Speaker	Tetsuya Yagi
Talk Title	A neuromorphic retina model and its applications to in physiology and engineering
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1. Tentative Abstract

We have developed a neuromorphic retina model to study the function of retinal circuits in visual information processing in natural environment. The model consists of a silicon retina and a FPGA module and is able to reproduce responses of retinal neurons in real time. In the workshop, I demonstrate "virtual *in vivo* experiments" using the neuromorphic retina model. Namely, neural images of retinal neurons responding to natural scenes in a feasible visual environment are reconstructed. I also refer to some applications in robotic vision and prosthetics. The model will provide a novel technology not only for physiological research but for artificial vision research in the field of engineering.

2. Brief Biography

Tetsuya Yagi received the Ph.D. degree in medical science from Nagoya University, Nagoya, Japan, in 1985. Following his study as a Postdoctoral Fellow with the National Institute of Physiological Science and the Rockefeller University, he joined Kyushu Institute of Technology as an Associate Professor in 1990. He is currently a Professor with the Graduate School of Engineering, Osaka University and a director of the Global Center for Medical Engineering and Informatics, Osaka University. His research interests include neurophysiology of visual systems, and neuromorphic engineering systems and their applications for medicine.

3. List of Representative Publications

1. Y. Hayashida K. Takeuchi, N. Ishikawa, Y. Okazaki, F. Tamas, H. Tanaka and T. Yagi, "Voltage-sensitive dye imaging of the visual cortices responding to electrical pulses at different intervals in mice in vivo," *EMBC, 36th Annual International Conference of the IEEE* , 2014
2. H. Okuno, J. Hasegawa, T. Sanada, and T. Yagi, "Real-Time Emulator for Reproducing Graded Potentials in Vertebrate Retina," *IEEE Transactions on biomedical circuits and systems*.
3. K.Shimonomura, S. Kameda, A. Iwata, and T. Yagi, "Wide-Dynamic Range APS-based Silicon Retina with Brightness Constancy," *IEEE Transaction on Neural networks*, 22, pp.1482-1493, 2011
4. J. Hasegawa and T. Yagi, "Emulation of retinal cell responses during fixational eye movements," *IEICE Electronics Express*, vol. 7, no. 3, pp. 184-189, 2010.
5. M. Osanai, S. Tanaka, Y. Takeno, S. Takimoto, T. Yagi., "Spatiotemporal Properties of the Action Potential Propagation in the Mouse Visual Cortical Slice analyzed by Calcium Imaging," *PLoS ONE*, Volume 5 ,Issue 10, e13738.October 2010
6. K. Shimonomura, T. Kushima, and T. Yagi, "Binocular robot vision emulating disparity computation in the primary visual cortex," *Neural Networks*, vol.21, no.2-3, pp.331-340, 2008.
7. J. Hasegawa and T. Yagi, "Real-Time Emulation of Neural Images in the Outer Retinal Circuit," *The Journal of Physiological Sciences*, vol.58, no.7, pp.507-514, 2008.
8. S. Kameda and T. Yagi, "An analog silicon retina with multichip configuration", *IEEE Transactions on Neural Networks*, pp.197-210, 2006.
9. K. Shimonomura and T. Yagi T, "A multi-chip aVLSI system emulating orientation selectivity of primary visual cortical cell," *IEEE Transactions on Neural Networks,* vol.16, no.4, pp.972-979，2005.
10. S. Kameda and T. Yagi. "An analog VLSI chip emulating sustained and transient response channels of the vertebrate retina," *IEEE Trans on Neural Netw*, 14, 1405–1412, 2003.