Allen Tu

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Allen Tu is a PhD student in Computer Science at the University of Maryland, College Park, advised by Professor Tom Goldstein. His research advances 3D/4D scene reconstruction, multimodal biometric recognition, and generative priors and uncertainty quantification for robust vision systems, with publications in top computer vision and machine learning venues.

Education

University of Maryland, College Park — College Park, MD
Ph.D. in Computer Science — *January 2025 – May 2027 (Expected)*

- Advised by Professor Tom Goldstein

M.S. in Computer Science — *August 2023 – December 2024*

- Advised by Professor Tom Goldstein

B.S. in Computer Science, Minor in Statistics — *August 2019 – December 2022*

- National Merit Scholarship Winner, President's Scholarship

Work Experience

University of Maryland Institute of Advanced Computer Studies — College Park, MD
Graduate Research Assistant — *August 2023 – Present*

- Advancing state-of-the-art methods that accelerate static and dynamic 3D Gaussian Splatting (3DGS) in rendering speed and training time while maintaining visual fidelity and reducing the number of primitives by 10× [1, 4, 5]
- Researching diffusion-based priors and multi-view super-resolution methods to produce high-quality 3D reconstructions from sparse and low-resolution inputs [3]
- Developing uncertainty quantification techniques for 3DGS and Neural Radiance Fields (NeRF) to ensure trustworthy downstream decision-making in real-world deployment scenarios [5]
- Enabled real-time, edge-device 3DGS rasterization on VR headsets, probed the memory efficiency of large language models (LLMs) via memorization, and implemented mixture-of-experts (MOE) heads for large vision encoders

Systems & Technology Research — Arlington, VA
Computer Vision Research Intern — *May 2025 – Present*

- Published an explainable transfer-learning framework for Face Image Quality Assessment (FIQA) that aligns recognizability with encoder geometry and enables frame filtering and weighting during template compilation [2]
- Achieved state-of-the-art template-based recognition performance on the BRIAR and IJB-C surveillance benchmarks, and extended the approach to body recognition with strong cross-domain generalization

Computer Vision Research Intern — *May 2024 – August 2024*

- Trained a face chip quality estimator via transfer learning, achieving a strong 0.8534 correlation with probe–to–gallery similarity measured in the host SWIN ViT embedding space, outperforming existing methods
- Designed a cluster-and-aggregate network that filters low-importance frame embeddings and fuses the remaining informative ones into a single video template, improving face recognition accuracy by up to 11.54%

Computer Vision Research Co-op — *January 2023 – August 2023*

- Developed a mixed-voting ensemble that improved open-set search performance by 24.24% for face, 39.18% for body, and 49.10% for fused multimodal recognition
- Trained a self-supervised Barlow Twins model robust to challenges like extreme distance variation and atmospheric interference, improving face recognition accuracy by 52.10% in severe operating conditions

Undergraduate Researcher College Park, MD
University of Maryland Department of Computer Science *January 2021 – December 2022*

- Designed an approach for controlling generative AI image quality and conducted a human subject study comparing perceptual judgments to metrics such as FID under Professor Tom Goldstein in Capstone in Machine Learning
- Implemented a video GAN that synthesizes realistic talking-head sequences from a single face image and speech audio under Dr. Raymond Tu as a Peer Research Mentor in FIRE: Capital One Machine Learning
- Analyzed 2.3M dataset–visualization pairs from the Plotly Community Feed to identify bias in visualization recommendation systems in Undergraduate Honors Seminar

Systems & Technology Research Woburn, MA
Computer Vision Research Intern *June 2022 – August 2022*

- Integrated pose estimation, neural novel-view synthesis, semantic segmentation, and generative inpainting to synthesize realistic cross-subject garment transfers with 12.93 FID and strong biometric identity preservation
- Augmented real training data with garment-transfer images to overcome limited garment diversity and train clothing-invariant whole-body recognition models, improving robustness to cross-garment variation

nCino, Inc. Wilmington, NC
Software Engineering Intern *June 2021 – August 2021*

- Resolved feature requests and defects across three nCino cloud banking packages using Java, JavaScript, and SQL
- Integrated Salesforce with five credit, loan, and insurance services using Informatica, REST, and SOAP interfaces
- Developed full regression test suites for nine packages to ensure backward-compatible deployments

Research Projects

IARPA Walk-through Rendering from Images of Varying Altitude
University of Maryland Institute of Advanced Computer Studies *August 2023 – Present*
Unconstrained 3D reconstruction and novel view synthesis in challenging real-world environments.

- Efficient rendering, compression, and training for 3D Gaussian Splatting (3DGS) [1, 4, 5]
- Multi-view consistent super-resolution for training 3DGS with low-resolution imagery [3]
- Image, video, and multi-view diffusion model priors for sparse-view 3D reconstruction
- Uncertainty quantification algorithms for 3DGS and Neural Radiance Fields (NeRF) [5]
- **PIs:** Professor Tom Goldstein, Professor Matthias Zwicker, Professor Abhinav Shrivastava, Dr. Abhay Yadav, Dr. Cheng Peng, Professor Rama Chellappa

IARPA Biometric Recognition and Identification at Altitude and Range
Systems & Technology Research *June 2022 – Present*
Multimodal, opportunistic fusion of incomplete face, body, and gait information in severe operational conditions.

- Transfer Learning for Face Image Recognizability Assessment (2025) [2]
- Learned Frame Feature Aggregation for Face Recognition with Low-Quality Video (2024)
- Operating Condition-Invariant Barlow Twins and Multimodal Ensembling (2023)
- Style-Based Appearance Flow for Clothing-Robust Body Representation Learning (2022)
- **PIs:** Dr. Joshua Gleason, Dr. Jennifer Xu, Dr. Nathan Shnidman, Dr. Mark Keck, Professor Vishal Patel, Professor Rama Chellappa

Teaching Experience

Peer Research Mentor College Park, MD
The First Year Innovation and Research Experience: Capital One Machine Learning *January 2021 – December 2022*

- Mentored 80 students across two cohorts in a three-semester introduction to machine learning research program accessible to freshmen from all backgrounds
- Developed and taught project-based assignments, tutorials, coding labs, and lectures on peer-reviewed ML research
- Advised student research teams on problem formulation, literature review, model development, implementation, and producing reproducible GitHub releases
- Supported these teams as they presented projects on text-to-audio generation, image super-resolution, and face-attribute recognition at FIRE Summit 2021 and 2022

Technical Skills

Languages: Python, CUDA, C/C++, Shell, Java, SQL, MATLAB

Libraries: PyTorch, TensorFlow, NumPy, SciPy, OpenCV, Matplotlib, scikit-learn, pandas, Unity

Research: 3D/4D Gaussian Splatting, Neural Radiance Fields (NeRF), Differentiable Rendering, Diffusion Models, Vision Transformers (ViT/Swin), Multimodal Encoders, Uncertainty Quantification, Super-Resolution, GPU Programming, Structure-from-Motion (SfM), Mixture-of-Experts (MoE), Large Language Models (LLMs), Virtual Reality (VR)

Selected Graduate Coursework: Advanced Computer Graphics, Advances in XR, Computational Geometry, Foundations of Deep Learning, Physically-based Modeling & Simulation & Animation, Natural Language Processing, Interactive Technologies in Human-Computer Interaction

Selected Undergraduate Coursework: Advanced Data Structures, Applications of Linear Algebra, Applied Probability and Statistics, Capstone in Machine Learning, Computer Vision, Database Design, Design and Analysis of Algorithms, Introduction to Data Science, Introduction to Machine Learning, Introduction to Parallel Computing, Introduction to Probability Theory, Introduction to Statistical Computation, Programming Language Technologies and Paradigms, Programming Handheld Systems (Android)

Publications

1. **Allen Tu***, H. Ying*, A. Hanson, Y. Lee, T. Goldstein, and M. Zwicker, 'SpeeDe3DGS: Speedy Deformable 3D Gaussian Splatting with Temporal Pruning and Motion Grouping'. *Under Review*, 2025.
2. P. Asthana, A. Hanson, **Allen Tu**, T. Goldstein, M. Zwicker, and A. Varshney, 'SplatSuRe: Selective Super-Resolution for Multi-view Consistent 3D Gaussian Splatting'. *Under Review*, 2025.
3. **Allen Tu**, J. Gleason, K. Narayan, J. Xu, M. Meyn, and V. Patel, 'TransFIRA: Transfer Learning for Face Image Recognizability Assessment'. *Under Review*, 2025.
4. A. Hanson, **Allen Tu**, G. Lin, V. Singla, M. Zwicker, and T. Goldstein, 'Speedy-Splat: Fast 3D Gaussian Splatting with Sparse Pixels and Sparse Primitives', in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2025, pp. 21537–21546.
5. A. Hanson*, **Allen Tu***, V. Singla, M. Jayawardhana, M. Zwicker, and T. Goldstein, 'PUP 3D-GS: Principled Uncertainty Pruning for 3D Gaussian Splatting', in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2025, pp. 5949–5958.

* denotes equal contribution.