

Raja Kumar

BTECH + MTech · AI IN HEALTHCARE INFORMATICS

Indian Institute of Technology Bombay, India

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Education

Indian Institute of Technology Bombay

B.TECH IN MATERIALS SCIENCE + M.TECH IN AI IN HEALTHCARE INFORMATICS, CPI: 8.54/10

Mumbai, India

Jul'2019 - Present

- Secured **AA (highest)** grade in the first stage of **Master's Thesis**

Publications

Raja Kumar, Kishan Maharaj, Ashita Saxena, Pushpak Bhattacharyya. **Mental Disorder Classification via Temporal Representation of Text**, Under Review: **ACL 2024**

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**

Kishan Maharaj, Ashita Saxena, **Raja Kumar**, Abhijit Mishra, Pushpak Bhattacharyya. **Behavioural characterization for hallucination detection through Eye Movements**, Under Review: **CMCL 2024**

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

Image-Text Multimodal Classification | Research Project

Nov'2023 - Present

ADVISOR: PROF. KSHITIJ JADHAV, IIT BOMBAY

- Implementing a novel multimodal contrastive learning technique for image-text classification using cross-modality attention

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 _____

Computer Science	Deep Learning for NLP, Speech & NLP, Machine Learning, Image Processing, Speech Processing
Maths	Probability and Statistics, Optimization in ML, Applied Linear Algebra, Data Structures
MOOCs	Quantum Computing: Qubit, Specialization in DL: deeplearning.ai, Python Specialization

Research Interests _____

AI/ML Neuro-AI, Natural Language Processing, Psycholinguistics, Cognitively Inspired NLP

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
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