Robots take inspiration from insects to track targets

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Researchers used recordings from the ‘small target motion detector’ neurons in the brain of a dragonfly to develop a closed-loop target detection and tracking algorithm. Credit: University of Adelaide

The way insects visualise and hunt their prey could help improve autonomous robotic technology, according to a pioneering new study conducted by a team of engineers and neuroscientists from The University of Adelaide and Lund University.

The research, published today in the *Journal of Neural Engineering*, developed an autonomous robot to test a target and pursuit visualisation model, based on an insect's visual tracking.

"There is constantly-developing interest in the use of mobile robots for applications in industry, health and medical services, and entertainment products. However, our robots are still far behind the accuracy, efficiency and adaptability of the algorithms which exist in biological systems," says the lead author of the paper, Mechanical Engineering PhD student Zahra Bagheri.

"Nature provides a proof of concept that practical real world solutions exists, and with millions of years of evolution behind them, these solutions are highly efficient," she says.

"Insects, are capable of remarkably complex behaviour, yet have a miniature brain consuming tiny amounts of power compared with even the most efficient digital processors. Our research aimed to discover if the behaviour and neuronal mechanisms that underlie an insect's target detection and selection could provide a blueprint for a robot to perform similar tasks autonomously," says Dr Wiederman, who is leading the project in the Visual Physiology & Neurobotics lab of the university of Adelaide.

"Detecting and tracking a moving object against a cluttered background is among the most challenging tasks for both natural and artificial vision systems. We are looking at the actual algorithm the insect brain uses for target tracking as inspiration for robots," says Professor O'Carroll (Department of Biology, Lund University, Sweden).

The research team used recordings from the 'small target motion detector' neurons in the brain of a dragonfly to develop a closed-loop target detection and tracking algorithm. To test its performance in real-world conditions, they implemented the model on a robotic platform that uses active pursuit strategies based on insect behaviour.

"This is the first time that a target tracking model inspired by insect neurophysiology has been implemented on an autonomous robot and tested under real-world conditions," says Dr Wiederman.

"The robot performed very well in closed-loop pursuit of targets, despite a range of challenging conditions used in our experiments; low contrast targets, heavily cluttered environments and the presence of distracters. This type of performance can allow for real-time applications using quite simple processors," says Professor Cazzolato (School of Mechanical Engineering, The University of Adelaide).

"We uncovered insight into how insects' neuronal systems may handle varying challenges during target tracking and pursuit," Ms Bagheri says.

The team hopes their hardware implementation will provide a platform for better understanding the sensorimotor system of the insect, as well as a prototype for engineering applications.

More information: Zahra M Bagheri et al. An autonomous robot inspired by insect neurophysiology pursues moving features in natural environments, *Journal of Neural Engineering* (2017). DOI: 10.1088/1741-2552/aa776c

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