

Optimization of Gallager B Decoder Over Binary Symmetric Channels

Bachelor's Thesis

Project

Low-density parity-check (LDPC) codes is a code family widely used in communication systems due to their near-capacity performance. LDPC codes are conventionally decoded with a belief-propagation (BP) decoder which requires computation and exchange of float numbers, which leads to high energy consumption. Therefore, searching for a low-complexity decoding algorithm for LDPC codes is a research topic that has been extensively studied. Gallager B decoder is a low-complexity decoder with hard-message passing and the complexity is only a fraction of the BP counterpart. However, the decoding performance is usually worse than the BP decoder even over a binary symmetric channel with no soft channel output.

In our recent work, we showed that using an over-complete could improve decoding performance over a BSC with a BP decoder. Therefore, it is interesting to see if it could be applied to a Gallager B decoder as well. Moreover, it is interesting to see if the parameters of a Gallager B decoder could be learned with a neural network (NN).

Tasks

1. A Gallager B decoder should be implemented
2. The above-mentioned optimization should be implemented and evaluated.

Requirements

- ✓ Basic knowledge in channel coding
- ✓ Good programming skills

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