



IEEE Queensland Section presents
AGM Dinner Lecture for 2006

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TITLE: FROM FLYING INSECTS TO AUTONOMOUS AERIAL VEHICLES

Abstract

Insects, in general, and honeybees, in particular, perform remarkably well at seeing and perceiving the world and navigating effectively in it, despite possessing a brain that weighs less than a milligram and carries fewer than 0.01% as many neurons as ours does.

Although most insects lack stereo vision, they use a number of ingenious strategies for perceiving their world in three dimensions and navigating successfully in it. For example, distances to objects are gauged in terms of the apparent speeds of motion of the objects' images, rather than by using complex stereo mechanisms. Objects are distinguished from backgrounds by sensing the apparent relative motion at the boundary. Narrow gaps are negotiated by balancing the apparent speeds of the images in the two eyes. Flight speed is regulated by holding constant the average image velocity as seen by both eyes. Bees landing on a horizontal surface hold constant the image velocity of the surface as they approach it, thus automatically ensuring that flight speed is close to zero at touchdown. Foraging bees gauge distance flown by integrating optic flow: they possess a visually-driven "odometer" that is robust to variations in wind, body weight, energy expenditure, and the properties of the visual environment.

Some of these principles are offering novel, computationally elegant solutions to persistent problems in machine vision and robot navigation. We have been using some of the insect-based strategies described above to design, implement and test biologically-inspired algorithms for the guidance of autonomous terrestrial and aerial vehicles.



Biography

Professor Srinivasan holds an undergraduate degree in Electrical Engineering from Bangalore University, a Master's degree in Electronics from the Indian Institute of Science, a Ph.D. in Engineering and Applied Science from Yale University, and a D.Sc. in Neuroethology from the Australian National University. He is presently Professor of Visual Neuroscience at the Queensland Brain Institute of the University of Queensland. He is a Fellow of the Australian Academy of Science, of the

Royal Society of London, and of the Academy of Sciences for the Developing World. Srinivasan's research focuses on the principles of visual processing, perception and cognition in simple natural systems, and on the application of these principles to machine vision and robotics.

Awards:

The 2006 Prime Minister's Prize for Science winner
The 2003 Australian Centenary Medal