Angeline Aguinaldo

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Summary

Senior Research Scientist bridging formal methods and machine learning. Expert in AI planning, category theory, and multi-agent systems, with experience designing LLM-based agentic AI architectures and deploying ML-based decision-making systems for real-world applications.

- **Principal Investigator** for a $1M+ research project developing **LLM-based agentic AI systems** for **human-AI collaboration** in task planning and automated report generation; leading the design of a multi-agent planning framework using CrewAI and Pydantic AI
- Technically led the development of **computer vision pipelines** and **scalable ML infrastructure** to deliver daily AI-enabled disaster response products to FEMA during Hurricanes Florence (2018) and Dorian (2019), generating 1 m resolution flood maps and critical infrastructure detections across 2,000 km² of multispectral imagery *[link]*
- Developed a **planning method** for **cross-planning-domain transfer** in autonomous agents using category theory; demonstrated transfer from Blocksworld to a simulated Kitchen domain with medium-complexity ontology [*link*]
- Recognized with **Best Paper Award** at AAAI Fall Symposium 2023 [*link*] and published in IEEE Transactions on Automation Science and Engineering [*2022*, *2025*]

Education

Ph.D., Computer Science, University of Maryland, College Park (2025)
Dissertation Title: *Sequential, Hierarchical, and Analogical Plan Transfer in Robotics*
Dissertation Advisor: William Regli

Master of Science, Electrical Engineering, Drexel University (2017)

Bachelor of Science, Biomedical Engineering, Drexel University (2017)

Research Experience

Senior Research Staff, Johns Hopkins Applied Physics Lab Aug 2017 – Present

- Led a $2.1M analytics program delivering weekly misinformation detection products for 2+ years by managing a 13-person cross-functional team and building high-throughput text clustering and similarity search pipelines (500-1,000 docs/sec)
- Directed migration and modernization of a federal public health data platform (supporting 3-5M weekly queries and 100M+ annual visits), re-hosting a full-stack Java application and services into Azure cloud-native solutions with $<$1k launch errors by leading a joint team of 9 engineers and collaborators
- Built the open-source META [*Github*] [*paper*] system to optimize metagenomic workflows, benchmarking 12 leading classifiers and exposing $>$100x runtime differences and 700x memory variation through scalable simulation and interactive analysis
- Managed and collaborated on formal model development for NASA's Advanced Air Mobility initiative, coordinating design of safety constraints and architecture guarantees using category theory and ontologies; NASA Technical Paper in progress
- Managed and mentored 8 research staff in the Human-AI Collaboration group, fostering technical expertise by conducting performance reviews and participating on hiring teams

Doctoral Researcher, University of Maryland Sept 2018 – May 2025

- Collaborated with industry and research partners (Siemens, NIST, CMU, Topos Institute) to align formal methods with real-world robotics and AI needs
- Produced open-source contributions to the *AlgebraicJulia* ecosystem and published in IEEE T-ASE; presented at AAAI, ICRA, ICAPS, IJCAI, JuliaCon, AMS, and NIST [*web*]

Research Associate, Topos Institute May 2022 – Oct 2023

- Authored technical blog posts ("Using categorical logic for AI planning" *[link]*, "Analogies in Planning using Functorial Data Migrations" [*link*]) introducing categorical semantics for robot task plans
- Led collaborative research with Topos Institute, University of Florida, and University of Maryland, resulting in an AAAI paper: "A Categorical Representation Language for Knowledge-Based Planning" [*paper*]

Selected Publications

- **Aguinaldo, A.**, Patterson, E., Regli, W. Automating Transfer of Robot Task Plans using Functorial Data Migrations. IEEE Transactions on Automation Science and Engineering (2025) [*paper*]
- **Aguinaldo, A.**, Patterson, E., Fairbanks, J., Regli, W., Ruiz, J. A Categorical Representation Language for Knowledge-Based Planning. AAAI Fall Symposium URRAD (Best Paper [*link*]) (2023) *[paper]*

Selected Talks and Presentations

- Analogical Plan Transfer in Robotics. *AMS JMM Applied Category Theory (2025)* [*slides*]
- A Category Theoretic Approach to Planning in a Complex World. *Microsoft Future Leaders in Robotics and AI Seminar Series (2023)* [*video*]
- Category theory for automated planning and program compilation in robotics. *Topos Berkeley Seminar (2022)* [*video*]
- Contextual affordances in context-aware autonomous systems. *NIST Compositional Structures for Systems Engineering and Design Workshop (2022)* [*slides*]

Technical Skills

Topics: AI Planning, Category Theory, Knowledge Representation, Robotics, Agentic AI
Programming: Python, Julia, MATLAB, JavaScript, Haskell, Java
Technologies: Azure, Docker, Kubernetes, MongoDB, PostgreSQL, Redis, RabbitMQ, TensorFlow, PyTorch, OpenCV, GDAL, FastAPI

Professional Service & Community Leadership

- Organizer, Applied Category Theory Special Session AMS JMM (2026)
- Co-author, "Relational Thinking: From Abstractions to Applications" (2024) digital [*book*]
- Local Organizer, Applied Category Theory (ACT) conference (2023)
- Co-organizer, ICRA Compositional Robotics: Mathematics and Tools (2023)
- Reviewer, International Conference on Automated Planning and Scheduling (ICAPS)