FUTURE DEFINING

Can Insects Provide the "Know-How" for Advanced Artificial Intelligence?

AeroVironment begins research to capture insect brain functionality for artificial intelligence models

By Alyce Moncourtois, Content Marketing

The Defense Advanced Research Projects Agency (DARPA) has set out to find ways to build artificial intelligence (AI) systems that are as efficient at computing and processing as the brain of small flying insects. Yes, you heard that right!

DARPA wants to explore cutting-edge technology that involves the study of insect brains and their ability to react to the world around them with minimal computation. Those same computations could one day be "mapped onto suitable hardware to emulate their impressive function," says DARPA's Dr. Michael Fiddy. DARPA's aim is to "identify new computing paradigms that would enable improved AI with considerably reduced training times and power consumption."

So do insects, as annoying as they might be, hold the key to advancing AI technology? AeroVironment is on a path to find out.

DARPA's Microscale Biomimetic Robust Artificial Intelligence Networks program, or MicroBRAIN, awarded a million dollar contract to AeroVironment to conduct this research, putting the company on the leading edge of this technology.

The research team is led by AeroVironment's Dr. N. Andrew Browning, and includes Professor Holger Krapp of the Imperial College, London; Professor Sean Humbert of the University of Colorado, Boulder; and Dr. Geoffrey Barrows of Centeye Inc. They started their work in April 2019 and expect to complete their last deliverable in October 2020.

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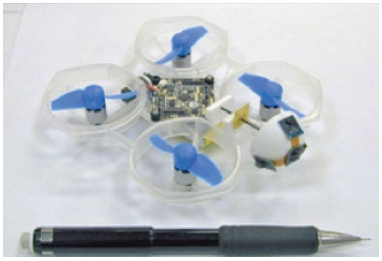
>
> *— Dr. N. Andrew Browning*

"The ultimate goal of the program is to learn from biology to allow us (as the human race) to develop more advanced AI with less computation and with less time for training," said Browning. "The AeroVironment project focus is on how insects perform robust, goal-driven, visual navigation with very low computation."

The researchers are working in 2 phases. In the



Potential "host" quadrotor drone aircraft that could be used for testing the gaze stabilization control — shown with the mockup of a proposed dragonfly head inspired optic flow sensor shell supported on a conceptual gimbal mechanism.

Definition

actuation = the action of causing a machine or device to operate.

first phase, they are performing a comprehensive study of existing data on insect sensors, neural networks, and actuation. They are also conducting a detailed analysis of signaling mechanisms, computational system modeling, and a hardware system design study.

"The focus of our research is on the house fly and dragonfly, looking at their mechanical stabilization structures and inner-loop controls," Browning reports.

During phase 1, researchers set out to simulate the general dragonfly head morphology as much as possible.

Phase 2 will focus on developing a deeper understanding of how the insect performs computation and conducting experimentation using computational and physical models.

The team will continue development of models with a primary focus on how system components enable robust AI functions with low energy and low complexity computation.

Browning states that their work in Phase 2, if successful, "will result in technologies and capabilities that are applicable to both autonomy-based AI and more generalized AI solutions."

When asked about their research efforts under the umbrella of autonomous systems, Browning stated that "engineers have tended to assume that autonomy and intelligent behavior is, or will be, a simple engineering challenge, in large part because autonomy is ubiquitous in the biological world."

He said that the last 30 years of research trying to build robust autonomous systems has demonstrated that the scientist's understanding of the mechanisms and techniques required is extremely limited. He also stated that insects provide the most efficient known example of robust, goal-driven autonomy and basic survival-based intelligence.

"By studying these insects and attempting to replicate key aspects of their structure, we can learn techniques and gain insights that will allow us to develop mission-relevant capabilities for man-made aircraft."

For Your Consideration

Those pesky flying insects that you want to swat may help AeroVironment define the future of autonomous artificial intelligence solutions.