Emma N. Bennett

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EDUCATION

Ph.D. in Computer Science, University of Missouri — Expected May 2028

M.S. in Computer Science; Graduate Certificate in Data Science, University of Missouri – GPA: 4.00 — May 2025

B.S. in Chemical Engineering; Minor in Mathematics, University of Missouri – GPA: 3.83 — May 2019

RESEARCH EXPERIENCE

Graduate Research Assistant, MAVI Research Lab, University of Missouri — Jan. 2024–Present

Advisor: Filiz Bunyak | Computer vision, graph learning, scientific machine learning

Graph-based localization — Aerial localization with U.S. Army ERDC collaborators

- Created graph-attribute encoding and sparse graph integral histograms for GNSS-denied aerial localization; accelerated search by more than 2,000× on reference graphs exceeding 150,000 nodes.
- Evaluated localization against a GNN baseline on four benchmarks: Massachusetts, WHU, INRIA, and SpaceNet 7.
- Led a first-author journal article accepted by Journal of Applied Remote Sensing and presented related work in two SPIE conf. talks.
- Led first-author conference article in quantum-enhanced graph localization at Intl. Joint Conference on Neural Networks (IJCNN)

Digital agriculture — UAV point-cloud soybean leaf area index estimation

- Developed parameter-efficient 2.5D CNN inference for soybean leaf area index ($R^2 \approx 0.90$); compared CNN, ViT, PointNet++, and PointNeXt on common train/test partitions.
- Validated ground normalization and plot/field/date splits for 1,199 tiles from 13 UAV flights; deployed preprocessing as a Kubernetes batch Job on NSF NRP Nautilus with Docker and CephFS/S3.

Graph tracing — Carbon-nanotube tracing from microscopy

- Designed a PyTorch Geometric successor-choice model with directed anisotropic neighborhoods and image-disjoint splits across 27 synthetic regimes (27 synthetic regimes ~100 GB).
- Containerized Nautilus workflows for training, storage, and experiment tracking.

Research Intern, MU Quantum Innovation Center — June–Aug. 2025

- Ran custom 8-qubit circuits on IBM Brisbane via Qiskit Runtime and trained 4-qubit node-level circuits in PennyLane for hybrid quantum-classical graph localization.
- Created an approximately 8,600-window perturbation testbed; improved Recall@1/5 by 10–20 points over classical baselines under moderate-to-heavy graph noise (IJCNN 2026).

PUBLICATIONS

Bennett, E., Shojaei, S., Arredondo, J. R., Sava, E., Massaro, R. D., Palaniappan, K., & Bunyak, F. "Graph Attribute Encoding and Sparse Graph Integral Histograms for Efficient Aerial Localization." *Journal of Applied Remote Sensing*, 20(4), 041604 (2026).

Bennett, E., Massaro, R. D., & Bunyak, F. "Integrating Quantum Feature Maps into Graph Neural Networks for Robust Visual Localization." *International Joint Conference on Neural Networks (IJCNN)*, 2026.

Bennett, E., Arredondo, J. R., Sava, E., Massaro, R. D., Palaniappan, K., & Bunyak, F. "Bag-of-Graph-Attributes and Sparse Graph Structures for Efficient UAV Localization in Complex Environments." *SPIE Defense + Commercial Sensing: Geospatial Informatics XV*, 2025.

Winterton, T., **Bennett, E.**, Atmaca, B. C., Shojaei, S., Palaniappan, K., & Bunyak, F. "Aerial Visual Localization Through Novel Applications of Weisfeiler–Lehman Graph Embeddings." *SPIE Defense + Commercial Sensing: Geospatial Informatics XV*, 2025.

Shojaei, S., Tousi, S. M. A., **Bennett, E.**, Sangani, P., Shiri Sichani, A., Ersoy, I., Ali-Akbarpour, H., Bunyak, F., & DeSouza, G. N. "Quantum-Enhanced Similarity Measures for Polarimetric Materials Classification." *arXiv:2606.07766*, 2026.

TEACHING EXPERIENCE

Graduate Teaching Assistant, University of Missouri — Aug. 2024–Present

Fall 2026 — CMP_SC 4320, Software Engineering I

- Support instruction in requirements, design, implementation, testing, maintenance, project management, peer review, and software QA.

Spring 2025 — CMP_SC 2050, Algorithm Design and Programming II

- Co-led weekly labs and exam-review sessions for a course enrolling ~ 110 students; held office hours, graded programming work, and proctored exams as one of five TAs.
- Guided students through memory, abstract data types, recursion, linked structures, sorting/searching, trees, and asymptotic analysis.

Fall 2024 — CMP_SC 4050/7050, Design and Analysis of Algorithms I

- Supported ~ 45 undergraduate and graduate students as one of two TAs through office hours, grading, and course communication. Curriculum included graph-based and greedy algorithms, dynamic programming, and computational tractability.

RESEARCH MENTORING AND OUTREACH

Undergraduate Research Mentor, Graph-Based Aerial Localization — 2024-2025

- Mentored undergraduate in graph-based aerial-localization research and manuscript preparation, culminating in first-author paper (see above – "Aerial Visual Localization Through Novel Applications of Weisfeiler–Lehman Graph Embeddings")

Undergraduate Research Mentor, Soybean Canopy Analysis — 2026–Present

- Mentored an undergraduate researcher implementing and evaluating PointNet++/PointNeXt baselines on shared point cloud train/test sets; guide experimental design and interpretation.

• Directed poster development and presentation preparation for the MU Undergraduate Research Forum.

Co-Facilitator, AI as a Tool for Future Engineers July 6–10, 2026

• Co-led a week-long AI/ML engineering camp for 15 students in grades 9–12.

Engineering Mentor, Burns & McDonnell 2019–2023

• Mentored summer interns through workload planning, task delegation, technical feedback, and regular support.

ACADEMIC LEADERSHIP AND SERVICE

NSF Research Traineeship (NRT) Trainee, Cohort 2 Fall 2025–May 2028

• Participate in interdisciplinary training spanning materials research, data science, creativity, entrepreneurship, and outreach.

Director of Public Relations, NSF NRT Program Aug. 2026–Present

• Building a privacy-conscious recruitment and impact website with maintainable content and analytics workflows using Next.js, React, TypeScript, MDX/Zod, and Cloudflare Pages/Functions.

SELECTED PRESENTATIONS

• "Quantum Graph Neural Networks for Aerial Navigation," SC25, St. Louis, Missouri, November 2025; MU Quantum Day, Columbia, Missouri, September 2025; MU Engineering Research Day, April 2026; MU Graduate Professional Council Research and Creative Activities Forum, October 2025.
• "Deep Learning in the Field: Vision Transformers and CNNs for UAV-Based Soybean Canopy Analysis," MU AI Symposium; Missouri Soybean Center Symposium; Digital Agriculture Symposium; and MU Show-Me Research Week, 2025.
• "Automated Burned Area Delineation from Satellite Imagery," Taylor Geospatial Geo-Resolution, September 2024.
• "Development of an Acousto-Optic Array Sensor for Use with Broadband Photoacoustic Tomography," MU Life Sciences Research Forum, 2016 and 2017; SWE iCON 17, 2017.

PROFESSIONAL ENGINEERING EXPERIENCE

Staff Chemical Engineer, Burns & McDonnell Dec. 2022–Apr. 2023

• Prepared bids and procurement packages exceeding $1 million and developed water/sewer systems across a 1,000+ acre site.
• Coordinated process, civil, and environmental design for segregated stormwater and solids-capture systems.

Assistant Chemical Engineer, Burns & McDonnell June 2019–Dec. 2022

• Designed high-strength wastewater treatment, lift stations, and hydraulic systems using AFT Fathom and engineering standards; mentored summer interns.

Environmental Engineering Intern, Missouri Department of Natural Resources May–Aug. 2017

• Updated construction-permitting guidance and reviewed sewer extensions using fluid mechanics and NPDES criteria.

Undergraduate Researcher, University of Missouri Sept. 2015–May 2017

• Supported biomedical-optics research using LabVIEW, 3D modeling, additive manufacturing, and photoacoustic instrumentation.

TECHNICAL SKILLS AND CREDENTIALS

Programming — Python, C, Java, R, MATLAB, TypeScript, HTML/CSS
ML and scientific computing — PyTorch, PyTorch Geometric, scikit-learn, OpenCV, NumPy, SciPy, pandas, NetworkX, Qiskit, PennyLane
Research infrastructure — Docker, Kubernetes, NSF NRP Nautilus, CephFS/S3, rclone, Git/GitHub, Weights & Biases
Quantum computing — Qiskit; PennyLane; IBM quantum hardware and simulators
Credentials — IBM Quantum Road to Practitioner; Fundamentals of Engineering, Principles and Practice of Engineering examinations passed

SELECTED HONORS, AWARDS, SCHOLARSHIPS

- NSF Research Traineeship Award (2025)
- Mizzou Graduate Professional Council Conference Presentation Travel Award (2025)
- College of Engineering Undergraduate Research Grant (2015)
- Discovery Fellows (2015)
- Show-Me Scholars (2015)
- Dean's Scholars Engineering Scholarship (2015)
- Waldemar J. Klasing Annual Scholarship (2017)
- Missouri Bright Flight (2015)
- Mizzou Chancellor's Award (2015)