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6G-life

Photonic Reservoir Computing using Multimode Optical Fibers

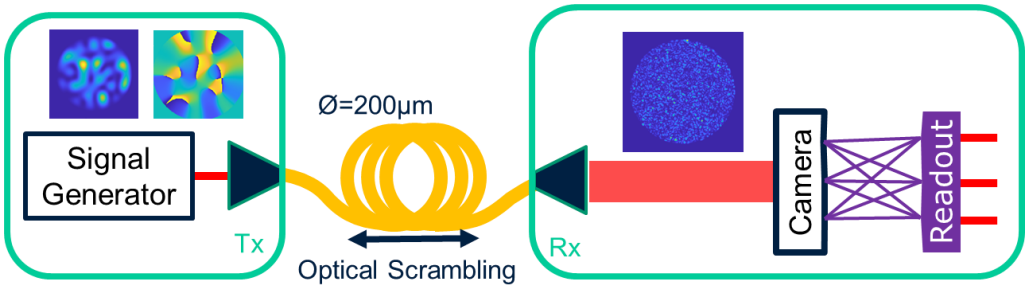
Motivation

Optical scattering processes into higher-order dimensions provide to increase the achievable capacity required for Internet-of-Things and global internet infrastructure, increase security by key generation on the physical layer or can be exploited for optical computing with the speed of light. Multimode fibers (MMF) are such physical devices providing this scattering and are thus used for communication, computing and imaging applications.

In this experiment, dimension-limited probe beams from a signal generator are send through the MMF and the scattered beams are measured by a camera. The optimization of a readout multiplication is investigated for the ability to reconstruct the MMF input, the probe beam. Doing so, the MMF is used for both, data transmission and computing to recover the signal.

The investigations include the generation and measurement of probe beams, the readout optimization and evaluation of the recovered signal. Requirements and boundary conditions for the underlying scattering are of further interest.

The experiment allows to gain fundamental knowledge about fiber optical communications, optical setups, measurement techniques and AI-based approaches. Basic knowledge about optics and MATLAB/Python is desirable but not mandatory.



Tasks

- Build desired optical setup
- Generation and propagation of optical light fields
- Measurement of high-dimensional scattering patterns
- Optimization of readout multiplication for signal recovery
- Evaluation on boundary conditions, accuracy and scalability

Keywords

fiber communication, optical computing, beam forming, light field measurement, signal processing, MATLAB, Python

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