Aman Goyal

AI Research Engineer - ML/Computer Vision

Email | Linkedin | Website | GitHub

Education

Carnegie Mellon University, Pittsburgh — Pittsburgh, Pennsylvania
Master's in Information Systems Management — *August 2023 – Present*

National Institute of Technology, Kurukshetra — Kurukshetra, India
Bachelor of Technology in Computer Engineering — *July 2017 – June 2021*

Publications

- *Detecting, Tracking and Counting Motorcycle Rider Traffic Violations on Unconstrained Roads*
  Aman Goyal*, Dev Agarwal*, Anbumani Subramanian, C. V. Jawahar, Ravi Kiran, Rohit Saluja.
  Published in CVPR Workshop (UG2+ challenge)
  **indicates equal contribution*
- *Multimodal Emotion Recognition in Polish.*
  Kritika Rupaulhia, **Aman Goyal**, Aman Saini, Akshay Shukla, Sridhar Swaminathan.
  Published in IEEE International Conference on Multimedia Big Data (BigMM), 2020, New Delhi, India
- *PC2L: PCA Continual Learning*
  Sima Behpour, Pooya Behpour, **Aman Goyal**, Richard Kang, Min Xu.
  Under Review

Research Experience

Emerging Systems Lab, Intel — August 2022 – May 2023
AI Research Engineer — *Bengaluru, India*

- Improved the pretrained model to AutoQ - mixed precision finetuning based model by 5% for the Intel Innovation Event 2022 within just 2 weeks of joining.
- Performed smooth codebase migration of BootstrapNAS and other models from Nvidia to Habana based GPUs for a demo in the Intel Innovation Event 2022.
- Optimized temporal convolutional networks by it's integration with BootstrapNAS for image classification and time series analysis based datasets. Achieved a 50% reduction in MACs with 2.5 times improvement in accuracy.
- Led an automated pruning-based project that determines when, where, and how to prune a neural network. Performed literature review of structured pruning strategies and reproduced their experimental findings.

Centre for Visual Information Technology, IIIT Hyderabad — February 2021 – September 2021
Applied Research Fellow - Autonomous Vehicles — *Hyderabad, India*

- Developed a novel helmet and triple riding violation detection solution for working on unconstrained roads. This project was carried out under the guidance of Prof. Ravi Kiran and Prof. C. V. Jawahar
- Designed and implemented a pre-processing pipeline for the Indian Driving Dataset. Additionally, fixed a bug in the dataset and contributed the codebase, due to which was provided access to upload it to official github repository.
- Developed the helmet violation detection solution using *YOLO*v4 model which achieved an mAP of 87%.
- Proposed a novel solution to detect and track triple riding violations using a trapezium regressor. The trapezium shaped bounding boxes were constructed over the rider-motorcycle instances, ensuring minimal overlapping. An IoU based counting algorithm was used for counting riders. A precision of 85% was achieved on a diversified test set.
- **Our work was published at CVPR Workshop, as well as a patent, is currently under review.**

Xulab, Carnegie Mellon University — June 2021 – February 2022
Research Intern - Computer Vision — *Pittsburgh, USA*

- Worked under the guidance of Prof. Min Xu and Dr. Sima Behpour on projects based on continual learning.
- Implemented several state-of-the-art methods such as *Dynamically Expandable Networks*, *Orthogonal Weight Modification* and *Layerwise Optimization by Gradient Decomposition* across various datasets and environments .
- Implemented a novel regularization approach for continual learning, utilizing principal vectors to reconstruct the orthogonal projection matrix, enhancing learning while reducing inference.

Optimization and Trustworthy ML Group, Michigan State University — March 2022 – July 2022
Research Intern — *East Lansing, USA*

- Worked with Prof. Sijia Liu on compression of object detection and tracking models for autonomous vehicles.
- Implemented a lightweight detection and tracking backbone for integration with state-of-the-art method *QDTrack*.
- Achieved a 30% increase in accuracy and a 60-fold reduction in size as compared to the *QDTrack* model variants with *Resnet-50* and *Resnet-101* backbones. All models were trained on *BDD100K Detection* dataset.
- Developed a lightweight backbone using feature-based knowledge distillation technique with *Resnet-50* as teacher network. The knowledge transfer took place on *BDD100K Detection* dataset.

Bennett University May 2019 - June 2019

Research Intern - Computer Vision *New Delhi, India*

- Worked under the guidance of Dr. Sridhar Swaminathan on a multimodal human emotion recognition system.
- Developed emotion recognition solution through *LSTM* based classifier for body language, facial landmark detection using *OpenCV* library and *Librosa* library for audio modality. Additionally, deployed the model as an Android app for real-time emotion recognition. It achieved an accuracy of 95%.
- **Our Work was published at IEEE BigMM 2020**.

Other Experience

Nayan Technologies January 2020 - August 2020

Deep Learning and Computer Vision Intern *New Delhi, India*

- Developed and deployed a cost efficient real-time traffic light recognition solution which reduced the organization's expenditure on data annotation by 2.5 times.
- Developed various solutions, including vehicle pose estimation, vehicle-camera distance estimation, and 2d-map vehicle trajectory estimation, all of which contributed to the development of the ADAS-based project's POC, which was **patented** and **deployed** by **Dubai police at driving test yards throughout the UAE.**
- Spearheaded and developed several multiple deep learning projects and pipelines such as yard segmentation, lane occlusion recognition, overloaded vehicle recognition and others.

Omdena May 2020 - June 2020

Machine Learning Engineer *Remote*

- Led a team of 10 collaborators in analyzing and visualizing data from Google Trends in 10 Indian languages, focusing on the surge in domestic violence-related activity during COVID.
- **Successful in influencing the Ministry of Affairs to prioritize domestic violence and issue guidelines** due to the various insights gathered by the team, which were representative of various socioeconomic classes.

NIT Kurukshetra August 2020 - December 2020

Teaching Assistant *Kurukshetra, India*

- Taught several machine learning concepts such as convolutional and recurrent neural networks to 240 students during the semester as part of the course content. Also conducted lab sessions and prepared its assignments.

Projects

Intrusion Detection in Low Light Scenarios | *Computer Vision*

- Developed a video surveillance based solution for low light scenes tackled using stacking and averaging techniques. Deep learning models such as *YOLO*v4 and *HRNet* were used for accurate intruder detection and pose estimation.

Vehicle Parking Occupancy Detection | *Computer Vision*

- Implemented a parking occupancy status detection solution using *YOLO*v3 model, homography estimation and *Point Polygon Test*. Also wrote a detailed blog on it .

Deep Learning based COVID-19 classifier | *Deep Learning*

- Developed an easily deployable COVID-19 classifier that performs binary classification on X-ray images. Achieved an accuracy of 99% on the *MobileNet* model with a training set of just 50 images.

Image Denoising with Autoencoders | *Deep Learning*

- Performed image denoising over *Olivetti Faces Dataset* using *Convolutional Autoencoders*.

QuickDraw - Image Recognition | *Deep Learning*

- Implemented a *CNN* based image classification tool for 15 categories. It was inspired by Google's Quick Draw.

Technical Skills

Languages: Python, C++, C, Java, Bash
Frameworks and Libraries: Tensorflow, Pytorch, Keras, OpenCV, NumPy, Scikit-Learn, Android Studio, ROS
Tools: Git, GCP, Docker, MySQL, LaTeX, HTML

Relevant Coursework

Artificial Intelligence: Deep Learning, Image Processing, Soft Computing, Automata Theory
Systems: Digitial System Design, Database Systems, Computer Networks, Operating Systems, Distributed Computing
Algorithms: Advanced Data Structures, C Programming, Principles of Programming Languages
Mathematics: Differential Calculus and Equations, Integral Calculus and Difference Equations, Discrete Mathematics

Achievements

- **OpenCV AI Competition 2021**: Spearheaded team which was shortlisted as **Finalists** among **1600 applicant teams across the world** for the proposing a visually impaired assistance solution.
- **EYRC-2019**: Led college team to the semi-finals in Eyantra 2019 competition. The project was based on application of drones in rescue and search operations.
- **Google AI Explore ML Program**: Selected as **Google AI Explore ML Facilitator** among **10k+ applicants across India.**
- **Hackshetra 2019**: Finished among **top 8 teams** from a total of 50 teams. Inspired by the happenings around various universities in India, including mine, the proposed solution was an *LSTM* based **therapeutic AI chatbot** mobile application which could converse and make the depressed users feel better.
- **Bennett University Hackathon**: Finished among **top 4 teams** from a total of 52 teams for our multimodal emotion recognition project at Bennett University.

Leadership And Volunteering

- **Google AI Explore ML Program**: Successfully conducted and taught in **10 Deep Learning sessions**. These were attended by **200+ students from various backgrounds** across the university.
- **Computer Vision Webinars**: Tutored 50+ students in various webinars held during the pandemic's initial lockdown phase on deep learning concepts such as *LSTM*, *Autoencoders*, and *Image Captioning*.
- **KAIR**: Founded the first ever AI research club of the institute - Kurukshetra AI Research Club.
- **Innovation Club**: Founding member of NIT Kurukshetra's Official Innovation Club.