

# Optimization of Hybrid Beamforming for Joint Communication and Sensing

## Bachelor's Thesis

### Project

6G shall not only provide communication but integrated sensing infrastructure as well. We work on joint learning of neural networks that provide the function of communication systems but also sensing systems. Hybrid beamforming describes systems that profit from analog and digital beamforming, meaning there is a digital precoding matrix applied to the input signal as well as the possibility of tunable phase shifters for different antenna groups. In a joint communication and sensing system, we need to form a beam

for each communication receiver enabling transmission and additional beams that enable sensing, which can differ greatly depending on the sensing task. While each communication beam needs to carry information, the sensing beams need to illuminate the range of interest with enough power, so that reflections remain detectable. We will start with a system with one communication receiver and one sensing task and extend the system if the timeframe permits it.

### Tasks

1. Implement a hybrid beamforming precoder
2. Build the structure for a trainable NN and define the loss functions
3. Compare some state-of-the-art algorithms to the trained NN

### Requirements

- ✓ Programming experience or interest
- ✓ Interest in Machine Learning
- ✓ Communications Engineering I

### Institute

Communications  
Engineering  
Lab

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