present)*

- Responsible for **managing logistics** and assisting the professor in ensuring smooth functioning of the course
- Assisting in evaluation of answer scripts, designing projects and conducting tutorials for a batch of **210+** students

Technical Skills and Courses

Programming	Python (Expert), C++, MATLAB
Frameworks	PyTorch, TensorFlow, Keras, Git, MATLAB, LaTeX, Docker
Softwares	LTSpice, SolidWorks, AutoCAD
Libraries	Gradio, Numpy, Pandas, Matplotlib, Seaborn, Scikit-Learn, BeautifulSoup4
Technical Courses	Deep Learning for Natural Language Processing, Fundamental of Digital Image Processing, Speech Processing, Deep Learning:Theory and Practice, A First Course in Optimization, Machine Learning for Remote Sensing -II, Data Structures, Qubit's 2020-2021 Introduction to Quantum Computing Course, Deep Learning (Specialization: 5 Courses)[Coursera], Python for Everybody (Specialization: 5 Courses)[Coursera]

Extracurricular Activities

Sport	• Professionally trained in lawn tennis for one year under the NSO Program, IIT Bombay • Part of the team that secured the silver medal in the intra-department cricket tournament • Part of the team that stood first in the intra-hostel cricket tournament of Hostel 2
Competition	• Participated in a team of 4 students that stood 9th among 100+ teams in the Remote-Controlled Plane Competition 2019 • Our team ranked among the top 6, earning a cash prize of INR 5k for exceptional performance in the FinSearch Competition 2021 hosted by Finance Club, IIT Bombay