

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

NLP Research Assistant

Feb 2023 - Sep 2023

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

ML Intern at [Computer Analysis Division Lab \(CAD\)](#)

Dec 2022 - Jan 2023

Advisor - [Dr. Manoj Warriar](#)

- **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.
- Manually annotated the X-Ray images to obtain ground truth segmentation masks.
- Executed and tracked experiments using Weights and Biases.

Feb 2024

Implementation of Pure Dilated Residual UNet Architecture

[GitHub](#)

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

Mar 2024

TEACHING EXPERIENCE

Manipal Institute of Technology, Manipal, India

Undergraduate Teaching Assistant

Aug 2023 - Dec 2023

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 Structures, 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.