Karlsruhe Institute of Technology

Communications Engineering Lab (CEL)
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Design of a Distribution Matcher for Rate-Adaptive MacKay-Neal Codes

Master's Thesis

Project

In modern communication systems, rate adaptivity is crucial to allow for a dynamic adaption to the channel quality. MacKay-Neal (MN) codes enable rate adaptivity by introducing a distribution matcher mapping a uniform source into a sequence with a prescribed distribution before channel encoding. Thereby, the overall rate can be adapted by changing the distribution after the distribution matcher.

In contrast to other schemes, MN codes provide a rate adaptivity scheme with constant block length. This is interesting for different reasons.
First, the rate can be adapted without changing the channel encoder/decoder. Hence, it possibly limits the implementation complexity. Furthermore, it facilitates the introduction of periodic synchronization markers, with benefits for frame synchronization.

The goal of this work is to design a suitable distribution matcher for an MN coding scheme that allows for simple decoding using the BCJR algorithm.

Tasks

1. Understand MN coding schemes
2. Reproduce state-of-the-art approaches
3. Design of novel distribution matching schemes

Requirements

- ✔ Interest in programming (C++, Python or Matlab)
- ✔ Interest in channel coding and communications

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