Karlsruhe Institute of Technology

Communications Engineering Lab (CEL)
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Pilot-Free Communications using Bilinear Approximate Message Passing

Master's Thesis

Project

An essential step in communications systems is estimating the channel by transmitting pilot signals. However, reserving resources for pilot signals causes overhead and decreases the efficiency of the communications system. With future generations of communication systems being expected to support higher user density and more stringent throughput/latency requirements, the pilot overhead becomes increasingly undesirable. Therefore, there is a need for methods that demodulate signals without knowing the channel.

One candidate is Approximate Message Passing (AMP), which is a powerful estimation method that is widely used in the compressed sensing literature. AMP can be adapted to demodulate signals without knowing the channel, which eliminates the need for pilots and increases system efficiency.

In the scope of your master's thesis, you will investigate pilotless communications schemes. Specifically, you will perform simulations in Python to analyze how the bilinear AMP performs with various modulation/transmission schemes.

Tasks

1. Performing simulations in Python,
2. Comparing the performance of the bilinear AMP with different source dictionaries,
3. (Possibly) Designing source dictionaries for the given use case.

Requirements

- ✔ Foundations in probability theory and linear algebra,
- ✔ Interest in compressed sensing and approximate message passing,
- ✔ Interest in Python.

Institute

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