

Shane Cairns

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SUMMARY

Ph.D. researcher in Computer Science focused on representation learning, continual learning, adaptive neural systems, and adversarial ML. **First-author publication at IJCNN 2026, with two follow-up manuscripts in submission;** experienced in building large-scale PyTorch experiments on GPU/HPC infrastructure. Seeking AI research and engineering roles in defense and AI safety.

EDUCATION

Missouri University of Science and Technology | Rolla, MO

Ph.D., Computer Science | Expected Dec. 2027 | GPA: 3.75 | Kummer Innovation & Entrepreneurship Fellow

B.S. in Computer Science | Dec. 2022 | Major GPA: 3.7 | Distinguished Scholar Award, Dean's List

RESEARCH EXPERIENCE

Graduate Researcher – Adaptive Resonance Theory & Machine Learning

Aug. 2023 – Present

Missouri S&T, Computer Science Department | Rolla, MO

Adaptive Representation Learning & Generative Modeling

- Developed **ART-VQ**, a discrete-continuous latent layer replacing VQ-VAE point codebooks with Fuzzy ART hyperboxes to preserve discrete region identity and continuous within-box position; introduced a projection readout that prevents representational collapse, reducing error **35×** versus midpoint training.
- Achieved **~10×** lower reconstruction MSE than VQ-VAE at matched token count on CIFAR-10 (**1.01 vs. 10.55**); rate-distortion controls attributed most of the improvement to increased representational rate. Under MNIST class shift, ART-VQ limited forgetting to **+0.24 MSE vs. +19.3 for VQ-VAE**.
- Built a generative pipeline combining a transformer prior over hyperbox identities with diffusion modeling of within-box positions; a **pre-registered 12-seed CIFAR-10 study** improved FID by **3.0 points** over matched VQ ($p = .033$).

Adversarial Robustness of Incremental Learners (First-Author Research)

- Developed **WB-Softmax**, a differentiable attack objective for non-differentiable prototype-based models, achieving **89–100% white-box attack success** across USPS, MNIST, and Fashion-MNIST.
- Designed **progressive two-stage selective adversarial training** and separation-aware diagnostics using iCVIs; achieved best-in-class AURAC (28.2%, 64.5%, 41.3%) and improved high-perturbation USPS robustness **4×**.

DARPA Computer Vision Research

- Integrated ART classifiers into YOLO and built modular PyTorch infrastructure for classifier-head swapping, feature visualization, automated checkpointing, and **SLURM multi-GPU training**.

PUBLICATIONS & MANUSCRIPTS

- Cairns, S., et al. (2026). “**Robustness of Fuzzy ARTMAP to Adversarial Attacks and Progressive Adversarial Training for Streaming Learning.**” IJCNN 2026.
- Cairns, S., Wunsch, D.C., & Liu, J. (2026). “**ART-VQ: Vigilance-Controlled Projection Quantization for Discrete-Continuous Latent Representations.**” In submission.
- Cairns, S., Wunsch, D.C., & Liu, J. (2026). “**Generating from Regions: Modeling Discrete Hyperbox Identities and Continuous Within-Region Positions.**” In submission.

INDUSTRY EXPERIENCE

Software Engineer Intern | Ford Motor Company | Remote

May 2022 – Aug. 2022

- Modernized legacy flat-file workflows using a SQL datastore and Java API; delivered Qlik Sense dashboards to Ford Credit stakeholders.

Software Developer Intern | Howmet Aerospace | Cleveland, OH

May 2021 – Aug. 2021

- Improved shipping traceability across North American flow paths; maintained 10+ ASP.NET applications.

SKILLS

ML/AI: Python, PyTorch, scikit-learn, NumPy/Pandas, TorchVision, OpenCV, YOLO

HPC/Systems: CUDA, SLURM, Linux, Bash, multi-GPU training, Git