Matthew I. Swindall, Ph.D.

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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.

Education

Ph.D. Computational Science	Middle Tennessee State University
M.S. Computer Science	Middle Tennessee State University
B.S. Physics	Middle Tennessee State University
A.S. Physics	Columbia State Community College

Skills

AI/ML Concepts	Deep Learning, Neural Networks, Convolutional Neural Networks, Recurrent Neural Networks, Generative Adversarial Networks, Reinforcement Learning, Transfer Learning, Autoencoders, Transformers
AI/ML Libraries	TensorFlow, PyTorch, Keras, SciKitLearn, spaCy, BERTopic, NLTKs
Computer Science	Unix/Linux, Parallel processing, cluster computing (SLURM), Ethereum Blockchain & Smart Contracts, Neo4j (Graph Database)
Coding Languages	Python, C/C++, R, JavaScript, HTML, CSS, SQL, Solidity, Cypher
Python Libraries	NumPy, Pandas, Scikit-Learn, SciPy, Matplotlib, OpenCV
Mathematics	Linear Algebra, Calculus, Differential Equations, Probability, Statistics
Physical Sciences	Physics, Astronomy, Chemistry, Engineering, Electronics
Additional Technical	Iot, Raspberry Pi, Arduino, Robotics, 3D Printing, CAD, CNC
Soft Skills	Research, Publications, Public Speaking, Teaching, Science Outreach, Technical Writing, Project Management, Team Leadership

Internships & Honors

- **La Serena School for Data Science, Class of 2021** NFS & 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.

Refereed conference proceedings

- Graham West, Matthew I. Swindall, James H. Brusuelas, Francesca Maltomini, Marius Gerhardt, Marzia D'Angelo, John F. Wallin. A deep learning pipeline for the palaeographical dating of ancient Greek papyrus fragments. in the Machine Learning for Ancient Languages (ML4AL) Workshop at the 62nd Annual Meeting of the Association for Computational Linguistics (ACL). 2024
- Swindall, M. I., Upadhyay, K., Brusuelas, J. H., West, G., & Wallin, J. F. (2024, May). Smart Digital Edition Management: A Blockchain Framework for Papyrology. Proceedings of the 2024 Computers and People Research Conference. https://doi.org/10.1145/3632634.3655860
- Swindall, M. I., West, G., Brusuelas, J. H., Williams, A. C., & Wallin, J. F. (2024, March). Towards a Platform for AI-Assisted Papyrology. The Tenth AAAI Conference on Human Computation and Crowdsourcing Doctoral Consortium.
- Swindall, M. I., West, G., Brusuelas, J. H., & Wallin, J. F. (2022, November). Crowdsourcing Image Datasets: An Examination of Ground-Truth in Labeling, Text Segmentation, & Sampling Bias. The Tenth AAAI Conference on Human Computation and Crowdsourcing Doctoral Consortium.
- Swindall, M., Player, T., Keener, B., Williams, A., Brusuelas, J., Nicolardi, F., D'Angelo, M., Vergara, C., McOsker, M., & Wallin, J. (2022). Dataset Augmentation in Papyrology with Generative Models: A Study of Synthetic Ancient Greek Character Images. 4948–4954.
- Swindall, M. I., Croisdale, G., Hunter, C. C., Keener, B., Williams, A. C., Brusuelas, J. H., Krevans, N., Sellew, M., Fortson, L., & Wallin, J. F. Exploring Learning Approaches for Ancient GreekCharacter Recognition with Citizen Science Data. 2021 17th International Conference on EScience (EScience), 128–137.

Refereed journal Articles

- West, G., Swindall, M. I., Keener, B., Player, T., Williams, A. C., Brusuelas, J. H., & Wallin, J. F. (2024). Incorporating Crowdsourced Annotator Distributions into Ensemble Modeling to Improve Classification Trustworthiness for Ancient Greek Papyri. Journal of Data Mining & Digital Humanities, Documents historiques et reconnaissance automatique de texte. https://jdmdh.episciences.org/12958

Invited Talks

- **Understanding Ancient Manuscripts Using Crowd-sourcing 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.
- **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.
- **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.
- **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.

Certifications

- **Neo4j Graph Database** Certified Professional

Employment

Graduate Assistant 2019 - 2024 Middle Tennessee State University

- Management of various computational projects involving Optical Character Recognition (OCR) and object detection/recognition, semantic segmentation, micro-controllers, microcomputers, electrical circuits, robotics, 3D printing, laser etching/cutting, and augmented/virtual reality.
- Design & Prototype STEM demonstrations and institutional hardware/software tools.
- Equipment training and technology coaching.
- 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.

Physics & Astronomy Tutor 2015 - 2016 Middle Tennessee State University

- Tutored students in physics courses including Calculus-Based Physics 1 and 2, Electricity and Magnetism, and Classical Mechanics.
- Tutored students in astronomy courses including Introductory Astronomy, Solar System Astronomy, and Stars Galaxies and Cosmology.
- Tutored students in first year chemistry courses (Chemistry 1 and 2).
- Tutored students in advance mathematics courses including Calculus 1, 2, and 3.

Teller 3 2007 - 2013 First Tennessee Bank

- AML/BSA Compliance, Vault & ATM control and maintenance, Account Management
- Foreign Exchange, Branch auditing, Staff training
- Operated single-person satellite branch performing all banking related duties of a nearly-full-service branch.
- Won numerous awards including the FTB Presidents Award.