

## EDUCATION

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### Carnegie Mellon University, Pittsburgh

*Master's in Information Systems Management*

Pittsburgh, Pennsylvania

*August 2023 – Present*

### National Institute of Technology, Kurukshetra

*Bachelor of Technology in Computer Engineering*

Kurukshetra, India

*July 2017 – June 2021*

## PUBLICATIONS

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- *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

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### Emerging Systems Lab, Intel

*AI Research Engineer*

August 2022 – Present

*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 its 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 a pruning based project which automatically determines when, where and how to prune a neural network. Performed a comprehensive literature review of existing structured pruning strategies and reproduced their experimental findings. As a result, also proposed various methodologies. This project was carried out under the guidance of [Nilesh Jain](#) and [Pablo Munoz](#).

### Xulab, Carnegie Mellon University

*Research Intern*

June 2021 – February 2022

*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 .
- Formulated and implemented a novel regularization based approach for continual learning which uses principal vectors to reconstruct the orthogonal projection matrix.
- This technique extracts only the essential gradient directions, which enhances learning as well as reduces inference.
- **Our work is currently under review at CVPR 2023.**

### Optimization and Trustworthy ML Group, Michigan State University

*Research Intern*

March 2022 – July 2022

*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.

### Centre for Visual Information Technology, IIIT Hyderabad

*Applied Research Fellow, Mobility Group*

February 2021 – September 2021

*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 IDD dataset and contributed the codebase of the pipeline's various components, due to which was provided the access to upload it to [IDD github repository](#).
- Developed the helmet violation detection solution using *YOLOv4* 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 (UG2+ challenge)**.
- **A US patent application for the same is currently being processed.**

## [Bennett University](#)

*Research Intern*

May 2019 - June 2019

*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

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### [Nayan Technologies](#)

*Deep Learning and Computer Vision Intern*

January 2020 - August 2020

*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 proof-of-concept, 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](#)

*Machine Learning Engineer*

May 2020 - June 2020

*Remote*

- Led a team of 10 collaborators for data analysis and visualization gathered from Google trends for various domestic violence related terms on 10 Indian languages.
- **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](#)

*Teaching Assistant*

August 2020 - December 2020

*Kurukshetra, India*

- Taught several machine learning concepts to 240 students during the semester as part of the course content. Also conducted various lab sessions and prepared it's assignments.

## PROJECTS

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### [Intrusion Detection in Low Light Scenarios](#) | *Computer Vision*

- Developed a video surveillance based solution for low light scenes which were processed using stacking and averaging techniques. Deep learning models such as *YOLOv4* 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 *YOLOv3* 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.

#### Sujhav - Faculty Feedback App | *Mobile App Development*

- Developed and deployed a *Flutter* based Android app with *Firebase* as backend. It's use was mandated by college authorities and it aims to provide an open and transparent feedback platform for all students in the college.

### TECHNICAL SKILLS

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**Languages:** Python, C++, C, Java, Bash

**Frameworks and Libraries:** Tensorflow, Pytorch, Keras, OpenCV, NumPy, Scikit-Learn, Android Studio, ROS

**Tools:** Git, GCP, Docker, MySQL, L<sup>A</sup>T<sub>E</sub>X, HTML

**Embedded Devices:** OAK-D

### RELEVANT COURSEWORK

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**Artificial Intelligence:** Deep Learning, Image Processing, Soft Computing, Automata Theory

**Systems:** Digital 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

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- **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

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- **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.