Lehrstuhl für Informationstheorie und Datenanalytik
INDA
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Master Thesis/Hiwi Job

Reinforcement Learning aided Design of Polarization-based Codes

Keywords

Reinforcement Learning, Information Theory, Channel Coding, 6G communications

Description

The stringent requirements of 6G technology, such as ultra-reliable low-latency communication (URLLC), necessitate consideration and improvement in various aspects of wireless communication systems. The conflicting criteria of low latency and very low error (very high reliability) in finite blocklength regime, can be addressed by proper channel coding design. Polar codes are the first class of codes that can be proven to achieve the capacity of a symmetric binary input discrete memoryless channel (B-DMC) using efficient encoding and decoding schemes. However, for short blocklengths, the performance of polar codes has room for improvement. One way to improve the performance of polar codes in the finite block length regime is to add an outer layer of convolutional codes, where polarization-assisted convolutional (PAC) codes emerge.

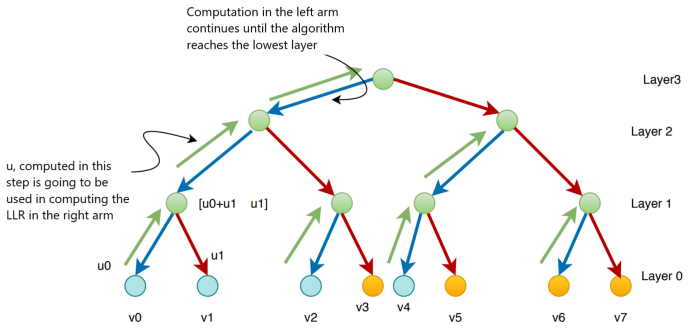

Figure 1: Encoding and decoding structure of Polarization-related codes

The performance of both Polar and PAC codes are heavily dependent on selecting the sequence of bit-channels, sorting from worst to best, where frozen bits (dummy zeros) are sent in worst bit-channels and information bits are sent in best bit-channels.

Goals

For the goal of this thesis, the student will be expected to learn the concept of polarization-based channel codes, and under guidance apply Reinforcement Learning to design a capacity-achieving channel codes. Simulation results are expected to validate the proposed design.

Requirements

- Basic knowledge on wireless communications.
- MATLAB/Python programming skills.
- Experienced in Reinforcement Learning.
- Fluent in written and spoken English.

Contact

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