DNDO intern helped improve nuclear detection through machine learning

By Jordan Stidham

While participating in the U.S. Department of Homeland Security Domestic Nuclear Detention Office, Erin Werner gained experience using machine learning. She employed it to improve the accuracy of nuclear threat detection.

Many common household goods, such as ceramic pottery and cat litter, emit low levels of radiation. These emissions are benign, but they can be confused with radiation from potential nuclear threats. Researchers are constantly looking for ways to make the detection process more accurate and efficient. When properly employed, machine learning can improve the discrimination between radiation from harmless and harmful objects.

Machine learning is an artificial intelligence application that provides computer systems with the ability to automatically learn by exposure to data, without being explicitly programmed. Using these methods to improve radioactive material detection, researchers are able to strengthen U.S. national border security and deter nuclear threats.

As an applied mathematics and computer science major at the University of California at San Diego, Erin Werner was looking for an opportunity to develop her skill set in analytics.

The DNDO Summer Internship Program provides opportunities for undergraduate and graduate students to participate in projects at federal research facilities across the United States. Participants address issues related to national security and nuclear detection to help DNDO meet its mission of preventing nuclear terrorism and training future generations of scientists.

As a participant in the DNDO Summer Internship Program, Werner was assigned to the Lawrence Livermore National Laboratory (LLNL) in Livermore, California. She was mentored by Simon Labov, Ph.D., and Karl Nelson, Ph.D.

Under the guidance of her mentors, Werner contributed to the Enhanced Radiological Nuclear Inspection and Evaluation (ERNIE) project. ERNIE is a computer system that recognizes and classifies radioactive material in vehicles and cargo. ERNIE applies machine learning analysis to distinguish threats from non-threats.

ERNIE is under development at LLNL in collaboration with Carnegie Mellon University and U.S. Customs and Border Protection, and is supported by the U.S. Department of Homeland Security Domestic Nuclear Detention Office (DNDO).

“Due to this experience, I know each of the steps as well as the reasoning behind different choices made in the [machine learning] process. Now, I have a better understanding of how machine learning can act as a solution to other problems, and I am able to conduct my own unsupervised learning project in the future,” said Werner.

Werner became proficient in the Python™ computer programming language, and she had access to the super-computer Borax, which enabled her to process code and large data sets much faster than a standard computer.

Werner was able to apply her background to areas that were relatively new to her. Werner learned about nuclear physics, the machine learning process and the different types of technology used to ensure U.S. border security. She also attended seminars on a variety of subjects, including homemade explosives and the U.S. deterrence strategy.

After graduating with a bachelor’s degree in applied mathematics, Werner envisions a career as a data analyst. “This internship has confirmed my desire for a career in data science and has motivated choices that will help me achieve my goals,” she said.

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