Efficient Privacy-Preserving Storage of Sensitive Documents in Big Data Environments

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Abstract:

In the age of pervasive digital identity storage and access, preserving the privacy of confidentially important documents like passports, driver's licenses, and national ID cards has become a key concern. Protecting confidentiality, integrity, and access, together with preserving user privacy, requires the use of a mix of secure storage methods and privacy-preserving solutions. This research puts forward a privacy-preserving framework that is designed to use lossless PNG compssion with Advanced Encryption Standard (AES) encryption and at the same time reduce storage issues, maintaining very strong data confidentiality. Also, we have incorporated role-based and attribute-based access control models, which enable only authorized access to the system with include audit logging for better accountability. Experimental results on a large dataset of like Aadhaar card, the proposed method achieves lossless reconstruction with an average PSNR of ∞ dB and an impactful compression ratio of 0.0837, while maintaining quick encryption and decryption performance for big data environments. Comparative analysis of traditional JPEG compression with AES mentions that the proposed method provides significantly higher image fidelity without compromising efficiency. These findings open a door for a practical area for secure, scalable, and privacy-preserving storage of sensitive identity documents in modern digital systems.

Keywords:

Privacy Preservation, Lossless Compression, AES Encryption, Identity Document Storage, Secure Image Archival, Access Control, Big Data Security, Aadhaar Card Images.