Aman Mehra

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Education

Carnegie Mellon University — **Aug 2022 - May 2024**
MS in Robotics — GPA: **4.08**/4

Indraprastha Institute of Information Technology (IIIT) Delhi — **Jul 2017 - Jun 2021**
B.Tech in Computer Science and Engineering — GPA: **9.39**/10.00 | *Dean's List for Academic Excellence*

Experience

Graduate Researcher (+Summer Research Assistant (RA)) | Auton Lab, CMU | *Advisor : Jeff Schneider* — **Nov 2022 — Present**
- Accelerating online reinforcement learning approaches through structured exploration. Achieved $10\times$ training speedup using Bezier curves for learning to overtake while driving.

Graduate Researcher (+Summer RA) | CSD, CMU | *Advisors : Aditi Raghunathan and Zico Kolter* — **Jan 2023 — Present**
- Formalized recipes for finetuning foundation models that are conducive for estimating in-the-wild performance without labels.

Research Fellow | Microsoft Research | *Manager : Saikat Guha* — **Jul 2021 — Jul 2022**
- Created a privacy preserving content modifier for document images using GANs capable of synthesizing high frequency patterns.
- Built an algorithm to estimate structure and automatically generate densely annotated document images in the wild and at scale.

Undergraduate Researcher | IAB Lab, IIT Jodhpur | *Advisors : Mayank Vatsa and Richa Singh* — **Jul 2019 — Jun 2021**
- Created a deepfake detection algorithm achieving SOTA on compressed video benchmarks and generalizing across forgery types.
- Highlighted prevalence of bias in deepfake detectors and demonstrated its interference in applications such as face recognition.

Core Engineering Intern | Tower Research Capital | *Rescinded due to Covid 19* — **May 2020 — May 2020**

Co-Founder | NXTclick | *Contextual digital outdoor ad platform* — **Jun 2018 — Jan 2019**

Research Intern | VAL, Indian Institute of Science (IISc) | *Advisor : R Venkatesh Babu* — **May 2019 — Jun 2019**
- Investigated using repeated cycles of memorization and forgetting as a universal method to learn self-supervised representations.

Publications

Predicting the Performance of Foundation Models via Agreement-on-the-line [Workshop] — **NeurIPS Workshop**
Aman Mehra*, Rahul Saxena*, Taeyoun Kim*, Christina Baek, J Zico Kolter, Aditi Raghunathan — 2023

Motion Magnified 3D Residual-in-Dense Network for Deepfake Detection [Link] [PDF] — **IEEE TBIOM**
Aman Mehra, Akshay Agarwal, Mayank Vatsa, Richa Singh — 2022

Detection of Digital Manipulation in Facial Images (Student Abstract) [Link] — **AAAI**
Aman Mehra, Akshay Agarwal, Mayank Vatsa, Richa Singh — 2021

Projects

Sparse Voxel Grids for Accelerated Inverse Rendering [Preprint] [Video Clip] — **Mar 2023 — Jul 2023**
- Achieved $10\times$ speedup in factorizing a NeRF's radiance into lighting, material and visibility through a sparse voxel representation.

Lottery Tickets through the lens of Random Matrix Theory [Report] — **Mar 2021 — May 2021**
- Studied initialization statistics and variance (Q) maps on pruning deep fully connected and convolutional networks.
- Reconciled the divergence from theoretical Q-map estimates through the emergence of bi-modal weight distribution on pruning.

Reinforcement Learning - Investigating Replay Memories [Code] [Report] — **Jul 2020 — May 2021**
- Improved learning efficiency for off-policy RL by refreshing stale transitions within the replay memory.

Accelerated Rapidly Exploring Random Tree (RRT) Algorithm [Code] [Report] — **Mar 2021 — Apr 2021**
- Accelerated RRT over $10\times$ using quad trees for log complexity and CUDA kernels for parallelism while performing collision checks.

Path Tracing based Renderer [Code] [Report] — **Oct 2020 — Dec 2020**
- Built a unidirectional path tracer with specular reflection. Optimized paths using multiple importance sampling and russian roulette.

Image Superresolution [Code] [Report] — **Mar 2020 — May 2020**
- Demonstrated the benefit of global information in reducing boundary artefacts in recurrent image super-resolution networks.

Reinforcement Learning For Drone Racing [Code] — **Sep 2019 — Nov 2019**
- Taught a drone to overtake by designing rewards and training a TD3 policy to produce velocity and residual trajectories.
- Obtained a lap time of 68 secs on competition Tier 1 of Game of Drones (NIPS'19), which would achieve a leaderboard rank of 8th.

Game Development [Snake Vs Block] [Angry Birds] [Flappy Bird] [BrainDots] — **Dec 2015 — Dec 2018**
- Simulated rigid body dynamics like collisions, friction and gravity to recreate games using pygame and JavaFx (Snake Vs Block).

Selected Coursework

3D Vision • Computational Photography [Poisson Blending][Lightfields][HDR] • Generative Vision • GPU Computing • Computer Graphics [Code] • Approximation Algorithms [Group Steiner Tree] • Statistical ML • Theories of Deep Learning [Talk] • Reinforcement Learning • Linear Optimization • Graph Theory • Meta Learning • OS • DBMS • Network Security [Code]

Awards & Honors

2022 J N Tata Endowment Scholarship for Higher Studies, India
2020 Among 50 selected nationally for Google Research India AI Summer School
2019 Won 3 medals at National Level IIT BHU Swim Meet
2018 Winner at Angelhack Bangalore. Globally top 19 / 1800 teams. [Angelhack website]
Invited to present NXTclick to VCs in San Francisco [Pitch] [NXTclick]
Global runners up at Zoohackathon '18 [US Embassy Website] [Code]
2017 Secured an All India Rank of 1548 in JEE mains out of 1.4 million candidates.
Winner (Delhi) at Zoohackathon '17