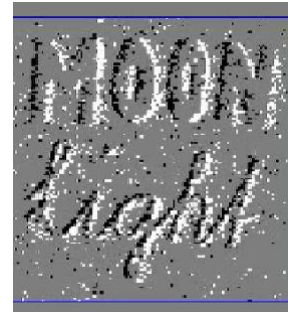inc

2023 Rockwood Memorial Lecture

Event Camera Silicon Retina
History, Live Demo, and Whiteboard Circuit Design

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Monday, November 20, 2023
3:30 – 5:00 pm PDT
Fung Auditorium, Powell-Focht Bioengineering Hall
University of California San Diego
Zoom: https://ucsd.zoom.us/j/2888083696

Abstract: Event cameras electronically model spike-based sparse output from biological eyes to reduce latency, increase dynamic range, and sparsify activity in comparison to conventional imagers. Driven by the need for more efficient battery powered, always-on machine vision in future wearables, event cameras have emerged as a next step in the continued evolution of electronic vision. This lecture will have 3 parts: 1. A brief history of silicon retina development starting from Fukushima's Neocognitron and Mahowald and Mead's earliest spatial retinas; 2: A live demo of a contemporary frame-event DAVIS camera that includes an inertial measurement unit (IMU) vestibular system, 3: (targeted for neuromorphic analog circuit design students in the BENG 216 class), a whiteboard discussion about event camera pixel design at the transistor level, highlighting design aspects of event camera pixels which endow them with fast response even under low lighting, precise threshold matching even under large transistor mismatch, and temperature-independent event threshold.

Bio: Tobi Delbruck received a BS degree in Physics from UCSD in 1986 and a PhD degree in Computation and Neural Systems from Caltech in 1993. Currently he is a Professor of Physics and Electrical Engineering at ETH Zurich in the Institute of Neuroinformatics, University of Zurich and ETH Zurich, Switzerland, where he has been since 1998. He directs the Sensors group together with Prof. Shih-Chii Liu. It focuses on neuromorphic event sensors and processing, with recent focus on theory and hardware accelerators for AI. He co-organizes the Telluride Neuromorphic Engineering workshop and has organized live demonstration sessions at ISCAS, NeurIPS, and AICAS and two Confession Sessions at ISCAS. Delbruck is past Chair of the IEEE CAS Sensory Systems Technical Committee. He worked on electronic imaging at Arithmos, Synaptics, National Semiconductor, and Foveon and has co-founded 3 companies inilabs, insightness, and inivation. His IEEE J. Solid State Circuits paper on the dynamic vision sensor silicon retina event camera is the 4th most cited in the 2005-2015 decade. His papers have been awarded 13 IEEE awards and in 2013 was named a Fellow of the IEEE Circuits and Systems Society for his work on neuromorphic sensors and processing. He likes to read storybooks, play tennis, and sometimes tries card magic on unwary subjects.