

# Aayush Katoch

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## SUMMARY

Data Scientist specializing machine learning and deep learning research. Proven success developing advanced Deep Learning (PyTorch/TensorFlow) algorithms during Research Internships with ISRO on satellite image analysis and DRDO. Proficient in Python, statistical analysis, and modeling frameworks, delivering robust solutions in computer vision and multimodal language models.

## EDUCATION

**Northeastern University, Silicon valley, CA**

**Dec 2027**

*Master's, science data science*

- GPA: 4.0

**Manipal University, Jaipur, India**

**Aug 2024**

*Bachelor of Technology, science data science*

- GPA: CGPA-8.58/10.0

## EXPERIENCE

**SSPL(Solid State Physical Laboratory) DRDO**

**Jan 2024 - Apr 2024**

*Research and Technical Intern*

*New Delhi, India*

- Engineered and deployed a responsive application for Military Vehicle Detection utilizing Python, aligning with strategic analytical needs. Performed comparative modeling across YOLO versions, achieving peak performance with YOLO V8-m at 80.41% mAP 0.5 and 57.81% mAP 0.5-0.95, demonstrating strong statistical analysis and machine learning proficiency.
- Enhanced model inference time by 22% during deployment, showcasing operational efficiency and optimization techniques.
- Achieved a 96.5% classification accuracy for vehicle types in testing scenarios, surpassing initial benchmarks by 6% and reinforcing the application of analytical models in real-world contexts.

**SAC (Space Application Centre) ISRO**

**May 2023 - Oct 2023**

*Research Intern*

*Ahmedabad, India*

- Developed deep learning models to segment clouds from LANDSAT satellite data, achieving a 98% accuracy score and a 93% Dice score, and effectively leveraging Python libraries and statistical methodologies.
- Analyzed and compared architectures including UNET, UNET++, RESUNET, and Attention-UNet, demonstrating that UNET++ outperformed alternatives by 5%, thus emphasizing rigorous model validation.
- Designed a cloud segmentation model that processed over 1,000 LANDSAT images, conducting core research that culminated in a publication on CNN models and architectures, and translating complex analytical results into strategic insights.

## PROJECTS

**Crop Damage Assessment Research Work**

- Conducted rigorous comparative analysis across YOLOv3, YOLOv4, and YOLOv5 object detection architectures to identify the optimal model for feature extraction.
- Benchmarked models using standard metrics (e.g.mAP and F1-score), demonstrating that YOLOv5 achieved a superior performance gain (83.1% mAP and 81.5% F1-score), which represented an 8% performance increase over YOLOv4, and was selected for final assessment application.

**Cloud detection on Satellite data**

- Developed and benchmarked various Deep Learning architectures (including UNET and Attention-UNet) for cloud segmentation on satellite data.
- Achieved a peak performance of 98% accuracy and a 93% Dice score using a Transfer Learning approach, demonstrating robust segmentation capability.
- The comparative study showed the Transfer Learning model outperformed a purely scratch-trained CNN by 6% in Dice score, proving the efficiency of leveraging pre-trained weights for geospatial tasks.

## Image Captioning on Satellite data

- Developed and benchmarked deep learning models for image captioning on two major satellite datasets, demonstrating expertise in Transfer Learning and LSTM Blending architectures.
- Conducted comparative analysis using encoder-decoder models (ResNet-50 + LSTM, VGG-19 + LSTM, DenseNet-201 + LSTM, and EfficientNet B7 + LSTM) across the Sydney and RSICD datasets.
- Achieved peak performance using the EfficientNet B7 + LSTM model on the RSICD dataset, reaching a 94.05% Accuracy and a BLEU-4 score of 0.6916.
- The study demonstrated that EfficientNet B7 + LSTM consistently provided the highest BLEU scores and Accuracy across both datasets, outperforming the VGG-19 baseline by up to 7.8%

## Military Vehicle Detection and Classification

- Benchmarked object detection models including YOLOv7, YOLOv8, and YOLOv9 to identify the most efficient solution for real-time inference.
- Achieved peak model performance with YOLOv8-m, yielding a 96.5% classification accuracy and an 80.41% mAP 0.5 score.

## Multimodal LLM

- Engineered an advanced deep learning framework for generating comprehensive reports from chest X-ray data, streamlining the reporting process and reducing average report generation time.

## RAG-based Query suggestion Chatbot

- RAG-based Query suggestion Chatbot with Chain of Thought for WordPress sites.

## TECHNICAL SKILLS

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- **Tools & Methodologies:** Eclipse, Ms Visual Studio code, Spring, GIS, Git, Github, Flask, NetBeans, Agile Development, FastAPI
- **Programming Languages:** Python, R, Java, SQL, C, C++, C#, HTML, CSS, javascript
- **Machine Learning And Ai:** Supervised and Unsupervised Learning, Neural Networks, CNNs, RNNs, Scikit-learn, Numpy, Pandas, Seaborn, TensorFlow, PyTorch, Keras, NLP, Transformer Models, LLMs, LangChain, GPT, Prompt Engineering, OpenCV, RAG, AI agent, Llama, Machine Learning Models
- **Cloud Computing:** AWS, Google Cloud, Azure, Docker, Kubernetes
- **Operating Systems:** Windows, Linux, MacOS, Android, IOS
- **Data Science And Analytics:** Data Science, Statistical Analysis
- **Research And Analysis:** Image Quality Metrics, Data Processing Tools, Visualization Techniques, Performance Evaluation

## CERTIFICATIONS

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- **Introduction to Artificial Intelligence (AI):**IBM, April 2023
- **Introduction to Computer Vision and Image Processing:**IBM, March 2023
- **Programming for everybody (getting started with python):**University of Michigan, February 2022

## PUBLICATIONS

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- Captioning of Satellite images using Transfer Learning and LSTM Blending..
- Enhancing Cloud Detection Performance: A Comparative Study of CNN Models and Architectures..
- Army Vehicle Detection using YOLO-v7, YOLO-v8 and YOLO-v9..