

Low Density Parity Check Codes - Proposal

Group Members:

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Title:

Pushing Shannon's Limit – Low Density Parity Check Codes

Description:

Digital technology is embedded in most facets of modern life and its impact ranges from mild to life or death. The storage and transmission of data is crucial in these digital systems and the consequences of corruption to the data can be severe. Out of the evolving digital technologies and their increasing complexity, it was recognised by Claude Shannon in 1948 that near error-free communication was possible through the use of error-correcting codes. Since then, many different types of codes have been developed such as block codes, convolutional codes and Turbo codes. Out of the block codes, the Low Density Parity Check (LDPC) codes are of particular interest.

Developed in the 1960s, they were impractical given the level of technology and forgotten until the modern era. Essentially they rely on the use of a sparse parity check matrix and provide a scalable level of error control which can provide data rates approaching Shannon's theoretical information limit. To date they are the most effective code developed and are important in modern developments that demand superior performance.

Context:

This project will take a comprehensive look at Low Density Parity Check codes to promote a better understanding of how they work and where they fit in with modern systems and coding schemes. The report will explore the history and evolution of error correcting codes as well as its basic theory. In particular, LDPC code theory and applications will be expounded and in order to develop a sense of the performance and capabilities of LDPC codes, they will be compared with modern high performance codes such as turbo codes. The possible future directions of error control coding and predictions will also be investigated. This will be supported by some encoding and decoding simulations in MATLAB.

Aims:

- Explore the history and evolution of block coding and LDPC codes.
- Explain relevant telecommunication concepts relating to error correcting codes and examine how LDPC codes work.
- Find modern digital signal processing applications that use LDPC codes.
- Compare the performance and weigh up advantages and disadvantages of LDPC with respect to other coding schemes.
- Investigate the future applications and predictions of LDPC codes and any other relevant codes.
- Create a simulation of the LDPC codes using MATLAB to assess performance.

Responsibilities

All group members will participate in the contribution of the LDPC part of the report. The rest of the report will be apportioned as needed by group decision.