**Title:**

How Reed-Solomon Codes Detect and Correct Errors: A Hands-On Demonstration

**Abstract:**

Error correction is essential for ensuring reliable digital communication and data storage. Reed-Solomon (RS) codes are a widely used error correction technique found in QR codes, CDs/DVDs, Blu-ray discs, and deep-space transmissions, where data corruption from noise or physical damage can render information unreadable. This study explores the underlying mathematics of RS codes and their ability to detect and correct burst errors by operating on entire symbols rather than individual bits. Through a Java-based application, we demonstrate the encoding, error injection, and decoding process, revealing how polynomial interpolation and finite field arithmetic enable data recovery. Our results demonstrate the efficiency of RS codes in recovering lost data, such as restoring content from a scratched disc or reconstructing missing segments in a damaged QR code. Understanding these principles provides insight into the vital role RS codes play in reliable communication and data storage in an increasingly digital world.