

Matthew Gwilliam

Curriculum Vitae



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RESEARCH PROJECTS

Analyzing and Improving Robustness of Self-supervised Learning

I built a toolkit for benchmarking and comparing the representations learned by different unsupervised algorithms for image representation learning. The manuscript was published at CVPR 2022.

Video Compression via Implicit Representation

I have contributed to papers that extend recent work that re-formulates video compression as a neural network compression problem. We extended the approach both in terms of improving its ability to generalize, as well as enabling it to perform video editing applications. One paper we wrote will appear as an Oral paper at BMVC 2022. Another is currently under review.

Rethinking Common Assumptions to Mitigate Racial Bias in Face Recognition Datasets

In collaboration with other students at the University of Maryland, I designed a suite of experiments to examine sources of bias within face recognition, for tasks such as person re-ID. We discovered that, contrary to the motivations for a substantial amount of prior work, balancing racial representation at the dataset-level does not result in equitable outcomes. We found and proposed suggestions for improving fairness in face recognition, specifically with respect to how datasets are organized. *As first author, I had the privilege to present on this work at the first Human-centric Trustworthy Computer Vision workshop at ICCV 2021, where it received the Best Paper runner-up (out of 23 submissions).*

Exploring Relationships Between Algorithms, Data, and Performance for Fine-grained Visual Categorization

During my undergraduate experience, I worked to identify the interplay between many factors for fine-grained visual categorization (FGVC) deep learning models. In my first work, *a first author paper at the Winter Conference on Applications of Computer Vision (WACV) in 2020*, I explored the way dataset composition affected performance. In a subsequent work, I demonstrated the extent of variance, at multiple levels, in results for FGVC methods, and, *as first author, I presented my findings at WACV 2021*. I later collaborated with other members in the lab to explore the complimentary nature of FGVC methods, and diagnose the source of their collective strengths and weaknesses.

WORK EXPERIENCE

Amazon Music

Applied Science Research Intern

I developed a proof-of-concept by adapting state-of-the-art computer vision and natural language processing techniques for music recommendations. I gained experience working with data in a different modality (music, rather than images or text), as well as using Apache Spark and AWS for manipulating and filtering large amounts of data for model training.

JUN 2021 – AUG 2021, AUG 2022 – CURRENT

EDUCATION

2020 – 2025 Doctor of Philosophy

3.7 GPA

Computer Science

University of Maryland, College Park

2014 – 2019 Bachelor of Science

MAGNA CUM LAUDE, 3.97 GPA

Computer Science

Brigham Young University

AWARDS

2020 GRFP Honorable Mention

National Science Foundation

SKILLS

TOOLS Python, PyTorch, NumPy, SciPy,
SQL, Javascript, HTML, CSS

LANGUAGES English, Spanish

PUBLICATIONS

Gwilliam, M., Shrivastava, A. (2022). Beyond Supervised vs. Unsupervised: Representative Benchmarking and Analysis of Image Representation Learning. CVPR 2022.

Chen, H., **Gwilliam, M.,** Lim, Ser-Nam, Shrivastava, A. (2022). HNeRV: A Hybrid Neural Representation for Videos. CVPR 2023.

Chen, H., **Gwilliam, M.,** He, B., Lim, Ser-Nam, Shrivastava, A. (2022). Beyond Supervised vs. Unsupervised: Representative Benchmarking and Analysis of Image Representation Learning. BMVC 2022.

Gwilliam, M., Hegde, S., Tinubu, L., Hanson, A. (2021). Rethinking Common Assumptions to Mitigate Racial Bias in Face Recognition Datasets. ICCV 2021 Workshop.

Gwilliam, M., Teuscher, A., Anderson, C., Farrell, R. (2021). Fair Comparison: Quantifying Variance in Results for Fine-grained Visual Categorization. WACV 2021.

Gwilliam, M., Farrell, R. (2020). Intelligent image collection: Building the optimal dataset. WACV 2020.

University of Maryland

Research Assistant

Working with my advisor, Dr. Abhinav Shrivastava, I published a paper analyzing and benchmarking methods for unsupervised image representation learning at CVPR 2022. I have also worked on implicit representation methods for video compression and editing, with a paper published at BMVC 2022 and another currently under review. I am currently continuing my work on unsupervised methods, this time with a method that analyzes network structure for both explainability and better performance on out-of-domain tasks.

SEP 2020 – MAY 2021, AUG 2021 – MAY 2022

University of Maryland

Teaching Assistant

I have participated in grading, running help sessions, substituting for lectures, holding office hours, and developing coursework. In addition to participating in exam design, my coursework responsibilities included developing several different assignments for the university's Introduction to Deep Learning course (CMSC 472).

SEP 2018 – AUG 2020

Qualtrics

Software Engineer

This role started as a part-time position while I was still a student. During this time, I designed, built, and deployed custom automations solutions. For one major project, I built a solution using Python that scraped data from hundreds of dashboards, with dozens of unique widgets. After graduation, I transitioned to fulltime work, where I helped maintain a text analysis pipeline and user interface.

JAN 2019 – DEC 2019

Brigham Young University

Research Assistant

As an undergraduate, I worked on fine-grained visual categorization (FGVC) under Dr. Ryan Farrell. I completed a project exploring interactions between algorithms and data for FGVC, described in greater detail in "Research Projects." As part of this work, I learned the basics of deep learning research: pre-requisite mathematical understanding, working with PyTorch, NumPy, GPUs, etc.

REFERENCES

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Dr. Ryan Farrell

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