Aman Shrivastava

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website | github | linkedin

EDUCATION

Ph.D. Computer Science, University of Virginia — 2020 – *present*
Advisors - Dr. Tom Fletcher, Dr. Vicente Ordonez Roman

M.S. Data Science, University of Virginia — 2018 – 2019

B.Tech. Mechanical Engineering, Indian Institute of Technology, Roorkee — 2013 – 2017

EXPERIENCE

Research Scientist Intern, Adobe Research, CA — May – Nov, 2023
Advisor - Dr. Kushal Kafle
- Worked on training, bootstrapping, and finetuning foundation large language and vision models for visual reasoning using self-synthesized datasets by converting existing annotations into instruction-response-image pairs

Research Scientist Intern, Salesforce Research, CA — May – Nov, 2022
Advisors - Dr. Stefano Ermon, Dr. Nikhil Naik
- Worked on conditional generative diffusion models for image synthesis using diverse modalities including text and audio. Formulated an information efficient contrastive learning objective for optimizing retrieval models in resource and data constrained settings

Research Scientist, University of Virginia, VA — 2019 – 2020
Advisors - Dr. Sana Syed, Dr. Donald E. Brown
- Worked on building machine learning frameworks for the understanding and assisted diagnosis of gastrointestinal diseases

Analyst, Citi, India — 2017 – 2018
- Built a streamlined visualization platform with data driven insights for the Chief Country Officer

Data Science Intern, Adwyze, India — Summer 2015
- Developed a predictive model to optimize client advertising expenditure

CURRENT RESEARCH

Learning Group Actions on Latent Representations of 3D objects
- Working on a novel approach to model group actions on objects in 3D scenes using autoencoders by learning these actions in the latent space

Implicit Latent Spaces for Generating Heterogeneous 3D Data at Arbitrary Resolutions
- Working on a novel approach using Implicit Neural Representation and diffusion models to reconstruct and synthesize visual 3D data at desired arbitrary resolutions

Adapting foundation models for visual reasoning
- Working on training, bootstrapping, and finetuning LLMs with foundation vision models to design visual reasoning systems that can handle both visual and textual prompts

Histopathology image synthesis using generative diffusion models, [code] [paper]
- Synthesizing histology images using conditional diffusion models for generating disease micro-environments along with their pixel-wise nuclei segmentation annotations

PAST RESEARCH

Information efficiency in contrastive multi-modal representation learning, [code] [paper]
- Designing frameworks to use information efficient lower-bounds on mutual information to learn multi-modal representations from paired image-text data with just one negative sample

Estimating and Maximizing Mutual Information for Knowledge Distillation, [paper]
- A distillation framework that simultaneously estimates and maximizes mutual information between intermediate and global feature representations from the teacher and the student networks

Correlating disease gene signature with imaging data, [paper]
- A deep learning framework to identify image features associated with functional gene clusters

Stain Normalization in Deferentially Stained Biopsy Slides, [code] [paper]
- A self-attention based generative framework for unpaired domain translation for stain normalization in histopathological images

Detection and Visual Understanding of Gastrointestinal Diseases, [code] [paper]
- A deep learning framework to classify Celiac and Environmental Enteropathy diseases using high resolution whole slide images from duodenal biopsy slides and numerical biomarkers

Deep Image Colorization, [code]
- A self attention generative architecture to automatically colorize black and white images. Designed a UNet based generator with a perceptual loss function to generate more natural and vibrant images

Data Driven Modelling of Composites, [slides]
- A machine learning framework to aid in the meta-modelling of composites. Developed a system to hypothesize physical properties of novel composites using historic experimental and simulation data

SIDE PROJECTS

Krity, [website]
- Co-founder of an open audiobook platform that allows listeners to find audiobooks in diverse voices, and narrators to give voices to their favorite books. Have produced and published over 40 audiobooks

Connect 4 AI, [code] [demo]
- An AI agent based on Minimax algorithm and Monte Carlo simulations for the game of connect 4. Featured on Hacker News. Released a Google Play Store App based on the project – Rated : 4.7

Deep Causal Inference on Time-Series Images
- Understanding and interpreting the structural causal relationships extracted from the filter values of the CNN trained on Gramian Angular Field images of time-series data

Humorous Image Captioning System, [code]
- A self-attentive encoder-decoder framework to generate humorous captions for images indistinguishable from human generated memes

News Sentiment Tracker, [code]
- Automatic scraping and analysis of trends in the sentiment of editorial articles on any selected topic of media discussion. Applied it to parameterize and co-relate social response with economic fluctuations during the demonetization drive by the Government of India in November 2016

Automated Clustering of Music, [code]
- An ML algorithm to automatically cluster songs onto playlists based on their intrinsic similarity in terms of music and lyrical features extracted from multiple sources

Soccer Squad Optimization, [code]
- Strategic team selection by predicting the best football squad given budget, nationality (and/or club) and playing formation constraints based on self extracted FIFA dataset

PUBLICATIONS AND PRE-PRINTS

[1] **NASDM: Nuclei-Aware Semantic Histopathology Image Generation Using Diffusion Models**, [paper]
Aman Shrivastava, P. Thomas Fletcher.
International Conference on Medical Image Computing and Computer Assisted Intervention, MICCAI 2023 | *Oral presentation*

[2] **CLIP-Lite: Information Efficient Visual Representation Learning from Textual Annotations**, [paper]
Aman Shrivastava, Ramprasaath R. Selvaraju, Nikhil Naik, Vicente Ordonez.
International Conference on Artificial Intelligence and Statistics. PMLR, 2023.

[3] **Identifying metabolic shifts in Crohn's disease using'omics-driven contextualized computational metabolic network models**, [paper]
Philip Fernandes, Yash Sharma, Fatima Zulqarnain, Brooklyn McGrew, Aman Shrivastava, Lubaina Ehsan, Dawson Payne, Lillian Dillard, Deborah Powers, Isabelle Aldridge, Jason Matthews, Subra Kugathasan, Facundo M FernÃąndez, David Gaul, Jason A Papin, Sana Syed.
Scientific Reports, 2023.

[4] **Estimating and Maximizing Mutual Information for Knowledge Distillation**, [paper]
Aman Shrivastava, Yanjun Qi, Vicente Ordonez.
IEEE CVPR Workshop on Fair, Data Efficient and Trusted Computer Vision, 2023.

[5] **Self-Attentive Adversarial Stain Normalization**, [paper]
Aman Shrivastava, Will Adorno, Lubaina Ehsan, S. Asad Ali, Sean R. Moore, Beatrice Amadi, Paul Kelly, Sana Syed, Donald Brown.
International Workshop on Artificial Intelligence for Digital Pathology, 25th International Conference on Pattern Recognition, Jan 10th, 2021 | Oral presentation

[6] **Deep Learning for Visual Recognition of Enteropathy and Celiac Disease**, [paper]
Aman Shrivastava, Karan Kant, Saurav Sengupta, Sung-Jun Kang, Marium Naveed Khan, S. Asad Ali, Sean R. Moore, Beatrice Amadi, Paul Kelly, Donald Brown, Sana Syed.
IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), May 19th, 2019 | Poster presentation

[7] **Cluster-to-Conquer: A Framework for End-to-End Multi-Instance Learning for Whole Slide Image Classification.**, [paper]
Yash Sharma, Aman Shrivastava, Lubaina Ehsan, Christopher A. Moskaluk, Sana Syed, and Donald E. Brown.
Medical Imaging with Deep Learning. PMLR, July 9, 2021 | Oral presentation

[8] **Improving interpretability via explicit word interaction graph layer**, [paper]
Arshdeep Sekhon, Hanjie Chen, Aman Shrivastava, Zhe Wang, Yangfeng Ji, and Yanjun Qi.
In Proceedings of the AAAI Conference on Artificial Intelligence, 2023

[9] **Artificial Intelligence Applied to Gastrointestinal Diagnostics: A Review**, [paper]
Vatsal Patel, Marium N. Khan, Aman Shrivastava, Kamran Sadiq, S. Asad Ali, Sean R. Moore, Donald E. Brown, Sana Syed.
Journal of Pediatric Gastroenterology and Nutrition, 2019

[10] **Solving the Stain Dilemma: Computational Image Analyses to Address Differential Tissue Staining Color Bias in Duodenal Biopsies**, [paper]
Sana Syed, Aman Shrivastava, Karan Kant, Luke Kang, Saurav Sengupta, Marium Naveed Khan, Najeeha Talat Iqbal, Kamran Sadiq, Christopher A. Moskaluk, Beatrice Amadi, Paul Kelly, Sean Moore, Donald Brown.
Digestive Disease Week (DDW), May 20th, 2019 | Poster presentation

[11] **Deep Learning for Detecting Diseases in Gastrointestinal Biopsy Images**, [paper]
Aman Shrivastava, Karan Kant, Saurav Sengupta, Sung-Jun Kang, Marium Naveed Khan, S. Asad Ali, Sean R. Moore, Beatrice Amadi, Paul Kelly, Donald Brown, Sana Syed.
Systems and Information Engineering Design Symposium, April 26th, 2019 | Invited talk

[12] **Team strategizing using a machine learning approach**, [paper]
Vignesh Rao, Aman Shrivastava
IEEE-International Conference on Inventive Computing and Informatics (ICICI), November 24th, 2017 | Invited talk

Interests and Competences

Interests: Generative Modeling, Multimodal learning, Computer Vision, Healthcare
Languages: Python, R, C++, Ruby, Julia, Javascript, LaTeX
Packages/Tools: PyTorch, Tensorflow, Keras, Git, AWS, GCP, MongoDB, Redis

Teaching Experience / Talks

Co-instructor, Geometry of Data, University of Virginia, [videos]	Fall 2023
Oral Presentation, MICCAI 2023	Fall 2023
Invited Speaker, Research Speaker Series, PathAI	Summer 2023
Teaching Assistant, Digital Signal Processing | Prof. Tom Fletcher, University of Virginia	Spring 2023
Teaching Assistant, Geometry of Data | Prof. Tom Fletcher, University of Virginia	Fall 2022
Teaching Assistant, Machine Learning | Prof. Yanjun Qi, University of Virginia	Spring 2022
Python Instructor, SOAR Scholars Program, University of Virginia	Spring 2021
Python Instructor, Health Sciences Library, University of Virginia	Spring 2020
Assistant Capstone Advisor, School of Data Science, University of Virginia	Fall 2019
Invited Speaker, Applied Machine Learning Conference, Tom Tom Festival	Fall 2018

Extra-curriculars

Chess: Represented UVA at Virginia State Collegiate Chess Championship 2023.
Editor-in-Chief: Geek Gazette, campus technical magazine, IIT Roorkee.
Coding Society: Information Management Group, an exclusive campus coding society, IIT Roorkee.
Quizzing Society Core-memeber of the IIT-R quizzing society, organised 20+ quizzes across campuses.