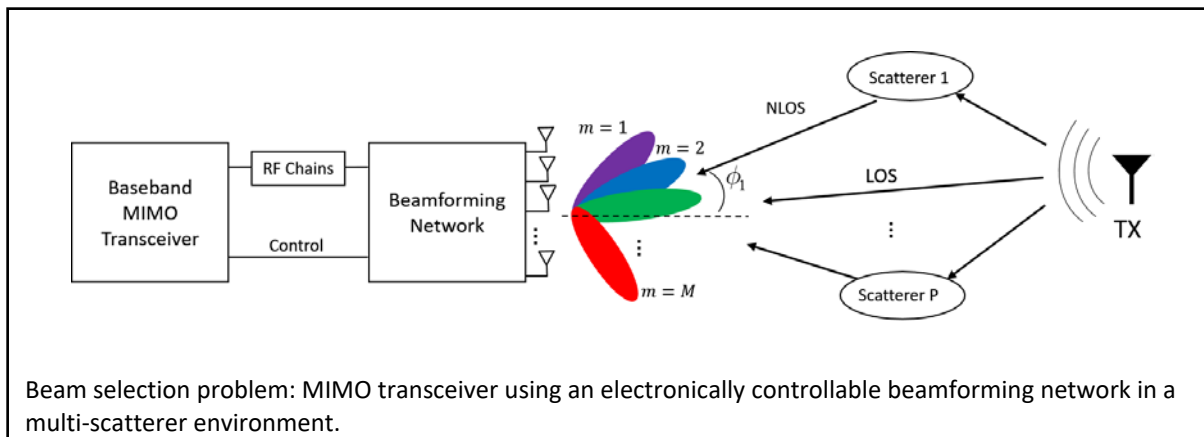


Diploma/Master Thesis:

Application of Machine Learning Methods in Beam Alignment

Utilization of high carrier frequencies in the next-generation of wireless communication systems enables energy efficiency, higher system capacity, reduced latency, and higher data rates. In earlier systems, base stations were sending out their signals roughly omnidirectionally with one or two antenna elements. At higher frequencies however, highly directional transmission using codebooks of narrow beams is necessary for cellular communication to compensate for higher isotropic path loss. Therefore, the problem of beam alignment will arise, which did not exist in previous generations. The task is to identify the strongest beam while minimizing the training overhead.

This thesis aims to study the application of machine learning methods in two main ways. First, Supervised Learning for selecting the strongest beam. Because of inherent correlations between the antenna elements, a well-trained Artificial Neural Network (ANN) could infer the strongest beam optimally. Second, Deep Reinforcement Learning (DRL) for determining the training stop criteria. Moreover, since extra training time is consumption of resources without data transmission, a well-trained DRL agent should be able to satisfy training transmission trade-off.



Your role will involve the following tasks:

- Literature study on beam alignment problem.
- Literature study on machine learning, especially supervised learning and reinforcement learning.
- Implementation of different ANN architectures for beam selection with different type of codebooks and different training strategies.
- Evaluation of the developed algorithms and comparison with legacy algorithms.
- Well presentation and documentation of the achieved results in the final thesis.

Requirements:

- Good knowledge in signal processing and estimation theory.
- Good programming skills in MATLAB.

Possible start date:

- From September 2020 or later

Contact:

- Behnam Khodapanah (behnam.khodapanah@ifn.et.tu-dresden.de)
- Mostafa Khalili Marandi (mostafa.khalili_marandi@tu-dresden.de)