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Short Commentary

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Fly Brain – A High Speed Computer

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Description

Neurobiologists have succeeded in singling out the response of individual cells in fly brains to specific movement stimuli. This breakthrough in motion vision research could lead to better understanding the motion detector systems in the fly brains and specific roles of individual cells within the neural network. The minute brains of flies process visual movements in only fractions of a second. Just how the brain of the fly manages to perceive motion with such speed and precision is predicted quite accurately by a mathematical model. The minute brains of these aeronautic acrobats process visual movements in only fractions of a second. Just how the brain of the fly manages to perceive motion with such speed and precision is predicted quite accurately by a mathematical model. However, even after 50 years of research, it remains a mystery as to how nerve cells are actually interconnected in the brain of the fly.

How does the speed of thought compare for brains and digital computers?

In the early part of the 20th century, the Harvard University Observatory employed a small army of women — they were known at the time as girl computers — to identify images of stars on photographic plates and then to record the intensity and location of each identified star. The job done by these girl computers has long since been taken over by the digital sort. We all know that digital computers are much better than we are at doing arithmetic, but over the past few decades computers have been taking over jobs, like playing chess or recognizing speech or carrying out symbolic mathematical manipulations, that we used to think of as the province of the human brain. How close are computers, like HAL in the movie 2001, to matching those things that now only our brains can do? Our goal here is to compare the capabilities and speeds of the brain with those of modern-day computers.

Brain simulation

Brain simulation is the concept of creating a functioning computer model of a brain or part of a brain. Brain simulation projects intend to contribute to a complete understanding of the brain, and eventually also assist the process of treating and diagnosing brain diseases. In an effort to understand, on the finest level, what makes us human, he's set out to create a complete map of the human brain: to chart where every neuron connects to every other neuron. The problem is, the brain has more connections than the Milky Way has stars. Just one millionth of the organ contains more information than all the written works in the Library of Congress. A map of the brain would represent the single largest dataset ever collected about anything in the history of the world.

The demands for a simulation of the brain are immense, and just building a computer like Aurora 21 is a massive undertaking. The finished computer is expected to cost hundreds of millions of dollars. It will occupy around a quarter-acre, have thousands of miles of wiring, and, if supercomputer trends continue, draw as much electricity as a medium-sized city.

High-Precision and High-Speed Registration of Brain

It remains a mystery as to how neurons are connected and thereby enable use to think, and volume reconstruction from series of microscopy sections of brains is a vital technique in determining this connectivity. Image registration is a key component; the aim of image registration is to estimate the deformation field between two images. Current methods choose to directly regress the deformation field; however, this task is very challenging. It is common to trade off computational complexity with precision when designing complex models for deformation field estimation. This approach is very inefficient, leading to a long inference time.

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