

# AJAY RAJENDRA KUMAR

☎ +1 (857) 919-5124 ✉ [rajendrakumar.a@northeastern.edu](mailto:rajendrakumar.a@northeastern.edu) 🔗 [ajaystar8.github.io](https://ajaystar8.github.io) 🌐 [LinkedIn](#) 🐙 [GitHub](#)

## RESEARCH INTERESTS

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Enthusiastic MSCS student with hands-on experience developing Deep Learning based predictive models for physical and medical applications. Eager to enhance my skills by working on challenging research projects, preferably in the domain of Computer Vision and Image Processing.

## EDUCATION

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**Northeastern University, Boston, USA**

Sept 2024 - Present

*Master of Science, [Computer Science](#)*

**Manipal Institute of Technology, Manipal, India**

Sept 2020 - Aug 2024

*B.Tech. in [Computer Science and Engineering](#) (Minor: [Computational Intelligence](#))*

*CGPA: 9.31/10*

## PUBLICATIONS

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- **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

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**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](#)*

- Worked on semantic image segmentation of Humerus bone from X-Ray images.
- Created three comprehensive bone segmentation datasets, leading to the successful training of deep learning models that processed 6000+ X-ray images, resulting in enhanced segmentation performance and reduced false positives.
- Implemented and fine-tuned six DL-based image segmentation models to test robustness and noise tolerance. U-Net achieved the best performance, with a Dice score of 0.97 without noise and 0.96 with noise.

**Manipal Institute of Technology, Manipal, India**

Sept 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.
- The new standardized workflow improved system performance and significantly speeded up the data retrieval efficiency by reducing delays from two hours to just a few seconds.

**Samsung R&D Institute, Bengaluru, India**

Apr 2023 - Sept 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 - 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 published at ICMLDE-2023.**

- **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

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### 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 2<sup>nd</sup> 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](#)

### 1<sup>st</sup> 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

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### Implementation of UNet Architecture

[GitHub](#)

- Performed semantic segementation 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

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### 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

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**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

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**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 chatbot for IAP to raise COVID prevention awareness.