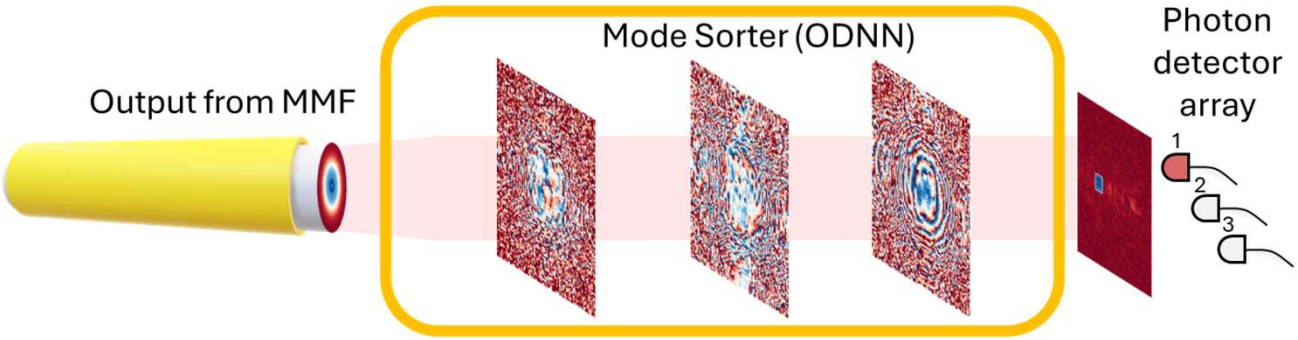
Studien- / Diplom- / Masterarbeit

Dual-Polarization Mode Sorter Based on Optical Diffractive Deep Neural Networks

Motivation

Optical Diffraction Neural Networks (ODNN) are a prominent example of the combination of deep learning and photonics, demonstrating the great potential of all-optical computing. Each pixel on the diffractive layer is a parameter that can be learned by the computer. ODNNs leverage various degrees of freedom of light (such as spectrum, polarization, phase, and amplitude) to enhance parallelism and performance. Multimode fibers (MMFs) can guide thousands of spatial modes within a single core, offering vastly higher data capacity than single-mode fibers. This makes MMFs attractive for high-throughput optical communication, imaging, and endoscopy. However, a major challenge is that as light propagates through an MMF, the modes mix and interfere, producing complex speckle patterns at the output due to modal dispersion and scattering. This scrambling of information makes it difficult to recover the original signals or images. The goal of this work is to explore the potential and performance of ODNN as a mode sorter in dual polarization using both simulation and experimental approaches.

The topic is suitable for a thesis of students in physics, electrical engineering, or similar studies with knowledge in optics, signal processing, deep learning, or quantum mechanics.



Tasks

- Literature review on optical diffractive neural networks (ODNNs)
- Implementation of diffractive neural networks
- Experimental demonstration and analysis

The tasks can be selected individually and the extent can be flexibly adapted.

Keywords

optical diffractive neural network, deep learning, optical computing, orbital angular momentum, optical communication, quantum communication, simulation, python

Contact

- Dipl.-Ing. Qian Zhang, BAR 24, Tel. 463-32417, E-Mail: qian.zhang@tu-dresden.de
- Prof. Dr.-Ing. habil. Jürgen Czarske, BAR 23, E-mail: juergen.czarske@tu-dresden.de
- Internet: http://tu-dresden.de/et/mst