Master Thesis / PhD position:
Signal Processing in Optical Communication Systems

Karlsruhe Institute of Technology

With high-speed digital-to-analog and analog-to-digital converters, complex digital signal processing (DSP) became feasible for optical trans-mission systems. Being first an interesting topic for researchers, industry developed tremendous interest in the opportunities opened by DSP such as mitigation of linear impairments throughout the whole system, higher order modulation formats (Fig. 2(a)) and pulse shaping. The latter two increase the spectral efficiency and, therefore, the usable capacity of deployed fibers. However, higher order modulation formats dramatically reduce feasible transmission distances, posing a limit to increase the spectral efficiency in deployed systems. Hence, wavelength division multiplexing (WDM) was established which allows for separate transmission channels at distinct frequencies and an efficient use of a large bandwidth in one single fiber. Even newer and more complex concepts like spatial division-multiplexing exist, but are only realizable with advanced DSP algorithms.

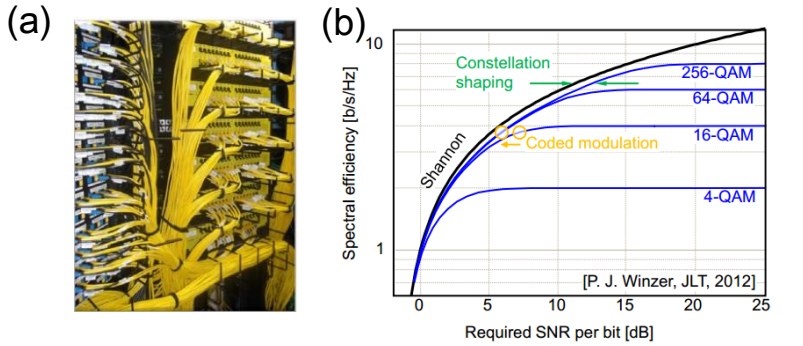

Fig. 1: The strongly increasing global data traffic (visible in the giant data centers of Google (a)), poses the challenge of transmitting more and more data in the same time. To cope with that researchers try to come as close to the theoretical Shannon limit as possible (b).

Your tasks:

- Optimization of DSP methods for short or long haul links programming in Matlab or Python.
- Execution of high-speed experiments to evaluate the developed DSP algorithms and investigate new system architectures (PhD).

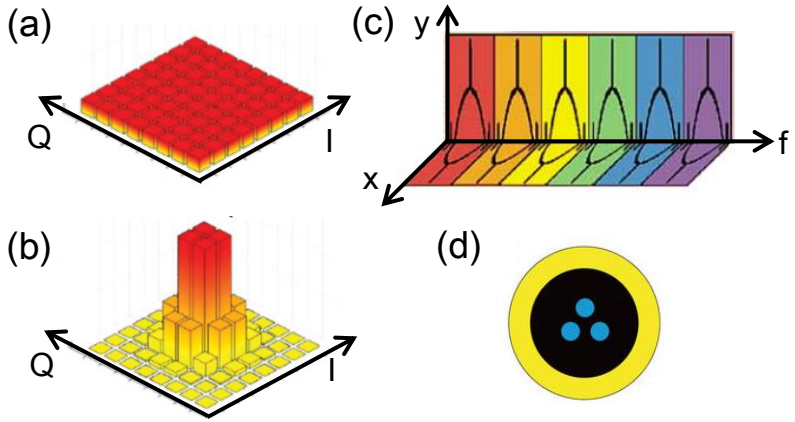

Fig. 2: Techniques to reach higher data rates include higher-order modulation formats such as 64-QAM (a), constellation shaping (b), wavelength-division multiplexing (c) or spatial division multiplexing in few-mode and multi-core fibers (d). All those require highly-efficient digital signal processing to work successfully.

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