

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 3D 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.

Johns Hopkins University 2016 – 2022

GRADUATE RESEARCHER

Topics: Equivariant deep learning on surfaces, feature descriptors, video stabilization, time series analysis, snake locomotion

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

New York University 2013 – 2015

UNDERGRADUATE RESEARCHER

Mentor: Leif Ristroph

Topic: Propulsive fluid dynamics of flapping wings

PAPERS

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

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, 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** C++, Python
 Libraries JAX, PyTorch, Eigen, CMake, OpenGL, Pybind, OpenCV
 Tools Linux, MATLAB, Mathematica, \LaTeX
 Theoretical Lie Groups, Differential Geometry, FFTs, Neural Networks
 Experimental High-Speed Video, 3D Tracking & Reconstruction