Speaker	Garrick Orchard
Talk Title	Spike-based Visual Processing
Institution	National University of Singapore
Department	Singapore Institute for Neurotechnology
E-mail	garrickorchard@nus.edu.sg
Webpage	www.garrickorchard.com

1. Tentative Abstract

Bio-inspired spike-based visual processing shows great promise as an effective and efficient approach for mobile agents to visually sense their environment. The spike-based approach takes advantage of “silicon retinae”, a unique class of bio-inspired vision sensors which differ significantly from conventional frame-based computer vision sensors. Traditional frame-based sensors rapidly and repetitively acquire massively redundant data from the visual scene. On the other hand, silicon retinae are designed to accurately detect when and where changes in the scene occur, thereby inherently suppressing redundant data acquisition.

However, the data from silicon retinae differs so much from frame-based cameras that traditional frame-based algorithms cannot be directly applied. Much like bio-inspired silicon retinae show great promise for vision, bio-inspired silicon neurons show great promise for computation, and they are well suited for computing on silicon retina data. In this talk I will describe our ongoing work on designing spiking neural network algorithms for processing data from silicon retinae, as well as discussing possible applications and future areas of research.

2. Brief Biography

Garrick Orchard is a Senior Research Scientist at the Singapore Institute for Neurotechnology (SINAPSE) and the Temasek Laboratories at the National University of Singapore. He holds a B.Sc. degree (with honours, 2006) in electrical engineering from the University of Cape Town, South Africa and M.S.E. (2009) and Ph.D. (2012) degrees in electrical and computer engineering from Johns Hopkins University, Baltimore, USA. He was named a Paul V. Renoff fellow in 2007, a Virginia and Edward M. Wysocki Sr. fellow in 2011, and a Temasek Research Fellow in 2015. He received the Johns Hopkins University Applied Physics Lab’s Hart Prize for Best Research and Development Project, and won the best live demonstration prize at the IEEE Biomedical Circuits and Systems conference 2012. His research focuses on developing neuromorphic vision algorithms and systems for real-time sensing on mobile platforms. His other research interests include mixed-signal very large scale integration (VLSI) design, compressive sensing, spiking neural networks, visual perception, and legged locomotion.

3. List of Representative Publications

1. Orchard, G.; Meyer, C.; Etienne-Cummings, R.; Posch, C.; Thakor, N.; and Benosman, R., "HFIRST: A Temporal Approach to Object Recognition," Pattern Analysis and

Machine Intelligence, IEEE Transactions on vol.PP, no.99, pp.1,1 (accepted, available in preprint)

2. Orchard, G.; and Etienne-Cummings, R. “Bioinspired Visual Motion Estimation” Proceedings of the IEEE, 102(10), 1520–1536, Oct 2014.

3. Orchard, G.; Martin, J.G.; Vogelstein, R.J.; and Etienne-Cummings, R., "Fast Neuromimetic Object Recognition Using FPGA Outperforms GPU Implementations," Neural Networks and Learning Systems, IEEE Transactions on, vol.24, no.8, pp.1239,1252, Aug. 2013

4. Orchard, G.; Lagorce, X.; Posch, C.; Benosman R.; and Galluppi, F. “Real-time Event-driven Spiking Neural Network Object Recognition on the SpiNNaker Platform” IEEE International Symposium on Circuits and Systems, special session on Real-Time Event-Based Sensor Processing, Lisbon, Portugal, May 2015 (accepted, to appear)

5. Ghosh, R.; Mishra, A.; Orchard, G.; and Thakor, V. “Real-Time Object Recognition and Orientation Estimation Using an Event-Based Camera and CNN”, IEEE Biomedical Circuits and Systems, Lausanne, Switzerland, Nov 2014

6. Orchard, G.; Matolin, D.; Lagorce, X.; Benosman, R.; Posch, C. “Accelerated Frame-Free Time-Encoded Multi-Step Imaging", IEEE International Symposium on Circuits and Systems, Melbourne, Australia, June 2014

7. Orchard, G.; Benosman, R.; Etienne-Cummings, R.; and Thakor, N. "A Spiking Neural Network Architecture for Visual Motion Estimation,” IEEE Biomedical Circuits and Systems, Rotterdam, Holland, Nov 2013.