Thomas W. Mitchel

https://www.mitchel.computer

Research Interests

Equivariant and geometric deep learning, computer graphics, and harmonic analysis with a particular focus on developing novel tools for analyzing, understanding, and manipulating 3D geometry.

Education

Johns Hopkins University • PhD & MSE • Mechanical Engineering 2022
Advisor: Michael Kazhdan
Thesis: Extending Convolution Through Spatially Adaptive Alignment

New York University • BA • Mathematics 2015
Magna Cum Laude

Work History

PlayStation • Sony Interactive Entertainment 2023 –
Senior Research Scientist
Technical lead for PlayStation's Geometric AI research group.

Google Research 2022 – 2023
Postdoctoral Fellow • Geometric AI
Host: Ameesh Makadia
Developed novel generative AI models for creating high-fidelity 3D textured assets.

Adobe Research 2021 – 2022
Research Intern • 2D & 3D Graphics
Mentors: Vladimir Kim & Noam Aigerman
Topics: Equivariant surface CNNs for shape and image analysis, diffusion models for shape generation

Papers

[1] **Neural Isometries: Taming Transformations for Equivariant ML**
T. W. Mitchel, M. Taylor, V. Sitzmann
NeurIPS, 2024

[2] **Single Mesh Diffusion Models with Field Latents for Texture Generation**
T. W. Mitchel, C. Esteves, A. Makadia
CVPR, 2024

[3] **Möbius Convolutions for Spherical CNNs**
T. W. Mitchel, N. Aigerman, V. G. Kim, M. Kazhdan
ACM SIGGRAPH, 2022

[4] **Extending Convolution Through Spatially Adaptive Alignment**
T. W. Mitchel
PhD Thesis, Johns Hopkins University, 2022

[5] **Field Convolutions for Surface CNNs**
T. W. Mitchel, V. G. Kim, M. Kazhdan
International Conference on Computer Vision (ICCV), 2021
Selected for Oral Presentation

[6] **ECHO: Extended Convolution Histogram of Orientations For Local Surface Description**
T. W. Mitchel, S. Rusinkiewicz, G. S. Chirikjian, M. Kazhdan
Computer Graphics Forum, 2021

[7] **Continuous Body 3D Reconstruction of Limbless Animals**
Q. Fu[†], T. W. Mitchel[†], J. S. Kim, G. S. Chirikjian, C. Li
[†]*Equally contributing authors*
Journal of Experimental Biology, 2021

[8] **Efficient Spatially Adaptive Convolution and Correlation**
T. W. Mitchel, B. Brown, D. Koller, T. Weyrich, S. Rusinkiewicz, M. Kazhdan
arXiv, 2020

[9] **Quotienting Impertinent Camera Kinematics for 3D Video Stabilization**
T. W. Mitchel, C. Wüelker, J. S. Kim, S. Ruan, G. S. Chirikjian
ICCV 2019 Advances in Image Manipulation Workshop

[10] **Snakes Partition Their Body to Traverse Large Steps Stably**
S. W. Gart, T. W. Mitchel, C. Li
Journal of Experimental biology, 2019

[11] **Improving the Propulsion Speed of a Heaving Wing Through Artificial Evolution of Shape**
S. Ramananarivo, T. W. Mitchel, L. Ristroph
Proceedings of the Royal Society A, 2019

Invited Talks

Möbius Convolutions for Spherical CNNs
SIGGRAPH 2022 Oral Presentation — Vancouver, BC • Aug 2022

Transformation-Aware Convolutions for Image and Shape Analysis
Apple — Cupertino, CA (Virtual) • July 2023
Roblox Research — San Mateo, CA (Virtual) • Sept 2022
Sony Research — San Jose, CA (Virtual) • Sept 2022
Google Research — New York, NY (Virtual) • July 2022

CAM Initiative, UChicago — Chicago, IL (Virtual) • June 2022
Dynamic Graphics Project, UToronto — Toronto, ON • May 2022
NVIDIA AI — Toronto, ON (Virtual) • April 2022
GeoVic Group, Ecole Polytechnique — Paris, France (Virtual) • April 2022
Mathematical Data Science Group, JHU — Baltimore, MD • March 2022
Qualcomm Research — San Diego, CA (Virtual) • Feb 2022
Amazon Research — Sunnyvale, CA (Virtual) • Feb 2022
Adobe Research — San Jose, CA (Virtual) • Dec 2021

Field Convolutions for Surface CNNs
ICCV 2021 Oral Presentation — (Virtual) • Oct 2021

A Novel 3D Full Body Model of Snake Locomotion in Complex 3D Terrain
APS March Meeting — Los Angeles, CA • March 2018

Snakes Traversing Large Step Obstacles: Kinematics and Mechanics
Society for Integrative and Comparative Biology — San Francisco, CA • Jan 2018

Teaching

Johns Hopkins University • Teaching Assistant

EN.601.457/657 Computer Graphics — Fall 2020 – 2021
EN.601.454/654 Alternate Reality — Spring 2021
EN.601.459/659 Computational Geometry — Spring 2020
EN.530.645 Kinematics — Spring 2019
EN.530.653 Advanced Systems Modeling — Fall 2018

Service

Reviewer CVPR, NeurIPS, ICLR, SIGGRAPH, SIGGRAPH Asia, PAMI

Software

TS2Kit
Lightweight library for differentiable spherical harmonic transforms in PyTorch
https://github.com/twmitchel/TS2Kit

ECHO Descriptors
C++ library for intrinsic surface feature descriptors
https://github.com/mkazhdan/ECHODescriptors

Skills

Programming Python, C++
Libraries JAX, PyTorch, Eigen, CMake, OpenGL, Pybind, OpenCV
Tools Linux, MATLAB, Mathematica, LaTeX
Theoretical Lie Groups, Differential Geometry, FFTs, Neural Networks