Chair of Communications Engineering
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Forschungspraxis

# Investigation of Improved Decoding for Polar Coded Shaping

Probabilistic shaping combines forward error correction and distribution matching. It allows to send encoded information with non-uniform symbol distributions. These non-uniform symbol distributions are required to achieve optimal transmission rates. One way to implement probabilistic shaping is polar coding [1], in particular Honda-Yamamoto coding [2]. For a more practical introduction to polar coding see [3].

The goal is to compare the performances of different encoding and decoding schemes for Honda-Yamamoto codes.

In this Forschungspraxis, the task is to investigate decoder performances for Honda-Yamamoto codes with different, structurally similar, decoders. The student will understand and implement successive-cancellation decoding [1] and successive-cancellation list decoding [4] for polar codes. Using these two decoders, one can directly construct encoders and decoders for Honda-Yamamoto codes for which we compare error correction capability and en-/decoding complexity under probabilistic shaping scenarios.

[1] https://doi.org/10.1109/TIT.2009.2021379 or https://arxiv.org/abs/0807.3917

[2] https://doi.org/10.1109/TIT.2013.2282305

[3] https://tselab.stanford.edu/mirror/ee376a_winter1617/lectures.html

[4] https://arxiv.org/abs/1206.0050

## Prerequisites

- Basics in Information Theory (entropy, mutual information, channel capacity)
- Basics in Channel Coding (goal of forward error correction, linear block codes, knowledge about soft decoding algorithms is helpful)

## Advisors

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