Aayush Mishra

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I am passionate about Robust and Explainable Machine Intelligence.

EDUCATION

Johns Hopkins University Jan 2022 –
PhD in Computer Science

Indian Institute of Technology, Mandi Aug 2015 – Jun 2019
Bachelor of Technology in Computer Science and Engineering
with *Minor* in Management *CGPA: **8.88** / 10* [transcript]

WORK EXPERIENCE

Microsoft *Hyderabad, India*
Data and Applied Scientist – Shopping Team Aug 2021 – Jan 2022

- **Query Understanding**
  Find query's intended product classes using historical click data to improve product relevance.

Siemens *Bengaluru, India*

Research Professional – Verification and Validation of Intelligent Systems Jul 2019 – Aug 2021

- **Neural Network Optimization and Explanation**
  Introduced specificity/discriminative coefficients to quantitatively explain the behavior of units in a neural network, and prune redundant units/layers.
- **Detecting Data Drift for Large Neural Networks**
  Used a novel trace compression technique to find surprising inputs for large neural networks (like YOLOv3). This reduces performance testing costs by uncertainty modelling.
- **Simulation testing of Self-Driving Agents**
  Trained an RL model to quickly find edge-case scenarios where self-driving agents violate safety properties in a simulation environment.
- **Synthetic Data Generation for testing Neural Networks**
  Used ProGAN to generate high resolution traffic scenes. Proposed a method to generate these scenes with specific properties through a description using GAN-Dissection.

Research Intern – Statistical NLP

2. **Siemens Social Network Post Classification** Jul 2018 – Aug 2018

   Modelled users' history of engagements to match posts with relevant people.

1. **Source Code Analysis and Reuse Recommendation** Dec 2017 – Feb 2018

   Extracted semantic information from source code using Latent Semantic Analysis. Made a search tool to query provide code/contact suggestions.

UNDERGRADUATE RESEARCH EXPERIENCE

- **Generating MasterPrints** – Bachelor's Thesis [link] Aug 2018 – May 2019
  Advisor – Dr. Aditya Nigam

  Generated fake biometric images using GANs. Used numerical optimization to find masterprints in the fake images. Showed that masterprints did not exist in the fake Iris images when Siamese CNNs are used as matching networks.

- **Video Steganography** ⟨Mar 2019 – Apr 2019⟩
  Advisor – Dr. Aditya Nigam

  Devised a novel 3D-CNN based Autoencoder to hide a secret video inside another cover video. Improved the state of the art, published the work and presented it at BMVC, 2019.

Publications / Inventions / Peer Reviews

7. *Fast Edge-Case Falsification for Autonomous Vehicle SIL validation using RL*
   Mishra A., et al, Patent Pending – Siemens, 2021.

6. *Reducing testing costs of Large Neural Networks by finding surprising inputs using compressed activation traces*
   Mishra A., et al, Patent Pending – Siemens, 2021.

5. *Description based Data Generation and Augmentation using GANs*
   Mishra A., et al, Archived Invention – Siemens, 2020.

4. *System and method for developing and analyzing scenarios for autonomous vehicle simulation-based testing*
   Maskeri, G.M., **Mishra A.**, et al, Archived Invention – Siemens, 2020.

3. *Method of dynamically estimating region of interest for video analytics based counting applications*
   Janardhanan, S., **Mishra A.**, et al, Archived Invention – Siemens, 2020.

2. *Novel usage of Model Coverage for Network Pruning, Optimization and Explanation*
   Mishra A., Defensive Publication – Siemens, 2020.

1. *VStegNET: Video Steganography Network using Spatio-Temporal features and Micro-Bottleneck*
   Mishra A., et al, in BMVC, 2019. [link to paper]

Peer Review

- IEEE Transactions on Circuits and Systems for Video Technology, Oct 2021.

- IEEE Transactions on Image Processing, Feb 2021.

Teaching Experience

- **CS671 – Deep Learning and its Applications** – Dr. Aditya Nigam [link] ⟨*Spring 2019*⟩
  Held tutorial sessions, designed and evaluated assignments/exams.

- **CS562 – Artificial Intelligence** – Dr. Deepak Khemani [link] ⟨*Fall 2018*⟩
  Helped design and evaluate assignments/exams.

Miscellaneous

- **Skills**: Proficient in Python, C++ and C. Well-versed in usage of ML/CV/NLP libraries.

- **Achievements**: Awarded for TA Duties in the course of AI, 2019. Rank – 2581 ($\sim$1.3M candidates) in JEE Advanced (2015), Rank – 23 ($\sim$150K candidates) in UPSEE (2015).

- **Leadership**: Coordinated the activities of Entrepreneurship-Cell at IIT Mandi during 2016-17. Supervised Interns in research projects at Siemens.

- **Volunteering**: Designed and taught an introductory ML course to high school students in my hometown, 2020.