Machine Learning for Communications

Stefan Baumgartner

Typical tasks in communications engineering such as channel and data estimation, (self-) interference cancellation, and digital pre-distortion have been accomplished with model-based methods for several decades. These methods are based on well-established physical and statistical models. In order to find these models, simplifications and assumptions (e.g. linearity, Gaussianity, etc.) usually have to be made. However, modeling errors, oversimplifications, or insufficient domain knowledge might lead to severe performance degradation of model-based approaches. Furthermore, model-based methods that provide optimal performance often suffer from high computational complexity, leading to the use of suboptimal methods in practice. Data-driven machine learning approaches can resolve some of the aforementioned issues and have been employed with incredible success in a variety of application areas in the last few years. Therefore, recent research has been conducted on the applicability of these methods, particularly that of neural networks, to different tasks in communications engineering. The data-driven methods, however, usually require large amounts of data, and incorporating existing model knowledge is hardly possible. The goal is to combine the best of both model-based and data-driven approaches to obtain top-performing and/or low complex methods for various tasks in communications engineering.

In this talk, neural network based data estimation for a communication system employing the so-called unique word orthogonal frequency division multiplexing (UW-OFDM) signaling scheme will be presented. The neural network approach will be compared to traditional model-based methods, and the pros and cons of both will be highlighted. Furthermore, an end-to-end learning scheme, where the transmitter of the investigated communication system is optimized for neural network based data estimators, will be shown.