Performance Comparison of Low-Density Parity-Check (LDPC) Codes for Reliable Communication in Noisy Channels

Publisher: IEEE Cite This PDF

Wafaa Adnan Sajid ; Noor Baqir Hassan ; Lway Faisal Abdulrazak ; Yurii Khlaponin ; Ali Ibrahim Ahmed ; Andrii Yashchuk All Authors

Abstract:
Background: With significant improvements in communication systems, especially in the context of emerging smart cities, data dependability over noisy channels has become critical. Low-Density Parity-Check (LDPC) codes have gained popularity because to their large error correcting capabilities, which have even approached the Shannon limit, making them indispensable in current communication systems.Objective: The purpose of this article is to conduct a thorough examination of the performance of LDPC codes, with a focus on their effectiveness in noisy communication situations. Understanding the capabilities of LDPC in error correction, decoding complexity, and throughput efficiency across various setups and circumstances is the goal.Methods: A variety of LDPC code configurations, including specialized configurations such as turbo-coded LDPC and finite geometry-based LDPC codes, were investigated. Their performance was evaluated using simulations under various signal-to-noise ratio (SNR) settings, offering a realistic perspective on how they will behave in real-world communication scenarios.Results: Preliminary data indicate that LDPC code configurations vary in performance. The current study focuses on the trade-offs of various arrangements, stressing their unique strengths and disadvantages. This comparison analysis gives a road map for choosing the best LDPC code for certain communication applications, which is especially important for urban areas on their digital transformation path.Conclusion: In the smart cities, LDPC codes offer tremendous potential to improve the reliability and efficiency of communication networks. Understanding their intricacies, strengths, and trade-offs may help influence communication strategy choices, resulting in more connected, efficient, and sustainable urban ecosystems.

Published in: 2024 35th Conference of Open Innovations Association (FRUCT)

Date of Conference: 24-26 April 2024

DOI: 10.23919/FRUCT61870.2024.10516373

Date Added to IEEE *Xplore*: 09 May 2024

Publisher: IEEE

ISBN Information:

Conference Location: Tampere, Finland

ISSN Information:

Authors

Figures

References

Keywords

Keywords assist with retrieval of results and provide a means to discovering other relevant content. Learn more.

IEEE Keywords

Codes, Communication systems, Smart cities, Throughput, Parity check codes, Error correction codes, Complexity theory

Index Terms

Reliable Communication, Noisy Channels, Low-density Parity-check Codes, Low-density Parity-check, Communication Systems, Real-world Scenarios, Smart City, Digital Transformation, Communication Scenarios, Coding Performance, Additive Noise, Data Transmission, Channel State, Bit Error Rate, Noisy Environments, Bit Error, Block Length, Codeword, Performance Of Communication Systems, Convolutional Codes, Variable Nodes, Decoding Algorithm, Parity-check Matrix, Smart City Development, Symbol Coding, Polar Codes, Input Bits, Forward Error Correction

Metrics