

# 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**

## Research Experience

### Mental Disorder Identification through Linguistic Markers | Master's Thesis

Jul'2023 - Present

ADVISOR: PROF. PUSHPAK BHATTACHARYYA, IIT BOMBAY

- Proposed a novel idea of including temporal information for detecting mental disorders using time-series-based approaches
- Developed a novel framework for mental disorder identification via foundational deep learning models which surpasses the performance of BERT-based approaches by 4.67% in the F1 score on mental conditions: Depression, Self-harm, and Anorexia
- Conducted in-depth analysis on the common errors and investigated the potential for cross-domain mental health data usage

### Cognitive-Driven Hallucination Detection in LLMs | 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 and obtained a balanced accuracy of 87.1%
- Currently experimenting with prompt-based approaches for hallucination detection and mitigation in dialogue setting

### Semi-Supervised Nuclei Classification in Whole Slide Images | R&D Project

Jan'2023 - May'2023

ADVISOR: PROF. KSHITIJ JADHAV, IIT BOMBAY

- Devised a method to classify lymphocytic nuclei in WSI patches using image segmentation followed by data programming
- Implemented a pipeline for image segmentation followed by classification, resulting in a 0.75 F1-score using 800 segments
- Demonstrated the superior performance of the proposed pipeline compared to the ResNet18 model 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 demonstrating an 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 explainability and interpretability 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

### 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

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

## Research Interests

**AI/ML** AI for Healthcare, Biomedical Data Science, Computer Vision, Natural Language Processing

## References

**Prof. Pushpak Bhattacharyya**

Computer Science and Engineering  
IIT Bombay, India

**Prof. Abhijit Mishra**

School of Information  
The University of Texas at Austin

**Prof. Kshitij Jadhav**

Koita Centre for Digital Health  
IIT Bombay, India