

Aachen Graphene & 2D-Materials Center

Aachen-Graphene Flagship-Seminar

October 06, 2020 <u>12:00h</u> Location: Zoom

Ultrafast machine vision with 2D semiconductor photodiode arrays

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Machine vision technology has taken huge leaps in recent years, and is now becoming an integral part of various intelligent systems, including autonomous vehicles and robotics. Usually, visual information is captured by a frame-based camera, converted into a digital format and processed afterwards using a machine-learning algorithm such as an artificial neural network (ANN). The large amount of (mostly redundant) data passed through the entire signal chain, however, results in low frame rates and high power consumption. Various visual data preprocessing techniques have thus been developed to increase the efficiency of the subsequent signal processing in an ANN. In this talk I will demonstrate that an image sensor can itself constitute an ANN that can simultaneously sense and process optical images without latency. The device is based on a reconfigurable two-dimensional (2D) semiconductor photodiode array with the synaptic weights of the network being stored in a continuously tunable photoresponsivity matrix. I will discuss both supervised and unsupervised learning and demonstrate that the sensor can be trained to classify and encode images that are optically projected onto the chip with a throughput of 20 million bins per second - 6 orders of magnitude higher than state-of-the-art.



