
Popular Science Summary

Communication involves transferring data from one place to another. In the transmitter, the transmitted message is converted in a suitable form before going through the channel. At the receiver, the signal is estimated and reconstructed to match the transmitted signal. Digital communication is a mode of communication where the data source is converted in discrete format before modulated as analog waves and transferring to the receiver. One advantage of digital information is that it tends to be far more resistant to errors due to interference, noise and channel fading than information symbolized in an analog medium. Digital communication systems are becoming the most common communication solutions all around us.

Channel coding is a technique of detecting and correcting bit errors in digital communication systems. In transmitter, the information sequence is encoded, where some redundant information are added to form a codeword. In receiver, by analysing the received codeword, the decoder can detect and correct the bit error. There are different coding methods developed for different situations.

Polar codes received lots of research attention since introduced in a publication in 2008 by Erdal Arıkan[1]. They can achieve Shannon’s capacity at infinite block length with low complexity decoding due to their simple structure. So polar codes with long block length have both advantages of having good performance and low complexity. However, polar codes do not provide good performance at short block length. A lot of researches focus on finding methods to improve polar codes. List decoding of polar codes with cyclic redundancy check(CRC) is one of them.

There are several researches revealing that the combination of list decoding with CRC is able to improve the performance of short polar codes. List decoding builds a set of possible codewords, and the CRC is used at the last step to select the most probable one from the list. With this combination, short polar codes are greatly improved from performing relatively bad to having the start-of-the-art performance among all other codes such as LDPC and turbo codes. It is interesting to see, in this thesis, that if the combination of list decoding and CRC can also be used to improve the performance of traditional convolutional codes.