



Looking to Emerging Technology for Answers

Artificial intelligence, machine learning, and autonomous systems can drive modernization efforts at the DOD.

The Department of Defense is eyeing emerging technology such as autonomous systems, artificial intelligence, and machine learning to help boost its success both on and off the battlefield. Autonomous systems today are far more advanced than they were 30 years ago thanks to faster processing speed, more memory, and better algorithms.

Today there are 32 different facets of artificial intelligence, such as machine learning, deep learning, and neural networks, says Tommy Gardner, Chief Technology Officer, HP Federal. There are even 16 different versions of machine learning. “When you start applying some of these techniques and tools you really can come up with some fascinating systems,” he says.

In some cases, it takes time for a technology to evolve. The Shor’s algorithm, formulated in 1994, is an efficient way to identify large prime numbers, which is key to cryptography, says Gardner. However, organizations are just now learning how to apply it to cryptographic systems.

The Air Force has been looking at autonomous systems for some time and is using neural networks to dynamically analyze targets on the vehicles themselves. “[This is] based on some of the processing capabilities we are currently working with,” says Frank Konieczny, Chief Technology Officer, U.S. Air Force. The service is getting to the point where it can target and identify an object on the ground instantaneously from a drone.

The goal is to have interconnectivity between aircrafts and a “dynamic battle space” similar to a software-defined network capability where planes are identified as they enter and leave the airspace. The challenge is how to identify the aircraft correctly, quickly, and in an automated way, says Konieczny.

Hypersonic aircraft makes instantaneous identification even harder. The introduction of hypersonic weapons further underscores the importance of quantum computing and quantum encryption, something that HP is considering. Identity management is challenging when dealing with hypersonic speeds, says Gardner. Cryptographic signatures can be used with a static network, but with a rapidly changing dynamic network, organizations also need identity and processing “that’s able to discriminate between something that fits and doesn’t fit.”

There are scientists studying the swarm behavior of birds, and determining how to apply this to create new algorithms to support DOD autonomous vehicles. “[Looking at this can] give us insights into the problems we are trying to solve,” says Gardner.

This area of study could also apply to autonomous vehicles operating on the road. HP is studying how to control and maintain



self-driving cars. This will require a processor, memory, storage capacity for the black box, and Wi-Fi—much like a PC, he says.

As the Air Force moves ahead with AI and machine learning, it ultimately wants to get to probabilistic estimates of what will or will not happen, which is profoundly challenging. “The base by which you’re using the probability estimates against ... is going to change,” says Konieczny. “It’s running baseline you have to contend with.”

The more sensors the Air Force has collecting data; the better machine learning will get. Ultimately, it wants to be able to conduct trend analysis on the plane while it is in the air. “We can do some of this on the plane,” says Konieczny. “The issue has always been if we have to wait for the plane to land and dump the data.” That approach takes too long in the modern theater.

HP already relies on machine learning in the area of condition-based maintenance. With its managed print services the machines need to be up and running all the time. To guarantee this, the company takes years of HP print data and makes predictions of when components will fail, says Gardner. By adding variables to the machine-learning algorithm, it can predict within a week when a component will fail. “It’s a continuous process ... and it gets better and better.”