Title: Event-based Vision for High-Speed Robotics

Abstract: An event-based camera is a revolutionary vision sensor with three key advantages: a measurement rate that is 1 million times faster than standard cameras, a latency of 1 microsecond, and a high dynamic range of 120 decibels (standard cameras only have 60 dB). These properties enable the design of a new class of algorithms to track a baseball in the moonlight, build a robot with the same agility of a fly, localizing and mapping in challenging lighting conditions. However, all these advantages come at a cost: an event camera does not provide the grayscale values of pixels but only changes in the luminance, and, because the output is composed by a sequence of events, traditional frame-based computer-vision algorithms are not applicable. In this talk, I will describe the working principle of an event-based camera, how to model and calibrate it, and introduce several event-based algorithms for tracking, optical flow, visual SLAM, and collision avoidance at unprecedented computational speed.

Short Biography: Davide Scaramuzza (1980, Italian) is Assistant Professor of Robotics at the University of Zurich. He is founder and director of the Robotics and Perception Group (http://rpg.ifi.uzh.ch), where he develops cutting-edge research on low-latency vision and visually-guided micro aerial vehicles. He received his PhD (2008) in Robotics and Computer Vision at ETH Zurich. He was Postdoc at both ETH Zurich and the University of Pennsylvania. From 2009 to 2012, he led the European project "sFly", which introduced the world's first autonomous navigation of micro quadrotors in GPS-denied environments using vision as the main sensor modality. For his research contributions, he was awarded an ERC Starting Grant, the IEEE Robotics and Automation Early Career Award, and a Google Research Award. He coauthored the book "Introduction to Autonomous Mobile Robots" (MIT Press). He is author of the first open-source Omnidirectional Camera Calibration Toolbox for MATLAB, also used at NASA, Bosch, and Daimler. He is also author of the 1-point RANSAC algorithm, an effective and computationally efficient reduction of the standard 5-point RANSAC for visual odometry, when vehicle motion is non-holonomic. Finally, he is Associate Editor of the IEEE Transactions of Robotics.

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