Karan Uppal

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EDUCATION

Indian Institute of Technology (IIT) Kharagpur, India   **CGPA: 9.18/10.0**
Major: Integrated MSc. in Mathematics and Computing   2019 – 2024

Mother's International School   **Percentage: 96.8%**
CBSE: English, Physics, Chemistry, Maths, Computer Science   2019

The Pinnacle School   **CGPA: 10.0/10.0**
CBSE: Central Board of Secondary Education   2017

PUBLICATIONS

[1] Decoding Attention from Gaze: A Benchmark Dataset and End-to-End Models   [**arXiv**]
Karan Uppal, et al. | NeurIPS 2022 Gaze Meets ML Workshop

[2] Multiple Waypoint Navigation in Unknown Indoor Environments   [**IEEE**]
*Shivam Sood, Jaskaran Singh Sodhi, Parv Maheshwari, **Karan Uppal**, et al.* | ICCR 2022

[3] [RE] Background-Aware Pooling & Noise-Aware Loss for Weakly-Supervised Semantic Segmentation   [**ReScience**]
*Aryan Mehta, **Karan Uppal**, et al.* | ReScience C Journal 2021 | Journal Showcase NeurIPS 2022

RESEARCH EXPERIENCE

[1] Neural Network Models for Evaluating Attention in Dynamic Visual Scenes [Certificate]   **Max Planck Institute**
Guide: Prof. Bernhard Schölkopf and Dr. Shashank Singh   May 2022 – Jul 2022
- Designed a novel CNN architecture to incorporate gaze data over time for object localisation in dynamic road scenes
- Experimented with different methodologies to incorporate both spatial and temporal information to combat occlusions
- Benchmarked results for 16 participants on the Multiple Object Eye-Tracking (MOET) dataset, achieving 54% mIoU

Semi-supervised Instance Segmentation for EM Connectomics [Certificate]   **Harvard University**
Guide: Prof. Hanspeter Pfister   May 2021 – Aug 2021
- Achieved 1st position on the CREMI leaderboard for the task of synaptic cleft detection using a self-learning methodology
- Experimented with different variants of the 3D UNet model for the task of instance segmentation on brain volumes
- Implemented a pipeline for self-training & an efficient evaluation function for 3D segmentation in [PyTorch Connectomics]

Comparing Evolutionary Methods in a Continuous Control Problem [Report]   **IIT Kharagpur**
Guide: Prof. Nirupam Chakraborti   Jan 2021 – Apr 2021
- Applied evolutionary methods like NEAT and PSO, to train neural networks by evolving their weights as well as their architecture to solve the problem of controlling a Bipedal Walker, utilizing the environment from OpenAI Gym
- Developed a parallel processing pipeline to aid the training as well as hyperparameter tuning of genetic algorithms

Segmentation based Decision Trees for Interpretable Classification [Certificate]   **IIT Kharagpur**
Guide: Prof. Pallab Dasgupta   Oct 2020 – Apr 2021
- Created a classification pipeline utilizing a combination of decision-tree model and semantic segmentation model
- Outperformed standard classification networks (AlexNet, VGG16) for the task of bi/uni-cycle identification, achieving 88.9% accuracy from only 150 training images of bicycles, while also exhibiting zero-shot learning for unicycle class

WORK EXPERIENCE

Summer Fellow [Certificate]   **University of Warwick**
Data Science for Social Good in collaboration with UN-REDD   Jun 2023 – Aug 2023
- Modified the UNet architecture for spatiotemporal forecasting of deforestation in Amazon in collaboration with the UN
- Implemented a low-latency visualisation tool with feature ablation for interpretability to analyze drivers of deforestation

Applied Research Intern [Certificate]   **NVIDIA**
WWFO - Solution Architect and Engineering   Aug 2021 – Jan 2022
- Developed and deployed three scalable pipelines for the tasks of image classification, object detection and segmentation
- Accelerated model inference using post-training quantisation to 8-bit precision, achieving up to 90% reduction in latency

Cloud Computing and Vision Developer   **Yantrakaar Technologies**
Early stage startup providing AI solutions for social problems   Jun 2020 – Aug 2020
- Assisted in developing AI-based Social Distancing Surveillance solutions, recognised by the MHRD, Government of India
- Incorporated a lightweight facemask detector & a real-time object detector to be run alongside the whole setup | [Demo]

Software and AI team member [Certificate]   **Autonomous Ground Vehicle**
Multi-disciplinary research group under Prof. Debashish Chakravarty   Mar 2020 – Present
- Currently working on benchmarking unsupervised and semi-supervised domain adaptation on the Indian Driving Dataset
- Engineered multiple data augmentation techniques (CutOut, MixUp, CutMix & their variants) for semantic segmentation

TECHNICAL SKILLS

Programming languages: C/C++, Python, Bash, SQL, Haskell   **Web Technologies:** Streamlit, GEE, JavaScript, p5
ML/AI: PyTorch/PyTorch Lightning, Hydra, WandB, Sklearn   **Miscellaneous:** Docker, Git, Webots, LaTeX, Markdown

Competitions and Challenges

Campus Super Bowl: Data Science Challenge   **American Express**
One of India's largest Data Analytics Competitions [Link]   Sep 2022 – Nov 2022
- Achieved 2nd place out of 3600+ teams for the task of predicting the time to default for a credit card customer
- Attained 82.4% accuracy with the use of a gradient boosting ensemble backed by DART, battling dataset imbalance

[3] [RE] Background-Aware Pooling & Noise-Aware Loss for Weakly-Supervised Semantic Segmentation   **Papers with Code**
Machine Learning Reproducibility Challenge [Link]   Nov 2021 – Feb 2022
- Reviewed the above-accepted CVPR 2021 publication for reproducibility of its claims through computational experiments
- Implemented Noise-Aware Loss from scratch achieving state-of-the-art results on the PASCAL VOC 2012 dataset
- Developed the training module in PyTorch Lightning with documentation, creating codeflows for the entire pipeline

[2] Navigation and Planning in Unknown Indoor Environments [Certificate]   **IROS-RSJ**
Navigation and Manipulation Challenge   Jul 2021 – Sep 2021
- Attained a score of 88.7% for the task of navigation & manipulation in 10 environments, achieving 1st place internationally
- Developed a novel probabilistic travel distance minimization algorithm for traversal in unknown indoor environments
- Integrated global and local planning modules to TiaGO Base bot for multiple waypoints traversal in shortest time

Bosch Traffic Sign Recognition [Certificate]   **Inter IIT Tech Meet**
Annual technology competition between the IITs, organised by IIT Guwahati   Feb 2021 – Mar 2021
- Achieved Bronze Medal among 23 competing IITs in this event and 2nd Runner Up position in the entire Tech Meet
- Involved in running experiments on various models like MicronNet, with a special focus on battling the high dataset imbalance present in the German Traffic Sign Recognition dataset, achieving an accuracy of more than 98.7%

Review of "FDA: Fourier Domain Adaptation for Semantic Segmentation"   **Papers with Code**
Machine Learning Reproducibility Challenge [Link]   Oct 2020 – Jan 2021
- Analyzed the training process of the above-accepted CVPR 2020 publication in order to verify the empirical results
- Optimized models and revamped pre-processing pipelines, reducing computational load by over 50% making it possible to be run on Google Colaboratory as well as documented the code for easier reproducibility by future aspirants

Achievements

Datafest, London	Presented a poster in association with the University of Warwick and Alan Turing Institute	**2023**
DSSG Fellow	Selected internationally to pursue a project with the UN-REDD in Coventry, UK	**2023**
MLRC	One of the reviewers of the Machine Learning Reproducibility Challenge (Spring Edition)	**2023**
Indian Symposium on ML	Awarded a travel grant to attend the Third Indian Symposium on Machine Learning	**2022**
DAAD WISE Scholar	Awarded a €3000+ grant to pursue research in Germany as a visiting researcher	**2022**
INSPIRE Scholar	Awarded 60,000 INR by the Government of India for excellence in sciences	**2021**
JEE Main	Attained a percentile of 99.87% among more than 1.5 million applicants	**2019**
JEE Advanced	Ranked in the top 0.82% among the 200k shortlisted candidates from above	**2019**

Relevant Coursework   * indicates MOOCs

Artificial Intelligence : Deep Learning | Machine Learning* | Genetic Algorithms | Computer Vision* | Image Processing

Computer Science : Design & Analysis of Algorithms | Object-Oriented Systems Design | Database Management

Mathematics : Linear Algebra | Probability and Statistics | Real Analysis | Functional Analysis | Discrete Mathematics

Positions of Responsibility

Deep Learning Team Lead   **IIT Kharagpur**
Autonomous Ground Vehicle Research Group   Mar 2021 – Present
- Headed a team of 6 sophomores for participation in Machine Learning Reproducibility Challenge 2021 (Fall Edition)
- Led a team of 15 freshers for training in Image Processing and Deep Learning, specialised for autonomous ground vehicles

Head Analytics   **IIT Kharagpur**
Business Club   Jul 2021 – May 2022
- Organised the 4th international edition of our flagship event, Indian Case Challenge (ICC) 2021, witnessing 1200+ teams
- Conducted frequent knowledge sessions for a team of 30+ members on the topics of Machine Learning & Data Analytics
- Promoted analytics knowledge by co-authoring a module on 'Types of Neural Networks' to reach a 10,000+ follower base

Entrepreneurial Experience

KGP Launchpad   **IIT Kharagpur**
Technology Coordinator   Sep 2021 – May 2022
- Led a team of 20+ people to develop a student welfare and knowledge platform to cater to more than 2000 freshers
- Collaborated with the software development, design, information and publicity teams to ensure maximum utility & reach
- Spearheaded the application to an average rating of 4.7 with 1500+ monthly users & over 3200 downloads on Play Store

Extracurriculars

Technical Writing : Writer of a blog series reviewing the fundamental research papers in the field of deep learning [Medium]
Speed Cubing : Solved 2x2x2 Cube at Delhi Autumn Open, organized by World Cubing Association, in best time 3.02s
Teaching : Mentored children of economically weaker section of 6th to 8th standards in academics and extra-curricular activities
Volunteer Experience : Co-organised a Donation Drive for an Orphanage in IIT Kharagpur, raising more than 55,000 INR