Raja Kumar

BTech + MTech · AI in 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 AI in Healthcare Informatics, CPI: 8.54/10 *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: **EMNLP 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**

Raja Kumar, Raghav Singhal, Pranamya Kulkarni, Deval Mehta, Kshitij Jadhav. **M3CoL: Harnessing Implicit Relations via Multimodal Mixup Contrastive Learning for Multimodal Classification**, Under Review: **NeurIPS 2024**

Research Experience

Mental Disorder Identification through Linguistic Markers | Master's Thesis *Jul'2023 - May'2024*

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 - May'2024*

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
- 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 - May'2024*

Advisor: Prof. Kshitij Jadhav, IIT Bombay

- Implemented a multimodal contrastive learning objective for image-text classification using the extension of mixup strategy
- Experimented suing unimodality supervision, cross-attention on diverse datasets (N24News, ROSMAP, BRCA, and Food-101)

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	NeuroAI, Multimodal Representation Learning, 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