Hitesh Arora

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Education

- **Carnegie Mellon University** — Pittsburgh, PA
  Master of Science in Robotics, GPA: 4.22/4.33 — *Aug. 2018 - Aug. 2020*
  Relevant courses: Deep Learning, Reinforcement Learning, Computer Vision, Advanced Multimodal Machine Learning

- **Indian Institute of Technology Guwahati** — Guwahati, India
  Bachelor of Technology in Computer Science and Engineering, GPA: 9.69/10.0 — *July 2011 - May 2015*
  Received Institute Merit Scholarship for being Department Rank 1

Work Experience

- **Robotics Institute, Carnegie Mellon University** — Pittsburgh, PA
  Graduate Research Assistant, Advisor: Prof. Jeff Schneider — *Aug 2018 - Present*
  - **Master's Thesis Research**: Studying and designing sample-efficient deep reinforcement learning (DRL) algorithms for end-to-end self-driving. (*Ongoing*)
  - Designed an architecture for self-driving agent to learn control directly from semantically segmented images and waypoint input to drive in urban settings in the CARLA simulator for autonomous driving. Preliminary work accepted at NeurIPS 2019 Workshop on ML for Autonomous Driving.

- **Microsoft** — Hyderabad, India
  Software Engineer II, Azure Compute Team — *June 2015 - July 2018*
  - Delivered core compute platform functionalities to achieve availability and performance goals of five 9s (99.999%).
  - Shipped platform supported migration of IaaS resources from classic to Azure Resource Manager.
  - Designed and implemented automated health monitoring of Service Fabric (SF) infrastructure for Azure Diagnostics services. Shipped the throttling service to safeguard Geneva diagnostics cloud services from heavy users.

- **Massachusetts Institute of Technology** — Boston, MA
  Research Intern, Centre for Brain, Minds and Machines, Advisor: Prof. Tomaso Poggio — *Summer 2014*
  - Applied machine learning methods on neural data from monkeys' brains while they participated in experiments focused on specialized brain functions of spatial working memory and task representation.
  - Decoded information of remembered stimulus position with more than 90% classification accuracy to help compare spatial working memory in different brain regions of PFC and PPC.

- **The University of Queensland** — Brisbane, Australia
  Research Intern, SCMB, Advisor: Dr. Scott Beatson — *Winter 2013*
  - Developed a pipeline to classify bacterial DNA sequences as either chromosomes or plasmids.
  - Applied filtering techniques by mapping on reference genomes, and machine learning methods of Hidden Markov Model, Support Vector Machine and Neural networks achieving accuracy of 67.7%, 82% and 87.6% respectively.

- **Carnegie Mellon University** — Pittsburgh, PA
  Research Intern, ECE Department, Advisor: Prof. Onur Mutlu — *Summer 2013*
  - Designed time and space efficient algorithm for DNA sequence mapping based on the idea of *heterogeneous seeds.*
  - Gained more than 90% reduction in mapping cost (time) with respect to state-of-the-art mapper mrFAST while increasing memory usage by $\sim 5\%$.

Publications

- **Learning to Drive using Waypoints** - Tanmay Agarwal*, **Hitesh Arora***, Tanvir Parhar*, Shubhankar Deshpande, Jeff Schneider, NeurIPS 2019 Workshop on Machine Learning for Autonomous Driving.

- **Deep forest: Neural Network based reconstruction of the Lyman-alpha forest** - Lawrence Huang, Rupert A.C. Croft, **Hitesh Arora**, Monthly Notices of the Royal Astronomical Society (*in preparation*)

Key Academic Projects

- **Semi-supervised learning for Diabetic Retinopathy**
  Advised by Prof. Asim Smailagic, CMU
  - Designed semi-supervised deep learning pipeline for Diabetic Retinopathy (DR) detection using retinal fundus images based on a combined auto-encoder and classifier network architecture.
  - Extended the GradNorm algorithm to handle dynamic tuning of gradient magnitudes of multiple losses in semi-supervised multi-task settings, where some of the losses may not be present for all data samples.
  - Achieved an improvement of 2% on ResNet18 baseline on the Messidor DR dataset.
- **Deep forest: Neural Network based reconstruction of the Lyman-α forest**
  Advised by Prof. Rupert Croft, CMU
  - Applying deep learning approaches to make predictions on intergalactic medium characteristics such as the density of neutral hydrogen in dense regions of the universe which are not observable directly.
  - Designed a CNN based architecture to predict optical depth from noisy observations of observed flux from the simulation spectra of Lyman-α forest and achieved promising results.
- **Multi-Modal Multi-task 3D Object Detection for Self-Driving**
  Advanced Multimodal Machine Learning Course, Advised by Prof. LP Morency, CMU
  - Designed a multi-modal architecture to leverage the modalities of RGB and LiDAR for 3D object detection.
  - Exploring the ideas of multi-view fusion for LiDAR, a cross-modal coupled fusion between RGB and LiDAR, soft attention for geometric alignment, and multi-task losses for robustness.
- **Non-convex optimization for ML**
  Maths Fundamentals for Robotics Course, Advised by Prof. Michael Erdmann, CMU
  - Studied non-convex problem formulations of sparse recovery and low-rank matrix recovery and implemented projected gradient descent algorithms including (Iterative Hard Thresholding (IHT), Singular Value Projection (SVP), Orthogonal Matching Pursuit (OMP).
- **Geometric object tracking**
  Computer Vision Course, Advised by Prof. Srinivasa Narasimhan, CMU
  - Designed robust object tracking pipeline using Lucas Kanade algorithm with template correction, affine motion subtraction and inverse composition.

Selected Honors and Awards

- Awarded K.C. Mahindra Scholarship for Post-Graduate Studies Abroad for graduate education at CMU (2018).
- Awarded Climate Foundation Biochar Fellowship for work instrumental to biochar value chains in India (2015).
- Microsoft Oneweek Hackathon India region award in Developers Category (2015).
- Selected to attend 5th South Asia Workshop on Research Frontiers in Computing, by National University of Singapore (NUS) (2015).
- Received the prestigious SN Bose Scholars Program Award by Indo-US Science and Technology Forum and Government of India to pursue research internship at MIT (2014).
- Qualified for DAAD WISE Scholarship supported by Deutscher Akademischer Austausch Dienst (2014).
- Ranked 24th in ACM - ICPC Asia Amritapuri Regional (programming) contest (2012).
- Qualified for Indian National Mathematics Olympiad (2011).
- Qualified for Kishore Vaigyanik Protsahan Yojana (Young Scientist Encouragement Program Fellowship) by Department of Science and Technology, Government of India (2010).

Volunteer Work

- Pioneered Charvesting project with the Climate Foundation NGO for cost-effective conversion of rice straw to biochar. Received Urban Labs Innovation Challenge Delhi award and $100K grant to implement the pilot project.
- Volunteer Teacher, Cherish Foundation NGO - provided social services for underserved youth in India (2015 – 2018).

Technical Skills

Languages: Python, C++, C#, C, Matlab
Libraries: Pytorch, Tensorflow, OpenAI Gym, Numpy
Web: HTML, JavaScript, Typescript
Operating System: Linux, Windows