Matthew Gwilliam

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RESEARCH STATEMENT

I want to help computers understand and do useful things with images and videos. During my PhD, I worked on image and video representation learning, including specific applications, like leveraging implicit neural representations (INRs) for video compression or predicting features for efficient diffusion image generation. Now, I work on unified modeling, designing vision encoders that simultaneously support multimodal generation and understanding at scale.

EDUCATION

University of Maryland, College Park | College Park, MD   **May 2025**
Ph.D. in Computer Science

Brigham Young University | Provo, UT   **Dec 2019**
B.S. in Computer Science

RELEVANT EXPERIENCE

TikTok | San Jose, CA   **May 2025 - Present**
Research Scientist
- Worked on image representation learning for classification and generation, discrete representations for multimodal understanding and generation, and compositional image generation; papers under review.

UMD, Department of Computer Science | College Park, MD   **Jun. 2021- May 2025**
Research Assistant, Teaching Assistant
- Working under Dr. Abhinav Shrivastava, wrote several papers and a thesis on representation learning.
- Mentored 3 PhD students and 7 undergrads, who collectively wrote 7 first author papers.
- Developed assignments for undergraduate deep learning (CMSC 472) and graduate computer vision courses.

NVIDIA | Remote   **May 2024 - Sep. 2024**
Computer Vision Research Intern
- Used predictive feedback to speed up image generation with diffusion models by 1.8x, paper under review.

SRI International | Princeton, NJ   **May 2023 - Dec. 2023**
Computer Vision Research Intern
- Designed data synthesis pipeline leveraging large language models (LLMs) for better long-form video understanding, publishing a paper (WACV) and patent pending (Python, NumPy, Kubernetes, Docker, PyTorch).

UpGrad and Smith School of Business (UMD) | College Park, MD   **Jan. 2023 - Mar. 2025**
Computer Vision Research Intern
- Developed, prepared, and recorded 8 hours of lecture material for a deep learning course; quarterly office hours.

Amazon Music | Atlanta, GA   **May 2022 - Aug 2022**
Applied Science Research Intern
- Proposed and built proof-of-concept transformer-based, autoregressive recommendation model (Spark, PyTorch).

SERVICE

Primary Workshop Organizer   [INRV @ CVPR 2024](#)
Conference Reviewer (CVPR, ECCV, ICCV, NeurIPS, ICLR)   **2022 - Present**
Graduate Student Representative, UMD CS Department Council   **Sep. 2024 - May 2025**
Peer Mentor   **Sep. 2023 - May 2025**

SELECTED PUBLICATIONS

Unified Image Representation Learning   *equal contribution*

- **Matthew Gwilliam**, Xiao Wang, Xuefeng Hu, Zhenheng Yang. "Implicit Neural Representation Facilitates Unified Universal Vision Encoding". Under review, 2025.
- Soumik Mukhopadhyay*, **Matthew Gwilliam***, Yosuke Yamaguchi**, Vatsal Agarwal**, Namitha Padmanabhan, Archana Swaminathan, Tianyi Zhou, Jun Ohya, and Abhinav Shrivastava. "Do text-free diffusion models learn discriminative visual representations?" **ECCV**, 2024.
- Soumik Mukhopadhyay*, **Matthew Gwilliam***, Vatsal Agarwal, Namitha Padmanabhan, Archana Swaminathan, Srinidhi Hegde, Tianyi Zhou, and Abhinav Shrivastava. "Diffusion Models Beat GANs on Image Classification". arXiv, 2023.
- **Matthew Gwilliam** and Abhinav Shrivastava. "Beyond Supervised vs. Unsupervised: Representative Benchmarking and Analysis of Image Representation Learning". **CVPR**, 2022.
- Vatsal Agarwal, **Matthew Gwilliam**, Gefen Kohavi, Eshan Verma, Daniel Ulbricht, Abhinav Shrivastava. "Towards Multimodal Understanding via Stable Diffusion as a Task-Aware Feature Extractor". Under review, 2025.

Implicit Neural Representation for Video Compression   *equal contribution*

- **Matthew Gwilliam**, Roy Zhang, Namitha Padmanabhan, Hongyang Du, Abhinav Shrivastava. "How to Design and Train Your Implicit Neural Representation for Video Compression". **WACV**, 2025.
- Namitha Padmanabhan*, **Matthew Gwilliam***, Pulkit Kumar, Shishira R Maiya, Max Ehrlich, and Abhinav Shrivastava. "Explaining the Implicit Neural Canvas: Connecting Pixels to Neurons by Tracing their Contributions". **CVPR**, 2024.
- Hao Chen, **Matthew Gwilliam**, Ser-Nam Lim, and Abhinav Shrivastava. "HNeRV: A Hybrid Neural Representation for Videos". **CVPR**, 2023.
- Shishira R Maiya*, Anubhav Gupta*, **Matthew Gwilliam**, Max Ehrlich, and Abhinav Shrivastava. "Latent-INR: A Flexible Framework for Implicit Representations of Videos with Discriminative Semantics". **ECCV**, 2024.
- Hao Chen, **Matt Gwilliam**, Bo He, Ser-Nam Lim, and Abhinav Shrivastava. "CNeRV: Content-adaptive Neural Representation for Visual Data". **BMVC**, 2022.

Diffusion for Image Generation

- Anirud Aggarwal, Abhinav Shrivastava, **Matthew Gwilliam**. "Evolutionary Caching to Accelerate Your Off-the-Shelf Diffusion Model". Under Review, 2025.
- **Matthew Gwilliam**, Han Cai, Di Wu, Abhinav Shrivastava, and Zhiyu Cheng. "Accelerate High-Quality Diffusion Models with Inner Loop Feedback". arXiv, 2025.

Fine-grained Visual Categorization

- **Matthew Gwilliam**, Adam Teuscher, Connor Anderson, and Ryan Farrell. "Fair Comparison: Quantifying Variance in Results for Fine-Grained Visual Categorization". **WACV**, 2021.
- **Matthew Gwilliam** and Ryan Farrell. "Intelligent Image Collection: Building the Optimal Dataset". **WACV**, 2020.
- Connor Anderson, **Matt Gwilliam**, Evelyn Gaskin, and Ryan Farrell. "Elusive Images: Beyond Coarse Analysis for Fine-Grained Recognition". **WACV**, 2024.

Miscellaneous (Multimodal Understanding, Machine Translation)

- Gautom Das, Vincent La, Ethan Lau, Abhinav Shrivastava, **Matthew Gwilliam**. Towards Understanding Best Practices for Quantization of Vision-Language Models. Under review, 2025.
- **Matthew Gwilliam**, Michael Cogswell, Meng Ye, Karan Sikka, Abhinav Shrivastava, and Ajay Divakaran. "A Video is Worth 10,000 Words: Training and Benchmarking with Diverse Captions for Better Long Video Retrieval". **WACV**, 2025.
- Eva Vanmassenhove, Dimitar Shterionov, and **Matthew Gwilliam**. "Machine Translationese: Effects of Algorithmic Bias on Linguistic Complexity in Machine Translation". **EACL**, 2021.