AJAY RAJENDRA KUMAR

Boston, MA

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RESEARCH INTERESTS

Enthusiastic MSCS student with hands-on experience developing Deep Learning based predictive models for physical and medical applications.

EDUCATION

Northeastern University, Boston, MA — Sep 2024 - Present
Khoury College of Computer Sciences — *Expected graduation: May 2026*
Master of Science in Computer Science — *GPA: 4.0 / 4.0*
Related courses: Programming Design Paradigms, Pattern Recognition and Computer Vision

Manipal Institute of Technology, Manipal, India — Aug 2020 - Jul 2024
Bachelor of Technology in Computer Science and Engineering — *GPA: 9.3 / 10.0*
Minor: Computational Intelligence
Related courses: Machine Learning, Computer Vision, Data Structures and Algorithms

PUBLICATIONS

- **ICMLDE 2023** Addressing Vaccine Misinformation using Transformers and User Association Dynamics
  Paper | GitHub

EXPERIENCE

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

- Created three comprehensive datasets for semantic segmentation of Humerus bones from X-ray images.
- Developed and optimized three DL-based segmentation architectures from the ground up, resulting in a Dice score of 0.97 for the fine-tuned U-Net model.
- Conducted noise tolerance testing of the implemented models and integrated attention and dilated convolutions to improve robustness towards noise. The Residual Attention U-Net architecture achieved a Dice score of 0.92 when trained using noisy X-ray images.

Manipal Institute of Technology, Manipal, India — Sep 2023 - Aug 2024
Responsible AI Research Assistant — *Advisor - Prof. Sanjay Singh*

- Conducted a case study to analyze and evaluate the performance and fairness implications of various encoding and imputation strategies on tabular datasets during the data preprocessing stage.

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

- Revamped and streamlined change ticket management by rebuilding the frontend interface using Angular and backend architecture using SpringBoot and Oracle DB.
- Enhanced system performance and significantly sped up data retrieval efficiency by reducing delays from two hours to just a few seconds through the new standardized workflow.

Samsung R&D Institute, Bengaluru, India — Apr 2023 - Sep 2023
DL Intern

- Worked on the Multimodal Text to Speech for Avatars worklet using Text Emotion Classification, Emotional Text to Speech generation, and Generating 3D Avatars Dynamically with lip-sync and expressions using Deep Learning.

Institute for Plasma Research, Gandhinagar, India — Apr 2023 - Mar 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.
- Used Moehlis differential equations to generate datasets for training and testing the models. The trained LSTM model achieved validation losses in the range of 1e-6.
- 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 - Sep 2023

NLP Research Assistant *Advisor - Prof. Nisha P. Shetty*

- **Modelling**: Trained and optimized 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 published at ICMLDE-2023.**

Bhabha Atomic Research Center, Visakhapatnam, India Dec 2022 - Jan 2023

*ML Intern at **Computer Analysis Divison Lab (CAD)*** *Advisor - Dr. 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 segmentation 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 Pure Dilated Residual 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, HTML/CSS, Django

Technical Skills: Deep Learning, Computer Vision, Natural Language Processing, Data Structres, Algorithms, Databases

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

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 chatbot for IAP to raise COVID prevention awareness.