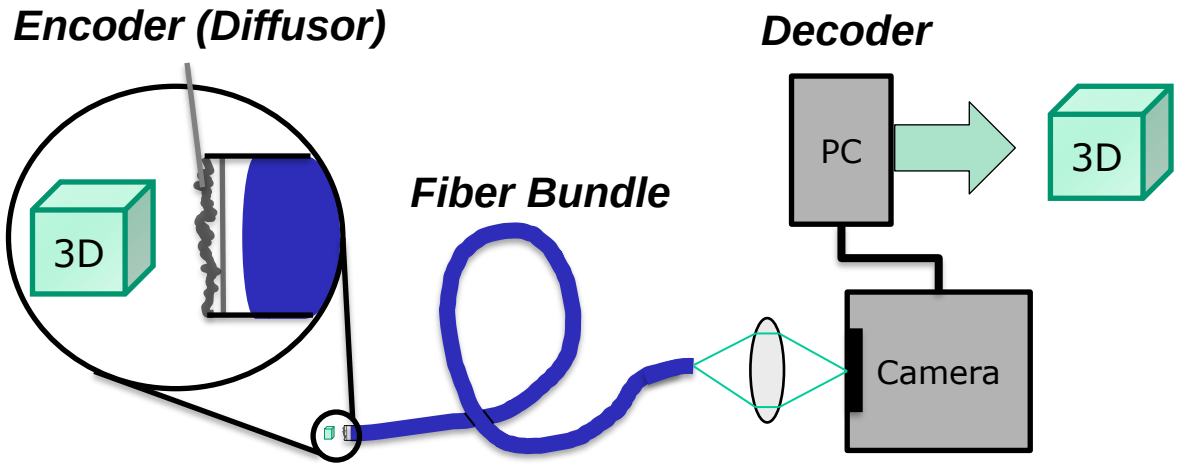
Studienarbeit / Diplomarbeit, ET/MT/RES/IST/Physik

Neural-network-based decoding of speckle patterns for 3D endomicroscopy

Motivation

Diffuser based imaging is a recent topic in computational optics. The diffuser generates a unique pseudorandom speckle pattern for every point within a volumetric field-of-view on an image plane. By solving the inverse problem, the 3D scene can be reconstructed computationally. In conjunction with imaging waveguides, this enables the realization of single shot 3D micro-endoscopes. For this purpose, the diffuser is placed in front of the waveguide to code the 3D object into a 2D speckle pattern, which is then transferred in a robust manner and read out by a camera. However, the limited number of fiber cores in the waveguide results in a bottle neck for the transferred information. Furthermore, iterative approaches are employed for solving the inverse problem, resulting in long evaluation times.

In order to increase the signal processing speed and available information, neural networks and color coding can be employed.



Tasks

- Numerical simulation or experimental realization of multi-color speckle patterns
- Developing and training a U-Net for object reconstruction
- Comparison with iterative reconstruction approaches

Key words

Endoscopy, neural network, computational optics

Kontakt

- M.Sc. Julian Lich (Dr. Kuschmierz, Prof. Czarske)
- E-Mail: julian.lich@tu-dresden.de
- Internet: tu-dresden.de/et/mst