

DATA COMPRESSION PACKAGE ABSTRACT

TITLE: FINGERPRINT IMAGE COMPRESSION

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ABSTRACT:

Fingerprint data compression is essential for reducing storage requirements and enabling efficient transmission in biometric authentication systems.

In this project, **Singular Value Decomposition (SVD)** is applied to fingerprint images by decomposing them into singular values and vectors. By retaining only the dominant singular values, compression is achieved while preserving the global structural patterns of the fingerprint.

The **Discrete Wavelet Transform (DWT)** is also implemented which decomposes fingerprint images into approximation and detail coefficients across multiple resolution levels. By discarding less significant high-frequency components, efficient compression is obtained while retaining important ridge and minutiae details necessary for identification.

The **Principal Component Analysis (PCA)** is also implemented, which transforms the fingerprint image data into a set of uncorrelated components known as principal components. PCA identifies directions (eigenvectors) in which the data varies the most and represents the image using only the most significant components. By retaining only the top few principal components, the dimensionality of the image is greatly reduced, resulting in efficient compression while preserving essential fingerprint features such as ridges and patterns required for accurate identification.

Key aspects of comparison include:

- Compression ratio achieved by SVD vs. DWT and PCA
- Preservation of fingerprint ridge and minutiae details
- Image quality metrics (PSNR/SSIM) after reconstruction
- Computational complexity and storage requirements

This comparative analysis highlights the strengths and limitations of both methods, providing valuable insights into selecting an optimal compression strategy for practical biometric systems.

DATASET: <https://www.kaggle.com/datasets/ruizgara/socofing?resource=download>

REFERENCE:

<https://www.ijraset.com/research-paper/fingerprint-and-iris-compression-based-on-sparse-representation>

