VolkswagenStiftung

Neuromorphic Computing using QD-Networks (NeuroQNet)

Initiative: Integration molekularer Komponenten in funktionale makroskopische Systeme (beendet, nur noch

Fortsetzungsanträge)

Bewilligung: 01.12.2015

Laufzeit: 3 Jahre

Projekt-Website: www.neuroqnet.com

The goal of this project is to develop a new nanophotonics based platform for neuro-inspired information processing. Dense arrays of semiconductor microlasers and single photon sources with quantum dots in the active layer will take a role comparable to neurons in the brain. Neuron-connectivity is being established via diffractive coupling by an external spatial light modulator. Similar to the brain's primary sensory cortex, computation is provided by induced macroscopic network-dynamics, which allows for efficient information processing with diverse applications such as pattern classification, nonlinear prediction and ultra-fast control loops. A particularly attractive aspect of the scheme is that it merges the inherently parallel concepts of reservoir computing and photonics within a compact and scalable physical machine learning implementation. As such, an ultra-fast (GHz bandwidth) and versatile platform complementary to recent large-scale electronic approaches (e.g. human brain project, IBM or Google) will be developed.

Projektbeteiligte

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Resonance fluorescence of a site-controlled quantum dot realized by the buriedstressor growth technique
Developing a photonic hardware platform for brain-inspired computing based on 5 x 5 VCSEL arrays
Development of Highly Homogenous Quantum Dot Micropillar Arrays for Optical Reservoir Computing
Reinforcement learning in a large-scale photonic recurrent neural network
Boolean learning under noise-perturbations in hardware neural networks