Abhinav Agarwalla

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Education

Jan 2021 - May 2022	Carnegie Mellon University, Pittsburgh Masters in Computer Vision Advisor: Prof. Deva Ramanan	GPA: 4.09 / 4.3
June 2013 - May 2018	Indian Institute of Technology, Kharagpur Bachelors and Masters (Integrated) in Mathematics and Computing	GPA: 8.52 / 10.0

Research Interests

I am excited about developing state-of-the-art algorithms and formulating relevant research problems that enable robots to sense and perceive the world as humans do. Presently, my research is focused on autonomous driving and point clouds, unsupervised learning, domain adaptation and transfer learning.

Papers

* denotes equal contribution

- **Abhinav Agarwalla***, DB Sam* and R. Venkatesh Babu. "Beyond Learning Features: Training a Fully-functional Classifier with ZERO Instance-level Labels". Proceedings of the AAAI Conference on Artificial Intelligence (**AAAI**) 2022. Also presented at ICML 2021 Workshop on Self-Supervised Learning for Reasoning and Perception. Poster
- **Abhinav Agarwalla***, JN Kundu*, Suvaansh Bhambri, Varun Jampani, R. Venkatesh Babu. "Towards Deployable Multi-Domain Learning for Inductive-Transductive Transfer". Under Review.
- **Abhinav Agarwalla***, DB Sam*, Jimmy Joseph, Vishwanath Sindagi, R. Venkatesh Babu, Vishal Patel. "Completely Self-Supervised Crowd Counting via Distribution Matching". Under Review at CVPR 2022.
- **Abhinav Agarwalla***, A Lahiri* and PK Biswas. "Unsupervised Domain Adaptation for Learning Eye Gaze from a Million Synthetic Images: An Adversarial Approach." Indian Conference on Computer Vision, Graphics and Image Processing (**ICVGIP**) 2018. (**Oral**). Paper
- **Abhinav Agarwalla**, A. Jain, KV Manohar, A. Saxena, J Mukhopadhyay. "Bayesian Optimisation with Prior Reuse for Motion Planning in Robot Soccer". *ACM iKDD Conference on Data Science (***CoDS***) 2018.* (**Oral**) Paper
- Arnav Jain*, **Abhinav Agarwalla***, KK Agrawal, and P Mitra. "Recurrent Memory Addressing for Describing Videos." *In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (***CVPR***) Workshops*, pp. 25-32. 2017. Paper
- **Abhinav Agarwalla***, Muhammad Shaban*, and Nasir M. Rajpoot. "Representation-Aggregation Networks for Segmentation of Multi-Gigapixel Histology Images." *British Machine Vision Conference (***BMVC***) Workshops 2017.* Paper

Research & Work Experience

MSCV Capstone | Advisor: *Prof. Deva Ramanan*, Carnegie Mellon University, Argo AI — May 2021 - Present
- Devised a multi-frame aggregation strategy that can account for moving objects and utilize scene flow to improve the performance of a 3D point-cloud segmentation network on Semantic-KITTI and NuScenes datasets
- Developed state-of-the-art panoptic segmentation network on NuScenes dataset through class-specific bandwidth optimization for mean-shift clustering. The resulting method was presented at **NeurIPS 2021 AIDO Workshop**

Research Assistant | Advisor: *Dr. Dong Huang*, Carnegie Mellon University — Feb 2021 - May 2021
- Implemented a multi-task multi-modal object detection framework for heading direction and occlusion prediction for RGB and multi-spectral images, as part of AIDTR project at National Robotics Engineering Center(NREC)
- The heading prediction model was deployed to unmanned ground vehicles (UGV)

Research Assistant | Advisor: *Prof. R. Venkatesh Babu*, Indian Institute of Science — Jan 2020 - Dec 2020
- Introduced optimal transport based self-supervised paradigm for unsupervised classification, ordinal classification and unsupervised crowd counting outperforming all baselines. Published at **AAAI 2022**
- Utilized a multi-domain learning to develop state-of-the-art approach to single/multi-source domain adaptation, and domain generalization. Under Review

Data Scientist | Microsoft India R&D Center, Hyderabad — June 2018 - December 2020
- Evaluated and quantified model inconsistency with respect to feature variance with changing search trends
- Deployed multiple classification and ranking models leading to **10.6 recall**, **0.3 precision**, and **0.3 DCG gains**.
- Addressed the regression pattern where a parent entity is surfaced on querying for a child entity through mining queries using data, featurization and training rankers leading to **0.8 DCG gain** on official sets

Visual Domain Adaptation | Advisor: *Prof. Pabitra Mitra, IIT Kharagpur* — July 2017 - April 2018

Grand Winner, Qualcomm Innovation Fellowship 2017 | Master's Project | Paper | Code
- Selected among 6 winning teams to receive fellowship for **"Bridging Cross-Domain Semantics Gaps in Vision"**
- Implemented domain-invariant **adversarial network** for eye gaze estimation on real images from game simulations that adapted the feature space instead of the visual space as in SoTA
- Yielded a post-adaptation improvement of 5.6 points on degree of error as opposed to 3.4 in the SoTA

Video Captioning | Advisor: *Prof. Pabitra Mitra, IIT Kharagpur* | Paper Sept 2016 - Mar 2017
- Developed a deep learning model based on memory networks, LSTMs and CNNs for captioning a video sequence
- Extended encoder-decoder networks with **multi-modal key-value memories** with keys, values from vision and language domain respectively and novel **attention-vector addressing** that utilises previous attention weights
- Incorporated 3 LSTMs for image, caption and attention sequences for capturing multiple temporal dependencies
- Accepted at Computer Vision and Pattern Recognition (**CVPR**) 2017 Deep Vision Workshop, Hawaii

Kharagpur RoboSoccer Students' Group (KRSSG) | Code1 | Code2 | Paper1 | Paper2 Mar 2014 - Apr 2017
Guide: *Prof. Jayanta Mukhopadhyay, Prof. Sudeshna Sarkar, IIT Kharagpur*
Developer, Vision and Artificial Intelligence Team
- Developed strategy, communication, planning and learning modules for soccer playing drives and humanoids
- Revamped a **multi-threaded architecture** for real time execution of planning and strategy at multiple hierarchies
- Incorporated **real time Bayesian Optimization** for time efficient trajectories leading to 2x increase in robot speeds
- Increased humanoid walking speed by 50% and kicking speed by 20% through **CMA-ES** based optimisation strategy
- Work on prior reuse for motion planning using Bayesian optimisation accepted (oral) at **ACM IKDD CoDS '18**
- Adjudged **3rd** in Mirosot League, **FIRA** RoboWorld Cup 2015, qualified for **RoboCup** 3D Simulation League 2016, 2017

Summer Research Intern | Guide: *Prof. Nasir Rajpoot, University of Warwick, UK* | Paper Summer 2017
- Developed Qt-based **Tensorflow-integrated GUI** for visualisation and analysis of tumor in multi-gigapixel slides
- Boosted training time of deep learning models by leveraging multiple GPUs and parallel data fetching
- **2x increase in F1-score** against SoTA CNNs on Camelyon '16 dataset in segmenting tumor regions by modelling spatial dependencies between smaller adjacent image patches by **stacking 2D-LSTMs on top of CNNs**
- Work accepted at British Machine Vision Conference (**BMVC**) 2017, Deep Learning for Irregular Domains workshop

Summer Research Intern | Guide: *Prof. Russell Greiner, University of Alberta* Summer 2016
- Compared performance of various classifiers like **Gaussian Process** Regressor, k-Nearest Neighbour Regressor along with **ensembling** methods for predicting blood glucose levels in Type-I diabetic patients
- Used **Q-Learning**, **SARSA** with eligibility traces to learn the policy for right insulin dosage before meal

Achievements and Awards

- Grand Winner, **Qualcomm Innovation Fellowship 2017** for project on adversarial domain adaptation 2017
- **ACM India Student Travel Grant** for presenting at Graduate Research Symposium, ACM IKDD CoDS 2017 2017
- Recipient of **University of Alberta Research Experience (UARE)** research award 2016
- Bronze in Mirosot League, **FIRA RoboWorld Cup 2015**, South Korea 2016
- All India Rank 8, **Kishore Vigyanik Protsahan Yojana (KVPY)** scholarship, Govt. of India 2014
- Awarded the **INSPIRE scholarship** by Department of Science and Technology, **Govt. of India** 2013

Skills

Proficient: C++, R, Python, Tensorflow, PyTorch, Keras, OpenCV, scikit-learn, Linux, Qt, Git

Coursework

Carnegie Mellon University:
- Computer Vision
- Machine Learning
- Statistics for Robotics
- Computer Graphics
- Visual Learning & Reasoning
- Robot Localization & Mapping
- Learning for 3D Vision

Indian Institute of Technology Kharagpur:
- Algorithms
- Artificial Intelligence
- Operating Systems
- Optimization
- Real Analysis
- Linear Algebra
- Graph Theory
- Probability and Statistics