

AI at the SEI

Engineering AI Systems for Mission-Practical Capabilities

ARTIFICIAL INTELLIGENCE HOLDS INCREDIBLE PROMISE for transforming our software-driven world in general and DoD mission capabilities in particular. The computational advantages AI offers allow us to make the most of human-machine teaming, freeing humans to focus their attention on the types of tasks they do best. The SEI's history as a federally funded research and development center (FFRDC) dedicated to software engineering means that we know what it takes to lay a foundation for confident, rapid adoption of AI for national defense and security.

Our Work

In collaboration with faculty and researchers at Carnegie Mellon, the SEI focuses in the following areas:

- **AI Engineering:** The SEI is addressing a variety of challenges of engineering AI-enabled systems. Such challenges include scalability, representation, AI architectures, verification and validation for AI assurance, and interpretability.
- **Applied AI:** The SEI applies AI to DoD missions, including intelligence, surveillance, and reconnaissance (ISR); cybersecurity; mission planning and mission command; and logistics.
- **AI for Software Engineering:** Not only is AI at the heart of many software programs, it has the potential to revolutionize the process of software engineering itself. The SEI is exploring the potential of AI in this area.

Carnegie Mellon University: Connecting the Brightest Minds with AI Mission Challenges

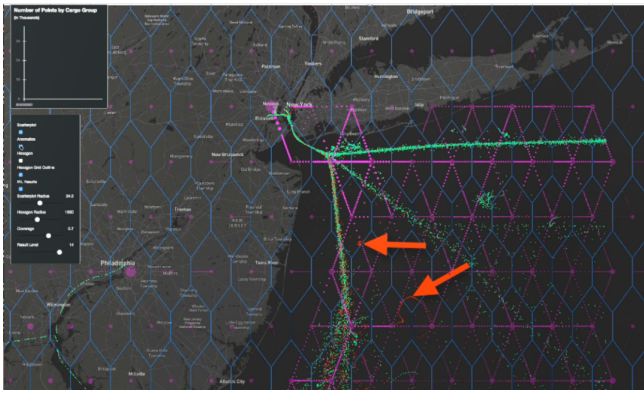
As a research institute operated by Carnegie Mellon University, the SEI has strong collaborative relationships with researchers who are making rapid advances in the field. In 2018, Carnegie Mellon launched the nation's first degree program in AI, and the United States Army selected Carnegie Mellon as the hub for its AI Task Force.

Recent Successes



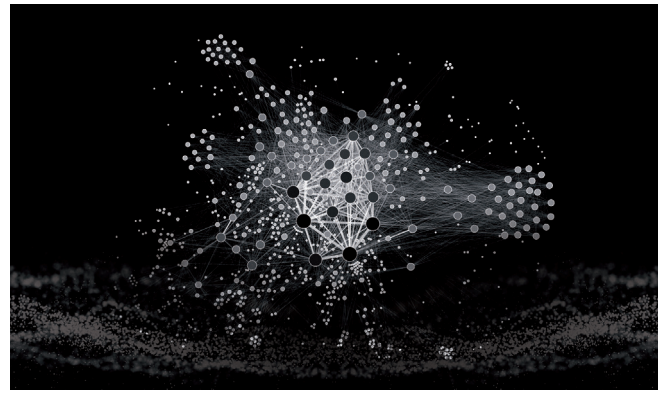
2018 DIU xView Detection Challenge

The United States military is increasingly interested in the use of AI to assist with humanitarian assistance disaster relief (HADR) efforts, in particular the identification of victims and structures. As part of the Defense Innovation Unit (DIU) xView Detection Challenge, an SEI team used deep learning to identify the use of structures in DIU's dataset of overhead imagery covering 1,415 km². With minimal equipment and person-hours, the team finished in 5th place out of 120 participants.



Detecting and Predicting Unlikely Events

Inverse reinforcement learning (IRL) is a machine learning approach for modeling behavior; a key advantage of IRL is that it does not require knowledge of a reward function to learn. The SEI is applying IRL to identify anomalies, and we have demonstrated how find anomalous paths in cargo ship data from the U.S. Coast Guard. We are extending this work to other domains, including computer user behavior.



Unlocking the Potential of Next-Gen Hardware

With rapid changes in computing, programming for new and diverse computer hardware is challenging. Researchers at Carnegie Mellon University have developed Spiral, a code generation technology that can generate high-performance signal-processing codes. Working with the Spiral project's leaders, researchers at the SEI are expanding Spiral's automated code generation technology to use mathematical formalizations of graph primitives to automatically generate the high-performance graph applications needed for targeted hardware platforms. The SEI team is expanding on this research to explore implementations of artificial intelligence/machine learning algorithms using graph primitives.

About the SEI

The Software Engineering Institute is a federally funded research and development center (FFRDC) that works with defense and government organizations, industry, and academia to advance the state of the art in software engineering and cybersecurity to benefit the public interest. Part of Carnegie Mellon University, the SEI is a national resource in pioneering emerging technologies, cybersecurity, software acquisition, and software lifecycle assurance.

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