

At a Glance

What is it?

- The Office of Naval Research (ONR) Intelligent and Autonomous Systems Program invests in basic research to develop principles of machine intelligence and efficient computational methods for building versatile smart agents (cyber and physical, individuals and teams). These agents would perform missions autonomously with minimal human supervision, and interact seamlessly with people and other agents.

How does it work?

- Research is focused on methods for constructing and seamlessly integrating the “building blocks” of intelligence—namely, knowledge bases, machine learning, reasoning, planning and intelligent architecture. These methods should be general, portable across application domains, robust and efficient. They should also provide performance guarantees that enable self-assessment, meta-reasoning and building trust.

What will it accomplish?

- This program aims to develop intelligent, mission-aware systems to support adaptive, persistent surveillance of large, uncontrolled areas over extended periods. Surveillance units would include lightly supervised teams of autonomous agents—composed of unmanned vehicles and cyber agents—to provide maritime domain awareness.

Point of Contact

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There have been significant advances in building intelligent agents that perform satisfactorily in highly structured domains. However, current approaches to developing the building blocks of intelligence generally become intractable for real-world problems, where the domain is unconstrained, evolving in time, uncertain, unpredictable, open and large.



The ONR Intelligent and Autonomous Systems Program seeks to develop intelligent agents—individual as well as teams—that can function in uncontrolled environments without close human supervision. In this model, “smart” systems would collaborate seamlessly with humans and each other as a holistic system.

Research focus areas include:

- Acquiring and refining knowledge from many sources that may have partial or contradictory information
- Learning complex tasks and concepts from instructions and observations, and life-long lightly supervised learning
- Qualitative or common-sense reasoning for robust and rapid reasoning with uncertain information
- Planning in situations with limited time and/or incomplete information about the environment, which includes decentralized planning, plan recognition and architectures that allow efficient and seamless integration of reasoning, planning and other processes for real-time perception and decision-making and learning

A critical issue that has prevented the deployment of autonomous agents is the lack of trust in their performance. Hence, ONR aims to develop methods and modules that can provide performance estimates. These estimates may be used by the agent to reason about its own performance, as well as provide a performance expectation to team members (human and/or agent).

Research Challenges and Opportunities:

- Developing methods for building knowledge bases from diverse sources with partial, inconsistent, contrary and/or uncertain information that is optimized for inference
- Planning in the real world where warfighters might have incomplete information about the environment, and cannot precisely model user preferences and costs and outcomes of actions
- Learning complex tasks and concepts, particularly learning from combining domain knowledge and examples, with performance guarantees