

# Maximillian K. Machado

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## Summary

**Interpretable deep learning researcher** focused on strengthening the methodological foundations of interpretable neural networks and cancer risk prediction in mammography:

- My recent work investigates how angular relationships in latent representations influence fine-grained image recognition, revealing mechanistic insights uniquely accessible to interpretable models [1].
- I develop visualization frameworks and evaluation protocols that rigorously link learned concepts to model decisions.
- My long-term goal is to advance foundational standards for ante-hoc interpretability in high-stakes domains.

## Education

### Duke University

PhD in Computer Science

MS in Computer Science, GPA: 3.96

Durham, NC

2026 – Present

2024 – 2026 (Expected)

### Lehigh University

BS in Computer Science, Major GPA: 3.97; GPA: 3.79

Minors: Data Science, Entrepreneurship

Bethlehem, PA

August 2018 – May 2022

## Honors & Awards

- 2024 **Adobe GEM Fellowship** – Adobe (full MS graduate tuition)
- 2024 **Sloan Affiliate** – Duke University
- 2022 **Magna Cum Laude** – Lehigh University
- 2021 **Membership** – Tau Beta Pi Honor Society
- 2021 **Membership** – Upsilon Pi Epsilon Honor Society
- 2020 **Baker Entrepreneurial Fellow** – Lehigh University (nominated by faculty)
- 2019 **1st Place Winner Eureka! Ventures Competition** – Baker Institute

## Publications

- [1] Luke Moffett, Frank Willard, **Maximillian Machado**, Emmanuel Mokel, Jon Donnelly, Zhicheng Guo, Adam Costarino, Julia Yang, Giyoung Kim, Alina Jade Barnett, and Cynthia Rudin, “Cosine similarity is *Almost* all you need (for prototypical-part models),” in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, **Oral presentation**, 2026.
- [2] **Maximillian Machado**, Ran Ran, and Liang Cheng, “Embedded crowdsensing for pavement monitoring and its incentive mechanisms,” in *Machine Learning under Resource Constraints – Applications*, **Book chapter**, De Gruyter, 2023.

## Research Experience

### Interpretable Machine Learning Lab

Research Assistant: Dr. Cynthia Rudin

Durham, NC

January 2025 – Present

- Develop novel initialization strategy for interpretable neural networks, reducing over-regularization of explanations.
- Curate full-field digital mammography datasets for any pathology, breast cancer risk prediction.

### Nano-Human Interfaces Laboratory

Research Assistant: Dr. Brian Chen and Dr. Martin Harmer

Bethlehem, PA

May 2021 – May 2022

- Predicted anomalies in material microstructures using graph convolutional neural networks with 84% accuracy.
- Developed a pipeline for Monte Carlo simulations in a high-performance computing cluster.

## Learning and Optimization on Networks and Graphs Laboratory

Research Assistant: Dr. Liang Cheng

Bethlehem, PA

April 2020 – May 2021

- Introduced 10 novel game-theoretical incentive mechanisms for federated learning crowdsensing platforms.
- Developed and analyzed a crowdsensing simulation in C++ to evaluate incentive mechanism for 11 million scenarios.

## ATLSS Engineering Research Center

Research Experience for Undergraduates (REU)

Bethlehem, PA

May 2020 – August 2020

- Deployed a MobileNet-SSD model to detect 8 road degradation classes with 60% confidence and geotagged outputs.
- Contributed to the published technical report and presented the project at the CIAMTIS conference.

## Work Experience

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### Adobe Inc

Data Scientist Intern – Firefly GenAI Product

San Jose, CA

May 2025 – August 2025

- Implemented a user segmentation framework for flagship generative AI products with 30M users and 40B prompts.
- Developed a novel prompt complexity metric for analyzing the linguistic complexity of prompts.
- Collaborated with business partners on user win-back campaigns and causal study opportunities (A/B tests).

### Adobe Inc

Data Scientist Intern – Express Product

San Francisco, CA

May 2024 – August 2024

- Built interpretable data mining models for customer satisfaction (CSAT) patterns across 1PB of behavioral data.
- Identified 5-key product recommendations targeting a 12% lift in customer retention.
- Deployed dashboards in Amplitude for real-time monitoring of project Objectives and Key Results (OKRs).

### Ernst & Young LLP

Technology Consultant

New York City, NY

July 2022 – April 2024

- Designed system diagrams for a multi-billion-dollar client across 6 product verticals on a monthly release cadence.
- Collaborated with 10 developers to build an event-driven model execution platform with serverless AWS.
- Developed ETL pipeline proof-of-concept for onboarding financial data for internal risk models.

## Teaching Experience

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### Duke University

Graduate Teaching Assistant – Theory & Algorithms for Machine Learning (CS 671) August 2025 – December 2025

Durham, NC

- Designed homework problems, quizzes, and exam questions covering fundamental machine learning topics.
- Taught lectures on neural networks and led weekly discussion groups with office hours.

### Duke University

Graduate Teaching Assistant – Data Science (CS 526)

Durham, NC

August 2024 – May 2024

- Taught lectures on model regularization with interactive Jupyter notebook demonstrations.
- Mentored 8 teams of graduate students in conducting data-driven analysis and organized final project judge panel.

### Lehigh University

Teaching Assistant – Software Engineering (CSE 216)

Bethlehem, PA

January 2021 – May 2022

- Mentored 15 teams of upper-class students, or 75 students, in weekly Agile stand-ups.
- Facilitated working sessions about OAuth2.0, design patterns, database design for audiences of 100.

### Lehigh University

Teaching Assistant – Applied Engineering Computer Methods (ENGR 010)

Bethlehem, PA

August 2019 – May 2020

- Taught 8 recitations, with an audience size of 40, covering Arduino programming for digital/analog IO devices.
- Graded 80 code submissions per week and judged 20 final project submissions for water pumps and assembly lines.

## Technical Skills

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**Machine Learning:** Python, PyTorch, TensorFlow, PySpark, NumPy, Databricks, R, SQL, Weights & Biases

**CI/CD:** Docker, Kubernetes, Jenkins, GitLab, Proxmox, OpenShift, AWS CodePipeline, Grafana

**Application:** Git, C++, JavaScript, Bootstrap, TypeScript, React, Prime React, Plotly.js, Vue, Java, NGINX

## Projects

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### Smart COPD Patient Monitoring System

[smartcopd.mkmachado.com](https://smartcopd.mkmachado.com)

*Technologies: Vue.js, Java Spark, Python Flask, PostgreSQL*

- Prototyped a hospital readmittance risk classifier for COPD patients with a 75% F1 score.
- Led a team of 4 developers in a collaboration with the University of Toledo and Worcester Polytechnic Institute.
- Adapted off-the-shelf devices for reading biometric data using Raspberry PI GPIO and analog sensors.

### TrussNet

[mkmachado.com/projects](https://mkmachado.com/projects)

*Technologies: Java*

- Developed platform for predicting incoming undergraduate students' interests and promoting relevant career paths.
- Interviewed administration from Lehigh University, Moravian University, and Northampton Community College.
- Winner of the Baker Institute's Eureka! Ventures Pitch Competition, Stage 1 (June 2019) and Stage 2 (July 2019).

### Home Lab

[mkmachado.com/homelab](https://mkmachado.com/homelab)

*Technologies: Proxmox, pfSense, GitLab, NGINX*

- Operate a self-built home lab running web services, game servers, bots, IoT experiments, and development tools.
- Utilize reverse proxies, Dynamic DNS, and VPN interfaces to securely route SSL-encrypted web service traffic.

### QoLab (MIT Hackathon '20)

[qolab.mkmachado.com](https://qolab.mkmachado.com)

*Technologies: Vue, Django*

- Built Lo-Fi beats synchronous streaming app to help students simulate studying together in a virtual environment.
- Prototyped frontend UX wireframe with 12 potential users and implemented UI using Vue JavaScript library.

## Interests

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Interpretable Machine Learning, Coffee, rock climbing, Spanish classical guitar, AI Safety, The Manifold Hypothesis.