Aman Goyal

Email | Linkedin | Website | GitHub

Education

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

Publications

- *PC2L: PCA Continual Learning*
  Sima Behpour, Pooya Behpour, **Aman Goyal**, Richard Kang, Min Xu.
  Under Review at Top Tier Conference (Level: A1)
- *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

Research Experience

Xulab, Carnegie Mellon University — Jun 2021 – Nov 2021
Research Intern — *Pittsburgh, USA*

- Worked under the guidance of Prof. Min Xu and Dr. Sima Behpour on projects based on continual learning.
- 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.
- 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 .
- **Our work is currently under review at a top tier conference (level: A1)**.

Optimization and Trustworthy ML Group, Michigan State University — Sept 2021 – Feb 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.

Centre for Visual Information Technology, IIIT Hyderabad — Feb 2021 – Sept 2021
Applied Research Fellow, Mobility Group — *Hyderabad, India*

- Worked under the guidance of Prof. Anbumani Subramanian, Prof. Ravi Kiran and Prof. C. V. Jawahar on a novel solution to detect helmet and triple riding violations on unconstrained roads.
- Designed and implemented a pre-processing pipeline for the Indian Driving Dataset. Additionally, I fixed a bug in the IDD dataset and contributed the codebase of the pipeline's various components, due to which I was provided the access to upload it to IDD github repository.
- Developed a helmet violation detection solution intended to be used for road surveillance by the patrolling vehicles. It is based on *YOLO*v4 model and achieves an mAP of 87%.
- Proposed a novel solution to detect and track triple riding violations using a trapezium regressor. For regressing the trapezium, the center and various offset coordinates were taken into account. 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 in the bounding box. We achieved 85% precision on a diversified test set.
- **Our work was published at CVPR Workshop (UG2+ challenge).**
- **A patent is also being filed for our novel trapezium bounding box technique**.

Bennett University May 2019 – Jun 2019
Research Intern *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 accepted and published in IEEE BigMM 2020**.

Other Experience

Nayan Technologies Jan 2020 – Aug 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.
- Worked on several tasks, 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 May 2020 – Jun 2020
Machine Learning Engineer *Remote*

- Led a team of 10 collaborators for analysis and visualization of data 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 Aug 2020 – Dec 2020
Teaching Assistant *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

Intrusion Detection in Low Light Scenarios | *Computer Vision*

- Developed a video surveillance based solution for low light scenarios as a capstone project. Low-light images were processed using stacking and averaging techniques, detection of intruders and their firearms using *YOLO*v4 based model, *HRNet* for intruder pose estimation, and the *Viola-Jones* algorithm for intruder face recognition.

Vehicle Parking Occupancy Detection | *Computer Vision*

- Proposed 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 which 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 recognition tool which classifies images across 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

Languages: Python, C++, C, Java, Bash
Frameworks and Libraries: Tensorflow, Pytorch, Keras, OpenCV, NumPy, Scikit-Learn, Android Studio
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.