

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

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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.

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IEEE Keywords

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

Index Terms

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