

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

Aug. 2019 - Present

- CPI (Cumulative Performance Index) 8.35 out of 10.0 after 8 semesters
- Secured AA grade in the first stage of thesis project (July 2023 - Nov 2023)

Publications

Raja Kumar, Kishan Maharaj, Pushpak Bhattacharyya. 2023. 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

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

Research Experience

Master's Thesis | Mental Disorder Identification through Linguistic Markers

July 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

RnD Project | Semi-Supervised Medical Image Classification

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

RnD Project | Depression Severity Prediction using Text Transcript

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

Research Project | Multimodal and Biological Language Models

Nov 2023 - Present

ADVISOR: PROF. KSHITIJ JADHAV, IIT BOMBAY

- Working with a group of dermatologists for describing dermatoscopic images to aid interpretable skin cancer diagnosis

Research Project | Cognitively Inspired Hallucination Detection

July 2023 - Present

ADVISOR: PROF. PUSHPAK BHATTACHARYYA & PROF. ABHIJIT MISHRA, IIT BOMBAY & UT AUSTIN

- 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

Professional Experience

Computer Vision & AI Intern

May 2022 - July 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

Riddle Solving

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%

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

June 2021 - 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

Academic Interests

AI/ML

AI for Healthcare, NeuroAI, Computational Neuroscience, Deep Learning, Computer Vision, Natural Language Processing, Multi-Modal Learning

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

Extracurricular Activities

- Participated in a team of 4 students that stood 9th among 100+ teams in the Remote-Controlled Plane Competition 2019
- Our team ranked top for exceptional performance in the FinSearch Competition 2021 hosted by Finance Club, IIT Bombay
- Part of the team that secured the silver medal in the intra-department cricket tournament hosted by the Material Science Dept.