Ajay Rajendra Kumar

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RESEARCH INTERESTS

I am interested in Deep Learning, specifically in the domain of Computer Vision and Natural Language Processing with a keen interest in exploring Vision Language Models.

EDUCATION

Northeastern University, Boston, USA Incoming Student, Starting Fall 2024
Master of Science, Computer Science with ML specialization

Manipal Institute of Technology, Manipal, India 2020 - 2024
B.Tech. in Computer Science and Engineering (Minor: Computational Intelligence) *CGPA: 9.25/10*

PUBLICATIONS

- **ICMLDE 2023** Addressing Vaccine Misinformation using Transformers and User Association Dynamics Paper | GitHub
  *Chirag Rao, Gautham Manuru Prabhu, **Ajay Rajendra Kumar**, Shourya Gupta and Nisha P. Shetty.*

EXPERIENCE

Indian Institute of Technology, Kharagpur, India Jan 2024 - Present
*DL Research Assistant at **School of Medical Science and Technology Lab (SMST)*** *Advisor - Prof. Subhamoy Mandal*

- Working on image segmentation of Humerus bone from X-Ray images. Implemented various DL-based segmentation architectures from research papers and reproduced results through experimental tracking using weights and bias.
- Currently developing a noise tolerant segmentation architecture to improve tolerance against inaccurately labeled segmentation masks in biomedical datasets.

Manipal Institute of Technology, Manipal, India Jul 2023 - Present
Responsible AI Research Assistant *Advisor - Prof. Sanjay Singh*

- Working in area of Responsible AI: conducting a study to analyze and evaluate performance and fairness implications of using different encoding and imputation strategies when applied to tabular datasets during the data preprocessing stage.

Fidelity Investments, Bengaluru, India Jun 2023 - Aug 2023
Software Development Intern

- Revamped the established workflow for handling change tickets by rebuilding the backend architecture using SpringBoot and Oracle Database. Developed a frontend interface using Angular to streamline change ticket management. The new modular workflow made working with change tickets real-time, eliminating delays of several hours to just a few seconds.

Institute for Plasma Research, Gandhinagar, India Apr 2023 - Jan 2024
*DL Intern at **Advance Computing and Simulation Lab*** *Advisor - Prof. Rajaraman Ganesh*

- Implemented a LSTM architecture using PyTorch to predict temporally evolving turbulent flows of fluids. Trained to fit custom datasets generated using the nine-equation shear flow model by Moehlis.
- Executed and tracked experiments by varying data augmentation, loss functions, and model hyperparameters. Reproduced results of a published research article addressing the same problem statement. GitHub

Manipal Institute of Technology, Manipal, India Feb 2023 - Sept 2023
NLP Research Assistant *Advisor - Prof. Nisha P. Shetty*

- **Modelling**: Implemented and trained BERT & XLNet to classify misinformation on custom datasets scraped from Twitter and Reddit. Fine tuned the architectures to obtain a F1-Score of 0.92 for BERT & 0.93 for XLNet.
- **Conversation Analysis**: Implemented a user association mapping algorithm based on cosine similarity to identify dense conversation clusters, analyze conversations and flag suspicious users. **Article accepted at ICMLDE-2023.**

Bhabha Atomic Research Center, Visakhapatnam, India Dec 2022 - Jan 2023
*ML Intern at **Computer Analysis Divison Lab (CAD)*** *Advisor - Prof. Manoj Warrier*

- **Data Engineering**: Compiled and maintained large datasets comprising of structural properties of Zirconium (Zr) lattices by converting them into Pymatgen compatible format. Automated the data-preprocessing pipeline using Python and Argparse.
- **Regression Modelling**: Implemented a linear regression model to generate a ML-based interatomic potential, SNAP for Zr lattices. Performed grid search to fine tune hyperparameters. Validated results using Molecular Dynamics simulations.

ACHIEVEMENTS

Undergraduate Sponsorship Grant Oct 2023

- From Manipal Academy of Higher Education (MAHE), Manipal, India, for participating and presenting the paper in ICMLDE-2023 in Dehradun, India. Link

National 2nd Runner Up: Daimler India Commercial Vehicles Hackathon

Organized by Daimler India Commercial Vehicles, Chennai, India Aug 2022

- Addressed the challenge of bringing Autonomous Vehicles to India by proposing a proof of concept to optimize truck mileage. Showcased the concept's ability to yield savings for owners and profits for the company. Link

1st Runner Up: Transfusion Medicine Hackathon

Organized by The Asian Association of Transfusion Medicine, Manipal, India Apr 2022

- Proposed ideas to attract and retain first-time blood donors, increase female donors and developed a novel concept to streamline the blood donation process at Kasturba Medical College and Hospital, Manipal, India. Link

Winner: Space Odyssey Web Development Hackathon

Organised by IE-E&C, Manipal Chapter Jun 2021

- Developed a website using Flutter and captivating content was added. The team secured the prize for the creative UI design and captivating content of the website. Link

Scholar's Scholarship Award Jan 2021

- Awarded by MAHE, Manipal, India, for being within the top 5% in the department. Link

SELECTED PROJECTS

Implementation of UNET Architecture GitHub

- Performed semantic segementation on X-Ray images of the Humerus bone obtained from the MURA dataset. Feb 2024
- Manually annotated the X-Ray images to obtain ground truth segmentation masks.
- Executed and tracked experiments using Weights and Biases.

Implementation of PDR-UNET Architecture GitHub

- Implemented and replicated results as presented in PDR-UNET publication. Mar 2024
- Validated and fine tuned the model using custom annotated MURA dataset to obtain a F1 score of 0.94.

TEACHING EXPERIENCE

Manipal Institute of Technology, Manipal, India Aug 2023 - Dec 2023

Undergraduate Teaching Assistant *Instructors - Prof. Anup Bhat & Prof. T. Sujithra*

- For **Object Oriented Design Lab (CS 2163)** and **Problem Solving using Computers Lab (CS 1081)** for CSE undergraduate students. Involved in overseeing lectures, grading assignments, evaluating lab records and conducting doubt clearing sessions.

SKILLS SUMMARY

Programming Languages: Python, C++, C, Java, SQL, R

Programming Frameworks: PyTorch, Huggingface, scikit-learn, AIF360, Fairlearn, LIME, SHAP

Technologies: Computer Vision, Natural Langugage Processing, Responsible-AI, Weights and Biases, Git, Linux

EXTRACURRICULAR

ISTE - AI Mentor: Mentoring members to pursue research in the field of Deep Learning.

AIESEC - Mentor: Providing guidance to craft resumes and apply for international internship opportunities.

COVID-19 ChatBot: Developed and deployed a website chatbt for IAP to raise COVID prevention awareness.