Jaspreet Ranjit

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RESEARCH INTERESTS

I am a Research Assistant in the **Vision, Language and Learning Lab**, working with **Prof. Vicente Ordóñez** on exploring biases in visual recognition models. I am interested in topics of fairness and explainability of machine learning models. Currently, I am a Master's student studying Computer Science at the University of Virginia.

EDUCATION

University of Virginia, Charlottesville, VA
Master of Science, Computer Science, December 2021
Advisor: Prof. Vicente Ordóñez
Thesis: Analyzing Gender Biases in Visual Recognition Models
Relevant Courses: Machine Learning, Vision and Language, Natural Language Processing, Algorithms, Cloud Computing, Geometry of Data, Machine Learning in Image Analysis

University of Virginia, Charlottesville, VA
Bachelor of Science, Computer Science, May 2021
Rodman Scholar: Top 5% of Engineering Class
Relevant Courses: Computer Science - Python, Java & C++/C, Analysis of Algorithms, Theory of Computation, Computer Architecture, Machine Learning, Artificial Intelligence, Human Computer Interaction in Software Development, Operating Systems, Probability, Linear Algebra, Ordinary Differential Equations

RESEARCH EXPERIENCE

The Vision, Language and Learning Lab at UVA — Charlottesville, VA
Machine Learning Research Assistant — Nov 2020 - Present
Advisor: Prof. Vicente Ordóñez
Focus: Developing a tool in Pytorch that analyzes the implicit feature representations of visual recognition models such as vision transformers and convolutional neural networks with respect to bias in datasets such as Coco and Openimages. This tool allows for comparison of implicit feature representations across different models and synthesizes this data for convenient comparison. Analyzed the impact of model characteristics such as: pretraining dataset, network architecture, and training setting on the representation of gender biases in the feature space. In collaboration with Columbia University: Prof. Baishakhi Ray *Thesis*, *Project Site*

UVA Engineering Link Lab — Charlottesville, VA
Machine Learning Research Assistant — Aug 2019 - Present
Advisor: Prof. Madhur Behl
Focus: Proposed a certification scheme to determine the level of safety and reliability which allows for safe market introduction of autonomous vehicles. Performed natural language processing analysis on caption data from Berkeley Deep Drive Dataset to extract high-level representations of traffic scenario videos. Aggregated the Traffic Scenario Similarity Dataset (TSS) which contains human ranking annotations for similarity between traffic scenarios. Prototyped multi-modal transformer networks in Pytorch for tagging traffic videos with labels. *Project Site*

UVA Aerospace Engineering Research Group — Charlottesville, VA
Machine Learning Research Assistant — Oct 2017 - Aug 2019
Advisor: Prof. David Sheffler
Focus: Developed a prototype of a 3D printed UAV that completes a mission autonomously using a Raspberry Pi and Pixhawk companion computer and designed machine learning programs for object recognition and communication in OpenCV for precise missions.

WORK EXPERIENCE

Vimeo New York, NY
Machine Learning Researcher on Search and Recommendations Jun 2021 - Aug 2021
Mentor: Silvena Chan
Analyzed gender biases in search and recommendation system and formulated a bias identification framework with the Rank Bias metric quantifying gender biases in ranked search results. Developed learning to rank (LTR) models in Pytorch using RankNet and LambdaMART, and developed an internal dataset for LTR models in private search. Worked with big data in Snowflake and wrote queries in SQL to scale bias experiments. *Medium Publication*

Minimally Invasive Spinal Technology Charlottesville, VA
Machine Learning Engineer and SWE Lead Oct 2019 - Aug 2020
Mentor: Alexander Singh
Worked as a lead Machine Learning Researcher to develop machine learning algorithms in Pytorch and Keras for the analysis and prediction of scoliosis using Unet++ and Centernet. Deployed this model for medical testing using Docker, AWS and Django. *Letter of Recommendation*

Expedition Technology Herndon, VA
Machine Learning Researcher Dec 2019 - Jan 2020
Mentor: Andrew Draganov
Researched novel semi-supervised framework for detecting out-of-distribution inputs. Implemented the OpenMax algorithm: a methodology to adapt deep networks for open set recognition - estimates the probability of an input being from an unknown class in Tensorflow. Investigated existing literature in the domain of Open Set Recognition and performed A-B testing.

Expedition Technology Herndon, VA
Machine Learning Engineer Jun 2019 - Aug 2019
Mentor: Cheryl Daner
Researched anchorless object detection techniques for 3D point cloud object detection. Designed a convolutional neural network on the basis of existing VoxelNet and CenterNet architectures in Tensorflow. *Summary of Work*

NASA Goddard Spaceflight Center Greenbelt, MD
Core Flight Software Engineer Jun 2018 - Aug 2018
Mentor: Alessandro Geist
Developed and benchmarked core Flight Software apps in C/C++ that directed AI image processing and command/telemetry with ground station. Worked with Xilinx Platform Studio and ISE Design Suite. *Summary of Work*

NASA Langley Research Center Hampton, VA
3D Printing Engineer Jun 2016 - Aug 2016
Mentor: Godfrey Sauti
Leveraged sensor technology to design and improve the dimensional integrity of a printed component using Pronterface. Designed 3D components in Inventor, and SketchUp. *Summary of Work*

PUBLICATIONS

Aron Harder, **Jaspreet Ranjit**, and Madhur Behl. 2021. Scenario2Vector: scenario description language based embeddings for traffic situations. *Proceedings of the ACM/IEEE 12th International Conference on Cyber-Physical Systems (ICCPS '21)*. Association for Computing Machinery, New York, NY, USA, 167–176. https://doi.org/10.1145/3450267.3450544

Draganov, A., Brown, C., Mattei, E., Dalton, C., & **Ranjit, J.** (2020). Open set recognition through unsupervised and class-distance learning. *Proceedings of the 2nd ACM Workshop on Wireless Security and Machine Learning, 7– 12.* https://doi.org/10.1145/3395352.3402901

Ranjit, J., Behl, Madhur (advisor), & Baritaud, Catherine (advisor) (2020). *Scenario2Vec: A Scenario Description Language to Characterize Traffic Scenarios for the Development of a Certification Scheme.* University of Virginia, School of Engineering and Applied Science, BS (Bachelor of Science), 2020: Charlottesville, VA. Retrieved from https://doi.org/10.18130/v3-16d9-gn66

PROJECTS & EXTRA

Cornell, Maryland, and Max Planck Pre-Doctoral Research School
Saarbrücken, Germany
Promising undergraduate and Masters students are invited to attend this program that provides an overview of the state of the art research in Computer Science.
Overview of Program

Society of Women Engineers Charlottesville, VA
Performed service projects at high schools in Charlottesville area to educate minority students about engineering opportunities

Rodman Scholar Charlottesville, VA
Academic honor awarded to top 5% of the engineering class

Project Clear Skies: UVA HooHacks Charlottesville, VA
Collaborated with Calvin Krist and Grady Roberts to develop a web app using RestAPI that aggregates real time data about a natural disaster from a variety of social media sources giving first responders the ability to perform rapid searches using key words and features. Leveraged Google Vision API and Tensorflow for image classification to provide an accurate assessment of the severity of disasters to reach victims and allocate resources more efficiently. *Code Release*

Save the Children: UVA Data Science Hackathon Charlottesville, VA
Prototyped transformer models in Pytorch for generating infrastructure damage values that can be applied to MDI's predictive analytics model in an effort to better help with displacement efforts due to disasters. Collaborated with Joshua Fitzpatrick to identify a framework for processing twitter data for disaster analytics. *Code Release*

Truly OpenML Charlottesville, VA
Led a team of four people to pitch a web application that provides a collaborative, intuitive and accessible platform for individuals who are passionate about learning machine learning (ML). Reached the semifinals at the American Evolution Innovator's Cup. *American Evolution Innovator's Cup: Semifinalist*

TECHNICAL SKILLS

Machine Learning: Tensorflow, Pytorch, Open CV, Numpy, Scikit-learn, Keras, Amazon Web Services
Software: Python, Java, C++, Snowflake, SQL, Django, Agile Methodologies, Git, Heroku, LaTeX

REFERENCES

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Assistant Professor
Department of Computer Science
University of Virginia
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