Bachelor / Master Thesis:
Neural Network Equalizers

The performance of high-speed optical transmission links is impaired by a variety of physical effects, such as chromatic dispersion (CD), polarization mode dispersion (PMD) or bandwidth limitations of the transceiver. Advanced digital-to-analog and analog-to-digital converters allow to compensate for such propagation effects and distortions in the digital domain using dedicated signal processing algorithms. While linear equalizers are quite performant and efficient nowadays, equalizers that combat nonlinear effects suffer from a significant implementation complexity and limited flexibility.

Neural networks are a promising approach to adress that problem. Due to their generalization capability, their employment is not restricted to any fixed channel model. Recently, a neural network equalizer was implemented at IPQ and demonstrated in a proof-of-concept experiment. However, it relied on a neural network toolbox and gives little insight in how the training and equalization process works. Furthermore, it is designed for deep learning purposes and might be non-optimal for communication applications.

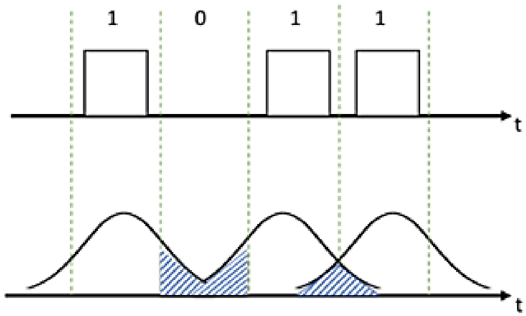

Fig. 1: Effect of chromatic dispersion resulting in overlapping signal pulses and so called inter-symbol interference. Without compensation, that effect strongly reduces the accuracy of the symbol decision.

Your tasks:

- Implementation of a neural network equalizer in MATLAB or Python.
- Analysis of the network's implementation complexity and investigation of real-time training.

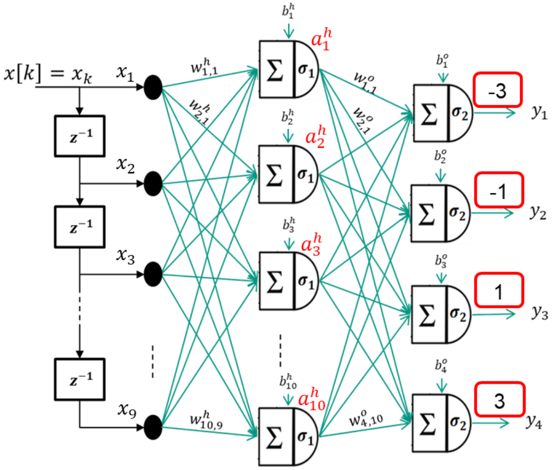

Fig. 2: Neural Network equalizer structure

For detailed information contact:

M. Sc. Christoph Füllner
christoph.fuellner@kit.edu
Tel. 0721-608-47173

Prof. Dr. Sebastian Randel
sebastian.randel@kit.edu
Tel. 0721-608-42490