

Matthew I. Swindall, PhD

AI/ML Researcher | Computer Scientist | Physicist

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Professional Profile

Accomplished AI and machine learning researcher with a background in physics and astronomy. My research focuses on interdisciplinary applications of AI. Specifically, my work bridges the gap between state-of-the-art technologies and ancient literary texts utilizing technologies including Handwritten Text Recognition (HTR/OCR), Natural Language Processing (NLP), and statistical analysis. While much of my research focuses on the field of papyrology, the work is broadly applicable to computer vision and language modeling research. I am the creator of the AL-PUB dataset, a large-scale, crowdsourced image dataset containing Greek characters on ancient papyri. This dataset is available on Kaggle and has been used in several deep learning research projects. Other research projects include blockchain and smart contracts for digital edition management, as well as projects involving transfer learning and generative AI. I am also interested in the application of AI and Machine Learning to other fields such as physics, chemistry, and astronomy. Additional interests include robotics, quantum computing, HPC, and GPU clusters.

Skills

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| • Deep Learning | • Natural Language Processing | • Astronomy |
| • Machine Learning | • Generative AI | • Unix/Linux, Bash |
| • Computer Vision | • Cloud Computing (GCP, AWS) | • Cluster Computing |
| • TensorFlow & PyTorch | • Advanced Calculus | • Linear Algebra |
| • Statistics | • Physics | • Robotics |
| • Chemistry | • Micro-Controllers | • Python, C, C++, SQL |
| • Angular & Flask | • Blockchain (Ethereum) | • STEM Education |
| • Data Science | • Smart Contracts (Solidity) | • Parallel Processing |
| • HTML, CSS, PHP | • JavaScript, TypeScript | • Git, Github, Docker |

Education

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| • PhD in Computational Science | Middle Tennessee State University |
| • Master of Science in Computer Science | Middle Tennessee State University |
| • Bachelor of Science in Physics | Middle Tennessee State University |
| • Associate of Science in Physics | Columbia State Community College |

Publications

Conference Articles with Presentations

- **“Smart Digital Edition Management: A Blockchain Framework for Papyrology”**. Matthew I. Swindall, Kritagya Upadhyay, James H. Brusuelas, Graham West, John F. Wallin. *Accepted* to the ACM SIGMIS Computers and People Research Conference. Murfreesboro, TN. May 29, 2024.
- **“Towards a Platform for AI-Assisted Papyrology”**. Matthew I. Swindall, Graham West, James H. Brusuelas, Alex C. Williams, and John F. Wallin. Past Meets Future Workshop on Human-AI

Interaction for Digital History and Cultural Heritage at the 29th ACM Conference on Intelligent User Interfaces. Greenville, SC. March 18, 2024.

- **“Crowdsourcing Image Datasets: An Examination of Ground-Truth in Labeling, Text Segmentation, & Sampling Bias”**. Matthew Swindall. In the Tenth AAAI Conference on Human Computation and Crowdsourcing Doctoral Consortium, November 6, 2022.
- **“Dataset Augmentation in Papyrology with Generative Models: A Study of Synthetic Ancient Greek Character Images”**. Matthew Swindall, Timothy Player, Ben Keener, Alex C. Williams, James H. Brusuelas, Federica Nicolardi, Marzia D’Angelo, Claudio Vergara, Michael McOsker, John F. Wallin. In 2022 Proceedings of the Thirty-First International Joint Conference on Artificial Intelligence, pages 4948-4954. IJCAI. Vienna, Austria. July 28, 2022.
- **“Exploring learning approaches for ancient Greek character recognition with citizen science data”**. Matthew I. Swindall, Gregory Croisdale, Chase C. Hunter, Ben Keener, Alex C. Williams, James H. Brusuelas, Nita Krevans, Melissa Sellew, Lucy Fortson, and John F. Wallin. In 2021 17th International Conference on eScience (eScience), pages 128– 137. IEEE. Innsbruck, Austria (virtual). September 22, 2021.

Peer-Reviewed Journal Articles

- **“Incorporating Crowdsourced Annotator Distributions into Ensemble Modeling to Improve Classification Trustworthiness for Ancient Greek Papyri”**. Graham West, Matthew Swindall, Ben Keener, Timothy Player, Alex C. Williams, James H. Brusuelas, John F. Wallin. In Historical Documents and automatic text recognition, Journal of Data Mining & Digital Humanities (JDMDH), 2023

Additional Conference & Seminar Presentations

- **“Generative AI and Higher Education”**. John F. Wallin, Matthew I. Swindall, Isaac Shirk. Middle Tennessee State University AI Initiative Research Conference. Murfreesboro, TN. November 10, 2023.
- **“Understanding Ancient Manuscripts Using Crowdsourcing and Data Science”**. Matthew I. Swindall, Graham West, James H. Brusuelas, John F. Wallin. AWS Human-in-the-Loop Science Summer Seminar Series. Presented virtually. August 17, 2023.
- **“A.I.-Assisted Papyrology: Integrating Deep Learning into the Scholarly Workflow”**. Matthew I. Swindall, Graham West, James H. Brusuelas, John F. Wallin. Alpha, Aleph, and AI: Languages of the Ancient Mediterranean and Near East Conference. Bristol, United Kingdom. June 14, 2023.
- **“Crowd-sourced Datasets and Deep Learning”**. John F. Wallin, Matthew I. Swindall, Graham West, James H. Brusuelas. American Mathematical Society, Special Session on Methods and Applications in Data Science – El Paso, Texas September 17, 2022.
- **“Dataset Augmentation in Papyrology with Generative Models: A Study of Synthetic Ancient Greek Character Images”**. Matthew I. Swindall. Middle Tennessee State University Scholars Day. Murfreesboro, TN. March 22, 2022.

Internships & Honors

- La Serena School for Data Science Class of 2021 - NFS and CMM/UCHile funded Data Science for Astronomy Program in partnership with NOIRLab/AURA-O.
- MTeach Summer Internship 2016 – STEM teaching internship in partnership with the Discovery Center at Murfree Spring.

Employment

2019 – 2024

Middle Tennessee State University

Graduate Assistant

Management of various computational projects. Project components include deep learning models, Optical Character Recognition (OCR) and computer vision, semantic segmentation, micro-controllers (Arduino), microcomputers (Raspberry Pi, Jetson Nano), electrical circuits, robotics, coding, object detection/recognition, 3D printing, laser etching/cutting, and augmented/virtual reality.

Key Responsibilities

- Design & Prototype STEM demonstrations and institutional hardware/software tools.
- Special projects involving software development and AI/ML workflows.
- Equipment training and technology coaching.
- Systems repair and maintenance.
- Curation of technology exhibits.

Key Achievements

- Designed & curated numerous STEM exhibits including a Lego block sorting robot, a Bluetooth enabled LED text sign with Android app, and a real-time object detection/segmentation exhibit.

2015 – 2016

Middle Tennessee State University

Physics & Astronomy Tutor

Tutored students in departmental courses.

Key Responsibilities

- Tutored physics students.
- Tutored astronomy students.
- Assisted other departments including chemistry and engineering.

Key Achievements

- Tutored numerous students in my expertise areas, as well as advanced mathematics, chemistry, and engineering.

2006 – 2013

First Tennessee Bank

Teller III

Award winning bank teller and trainer with extensive branch operations experience.

Key Responsibilities

- AML/BSA Compliance
- Staff training
- Foreign Exchange
- Vault & ATM control and maintenance
- Account Management
- Branch auditing

Key Achievements

- Numerous awards including the FTB Presidents Award