Raja Kumar

BTech + MTech Student · Healthcare Informatics

Indian Institute of Technology Bombay, India

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Education

Indian Institute of Technology Bombay *Mumbai, India*

B.Tech in Materials Science + M.Tech in Healthcare Informatics *Jul'2019 - Present*

- CPI (Cumulative Performance Index) 8.54* out of 10.0 after 9 semesters
- Secured AA grade in the first stage of Master's Thesis project (Jul'2023 - Nov'2023)

Publications

Raja Kumar, Kishan Maharaj, Pushpak Bhattacharyya. **MIND-TIMER: Mental Disorder Identification through Temporal Representation**, Under Review: **EACL 2024**

Raja Kumar, Kshitij Jadhav, Venkatapathy Subramanian, Ganesh Ramakrishnan. **SEAMLESS: Semi-Supervised Classification of Medical Images Using the Segment Anything Model and Data Programming**, Under Preparation [Code]

Kishan Maharaj, Ashita Saxena, **Raja Kumar**, Abhijit Mishra, Pushpak Bhattacharyya. **Eyes Show the Way: Modelling Gaze Behaviour for Hallucination Detection**, In Findings of Association for Computational Linguistics **EMNLP 2023**

Academic Interests

AI/ML AI for Healthcare, NeuroAI, Biomedical Data Science, Deep Learning, Computer Vision, Natural Language Processing, Multi-Modal Learning

Research Experience

Mental Disorder Identification through Linguistic Markers | Master's Thesis *Jul'2023 - Present*

Advisor: Prof. Pushpak Bhattacharyya, IIT Bombay

- Proposed a unique method to convert social media text into time series data for post-level analysis of mental disorders
- Developed a novel framework for mental disorder identification via foundational deep learning models which surpasses the performance of LLM-based approaches by 4.67% in the F1 score on mental conditions: Depression, Self-harm, and Anorexia
- Explored semantic overlaps among these disorders, underscoring the value of cross-domain data in mental health research

Cognitively Inspired Hallucination Detection | Research Project *Jul'2023 - Present*

Advisor: Prof. Abhijit Mishra, UT Austin & Prof. Pushpak Bhattacharyya, IIT Bombay

- Curated eye-tracking data with 500 instances for the task of hallucination detection and developed a BERT-based framework
- Proposed a novel attention bias framework inspired by human behavior for detecting hallucinated texts
- Currently experimenting with prompt-based approaches for hallucination detection and mitigation in dialogue setting

Semi-Supervised Medical Image Classification | R&D Project *Jan'2023 - May'2023*

Advisor: Prof. Kshitij Jadhav, IIT Bombay

- Devised a method to classify lymphocytic cells in WSI patches using the SAM followed by Semi-Supervised Data Programming
- Implemented a pipeline for image segmentation followed by classification, resulting in a 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 | R&D Project *Jan'2023 - May'2023*

Advisor: Prof. Pushpak Bhattacharyya, IIT Bombay

- Implemented depression severity prediction in interview transcripts using word embedding vectors: 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 one out of five depression severity in texts using Hugging Face hub and gradio

Neural Caption Generation for Dermatoscopy Images | Research Project *Nov'2023 - Present*

Advisor: Prof. Kshitij Jadhav, IIT Bombay

- Working on generating captions of dermatoscopy images for better explainability during skin cancer diagnosis

Professional Experience

Computer Vision & AI Intern *May'2022 - Jul'2022*

Assert AI

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

Positions of Responsibility

Head Teaching Assistant *Autumn 2023*

Introduction to Public Health Informatics, IIT Bombay

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

Key Technical Projects

Leveraging large language models for multiple-choice question answering *Autumn 2022*

Instructor : Prof. Pushpak Bhattacharyya | CS772: Deep Learning for NLP

- Incorporated the ALBERT model for solving riddles accompanied by a set of five available choices
- Conducted experiments on the RiddleSense dataset and achieved an accuracy of 61%

Deep Learning and Image Processing Method for Shadow Removal *Autumn 2021*

Instructor : Prof. Amit Sethi | EE610: Image Processing

- Implemented Stacked Conditional Generative Adversarial Networks for jointly detecting and removing shadows
- Applied k-means clustering to equalize global and local shadow background, eliminating shadows from documents

Image Quilting for Texture Synthesis and Transfer *Autumn 2021*

Instructor : Prof. Ajit Rajwade | CS663: Fundamentals of 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

Using ML to Predict Stock Price Movements *Jun'2021 - Jul'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

Key Courses Undertaken

Computer Science	Speech, NLP & the Web, Deep Learning for NLP, Digital Image Processing, Speech Processing, Image Processing, Deep Learning: Theory and Practice
Statistics	Data Analysis and Interpretation, Data Structure, A First Course in Optimization
MOOCs	Qubit's 2020-2021 Introduction to Quantum Computing Course, Specialization in Deep Learning by deeplearning.ai, Specialization in Python by University of Michigan