Multi-Agent Reinforcement Learning for Autonomous Naval Systems Control

About NIWC Atlantic:

Naval Information Warfare Center (NIWC) Atlantic's mission is to conduct research, development, prototyping, engineering, test and evaluation, installation, and sustainment of integrated information warfare capabilities and services across all warfighting domains with an emphasis on Expeditionary Tactical Capabilities & Enterprise IT and Business Systems in order to drive innovation and Warfighter information advantage.

The intern will research within the Science and Technology (S&T) Department at NIWC Atlantic. The Department's research focuses on (1) the intersection between human and automated decision making (2) agile and effective operations in the radio frequency spectrum and (3) next-generation capabilities that leverage quantum phenomena.

RESEARCH LOCATION: Hanahan, SC

PROJECT DESCRIPTION:

The project aims to investigate Multi-Agent Reinforcement Learning (MARL) techniques for controlling autonomous naval systems within simulation environments, emphasizing human-in-the-loop and decision intelligence frameworks. The project focuses on developing and evaluating MARL policies for cooperative autonomous system behaviors while maintaining transparent AI decision-making that enables human oversight. The research will provide comparative analysis between MARL-trained and traditional control approaches for autonomous naval systems, utilizing DoD HPCMP resources for large-scale simulation and training experiments applied to naval/maritime scenarios that align with the research interests of the intern and project mentor. The overall goal is to investigate and evaluate human-in-the-loop & Multi Agent Reinforcement Learning (MARL) techniques in simulation environments for autonomous naval systems control utilizing DoD HPCMP resources.

1. Literature review on MARL for autonomous systems control, simulation-based training, and decision intelligence frameworks.
2. Onboard into DoD HPCMP environment and familiarize with simulation platforms and distributed computing tools.
3. Design and implement MARL scenarios for autonomous naval systems in simulation environments, with interns choosing specific problem domains based on interest and research goals.
4. Develop multi-agent policies utilizing HPC systems, focusing on cooperative autonomous system behaviors and decision-making.
5. Implement human-in-the-loop decision intelligence components for transparent AI recommendations.
6. Conduct comparative analysis between MARL-trained and traditional control approaches.
7. Document findings, analyze simulation results, and prepare end of internship technical report.

Activities:

- Onboard into the DoD HPCMP environment
- Develop multi-agent ML policies for autonomous systems utilizing DoD HPC systems
- Conduct comparative analysis experiments between AI-augmented and traditional decision-making approaches
- Participate in weekly technical reviews, progress presentations, and collaborative problem-solving sessions
- Network with project mentor and other team members

Outcomes:

- Technical skills in leveraging HPC for AI/ML design using multi-agent ML techniques
- Develop technical collaboration and communication skills in a research team environment
- Demonstration models showcasing decision intelligence capabilities for autonomous systems
- Write a final technical report describing summer research experience

Professional Development Tours:

- Participation in NIWC Atlantic "Mission Mindset Tours" & Student Intern Tours and facility visits
- Attending research meetings with Communities of Interest to learn about AI work across naval commands
- Exposure to ongoing autonomous systems projects and state-of-the-art AI work supporting the warfighter

ANTICIPATED START DATE:

May/June 2026 – Exact start dates will be determined at the time of selection and in coordination with the selected candidate.

QUALIFICATIONS:

Skills:

- Strong programming skills in Python
- Familiarity with machine learning frameworks (e.g., PyTorch, TensorFlow)
- Experience with version control (e.g., git)
- Strong analytical and problem-solving skills
- Excellent written and verbal communication skills

Favorable Skills:

- Experience with reinforcement learning techniques
- Experience with agentic LLM systems
- Knowledge of multi-agent systems
- Familiarity of operations research concepts

ACADEMIC LEVEL:

Degree received within the last 60 months or currently pursuing:

- Bachelor’s
- Master’s
- Doctoral

DISCIPLINE NEEDED:

- Computer, Information, and Data Science
- Engineering
- Science & Engineering-related