Pulkit Madaan

pmadaan2@jhu.edu | madaanpulkit.github.io | Baltimore, MD, USA

Education

Johns Hopkins University Fall'22 Incoming
Masters of Science in Engineering, Computer Science

Indraprastha Institute of Information Technology Delhi 2016–2020
B.Tech., Computer Science And Applied Mathematics (CSAM) with Honors
CGPA – 9.23/10 [Best Academic Performance in B.Tech. CSAM]

- Thesis: Clustering with Deep Learning

Publications

- White, J., Madaan, P., Shenoy, N., Agnihotri, A., Sharma, M., & Doshi, J. (2022). A Case for Rejection in Low Resource ML Deployment. arXiv preprint arXiv:2208.06359. [preprint] [LINK]
- Madaan, P., Maiti, A., Anand, S., & Mittal, S. (2019). Deep mean shift clustering. [preprint] [LINK]
- Madaan, P., & Sadat, F. (2020, May). Multilingual neural machine translation involving Indian languages. In Proceedings of the WILDRE5–5th Workshop on Indian Language Data: Resources and Evaluation (pp. 29-32). [LINK]

Academic Service

- Served as a Reviewer, Programme Committee at The Second Workshop on Speech and Language Technologies for Dravidian Languages-ACL 2022

Industry Experience

Associate Machine Learning Scientist - I July, 2020 – July, 2022
Wadhwani Institute for Artificial Intelligence
Project: Cotton Farming

- Computer vision based solution informing farmers about the pest infestation levels and intervention.
- Solution reached 15,000 small landholder farmers in 3 of the highest cotton producing states of India.
- Solution won the Global Change Award 2022. [article]
- The farmers saw a benefit through increase in profit as well as a reduction in pesticide cost.
- Involved in every aspect of the solution, from creating the codebase to cleaning data to running experiments with different models & rejection systems, designing augmentations, visualizing and analyzing the failure modes of the model and improving it.
- Went to field visits and interacted with farmers in remote villages to understand the problems they face and take suggestions on how to improve the solution for them.
- Rejection work under review at CIKM'22 short paper track under the name of *A case for Rejection in a low resource ML deployment.*
- Currently underway open-sourcing data and code.

Project: Irrigation

- Built a prototype that uses remote sensing to advise farmers on the frequency and quantity of irrigation required in their fields based on the crop. The solution won the HUL, Google and MyGov India's AI for Agriculture Hackathon with a grant of 1 Million INR.

Research Experience

- Summer Research Intern May, 2020 – July, 2020

Indraprastha Institute of Information Technology, Delhi
Project: 3D Surface Reconstruction
Guide: Dr. Kaushik Kalyanaraman, Dr. Ojaswa Sharma

- Worked on implementing 3D surface reconstruction from curved cross-sections.
- Extended the codebase for experiments and visualisation.
- Ran experiments on different combinations of cross-sections and related work implementations for comparison.

▪ Research Intern — Apr, 2020 – May, 2020

Multimodal Digital Media Analysis Lab

Project: Automatic Speech Recognition
Guide: Dr. Rajiv Ratn Shah

- Worked on State-Of-The-Art deep learning Automatic Speech Recognition models like Jasper.
- Ran diagnostic experiments to identify failure modes of the model.

▪ Bachelor's Thesis — Jan, 2019 – Dec, 2019

Indraprastha Institute of Information Technology, Delhi

Project: Clustering with Deep Learning
Guide: Dr. Saket Anand, Dr. Sushil Mittal

- Analysed different neural clustering methods in unsupervised and semi-supervised settings.
- Worked on a model for better representation learning using deep neural clustering with mean-shift.
- The model learns a latent space that is clustered without the need for labels or number of clusters.
- Built the codebase and ran experiments for different formulations.

▪ Mitacs Globalink Research Intern — May, 2019 – Aug, 2019

Université du Québec à Montréal (UQAM)

Project: Multilingual Neural Machine Translation for Low Resource Languages
Guide: Dr. Fatiha Sadat

- Developed an approach to learn better neural translation models for low-resource languages.
- Improved the Multilingual Neural Transformer model by augmenting data and modifying the training pipeline in tandem.
- Work accepted at WILDRE-5 (part of LREC 2020) under the name *Multilingual Neural Machine Translation involving Indian Languages*.

▪ Undergraduate Researcher — May, 2018 – Dec, 2018

Laboratory for Computational Social Systems (LCS2)

Project: Detecting Sockpuppets in Online Social Networks
Guide: Dr. Tanmoy Chakraborty

Worked on detecting sockpuppets in social media using deep learning. Sockpuppets are fake profiles created to push an agenda as the consensus of the online social group. Used metric learning with Siamese network to find similarity between texts authored by the same person.

Awards

- Part of Wadhwani AI team that won the HUL, Google and MyGov India's AI for Agriculture Hackathon. The winning prize was a grant of 1 Million INR.
- Recipient of Best Academic Performance in B.Tech. CSAM [Branch Topper | Gold Medalist] **[cert]**
- *MITACS Globalink Research Intern 2019*: Selected as a summer research intern to work in STEM at top Canadian research universities. **[cert]**
- *6th Simons-NCBS Monsoon School*: One of the 41 selected as a participant. **[cert]**
- Recipient of Dean's Academic Excellence Award for 2 consecutive years: 2017-18, 2018-19 **[cert]**
- College Topper of ICCE Climate Change Certificate Program conducted by NASA Climate Change, UNFCCC and World Bank Institute in association with Govt. of India **[cert]**

Projects

Flow Based Generative Models: GLOW [Code] [Slides] — Jan,20 – Apr,20

Course Project | Probabilistic Graphical Models — *[PyTorch]*

- Explored flow based generative models, like GLOW, and normalising flows.
- Used GLOW in different generation and conversion tasks using its conditioning ability
  - Used it as a vocoder, as WaveGLOW does.
  - Replaced it in tasks dominated by GAN-based models.

Emotional TTS [Code] Jan,20 – Apr,20
Course Project | Speech Recognition and Understanding *[PyTorch, Librosa]*

- Conditioned State-of-the-Art Text-To-Speech models, like Tacotron, on emotional labels to produce to non-robotic audios of a given text in a given emotion.

Passive v/s Active Induced Emotions Jan,20 – Apr,20
Course Project | Affective Computing *[PyTorch, Librosa, Scikit-learn]*

- Did a comprehensive analysis on the widely used affective features.
- Worked to find importance of features in predicting affective state in an active v/s passive visuals study.
- Designed the experimental study.
- Collected gameplay videos for active visuals and Bollywood movie trailers for passive.
- Work currently under submission.

Doom Playing DeepRL Agent [Code] [Slides] Nov,19 – Dec,19
Course Project | Reinforcement Learning *[PyTorch, ViZDoom]*

- Trained an agent using Deep Recurrent Q-Learning to play Doom: An FPS game having partially observable 3D states.
- Recreated a simple case of Arnold
- Added the capability to self-learn as the agent plays against self to train itself.

Curvature Operators for Discrete 2-Manifolds [Code] Jan,19 – Apr,19
Independent Study | Differential Geometry *[Numpy, Python]*

- Python implementation of algorithms to help calculate different curvatures operators of discrete triangulated 2-manifolds.

Skills

Relevant CS Courses: Probabilistic Graphical Models, Speech Recognition and Understanding, Reinforcement Learning, Deep Learning, Machine Learning, Digital Image Processing, Object Oriented Programming, Analysis and Design of Algorithms, Data Structures

Relevant Math Courses: Differential Geometry, Calculus on $\mathbb{R}^N$, Numerical PDEs, Stochastic Processes, Statistical Inference, Linear Optimisation, Real Analysis, Abstract Algebra, Discrete Structures, Scientific Computing, ODEs & PDEs, Probability and Statistics, Linear Algebra

Languages: Python, Java, C++

Tools & Tech.: PyTorch, Jupyter, Google Colab, Torchtext, Latex, Streamlit, PyTorch Lightning, Detectron2, Voxel51, Docker, Flask, Hydra

Co-Curricular

- Volunteer at ICLR 2021
- Part of the organizing Committee, ACSS'18 (Workshop on AI for Computational Social Systems)
- Research Volunteer with Global Village Foundation. Helped conduct surveys in rural areas and analyzed data on the impact of government policies and schemes.
- Served as the Event Head, RoboWars, ESYA'17 (Technical Fest)

Interests and Hobbies

- Active member of Astronuts - Astronomy club of IIIT-D (2018-19)
- Astro-Space Blog [Link]
- Avid football player.