Secure Signature Verification through Neural Networks and Geometric Feature Extraction

Abstract:

This project focuses on the development of a secure and reliable signature verification system using neural networks and geometric feature extraction. Given the crucial role signatures play in financial, legal, and commercial transactions, enhancing authentication methods has become vital to prevent forgeries. The system incorporates image preprocessing, feature extraction (including image resizing, Local Binary Pattern (LBP) features, and normalised area of the signature), and neural network-based classification to distinguish between genuine and forged signatures. The final verification is based on the comparison of extracted features from the test signature to a trained neural network.

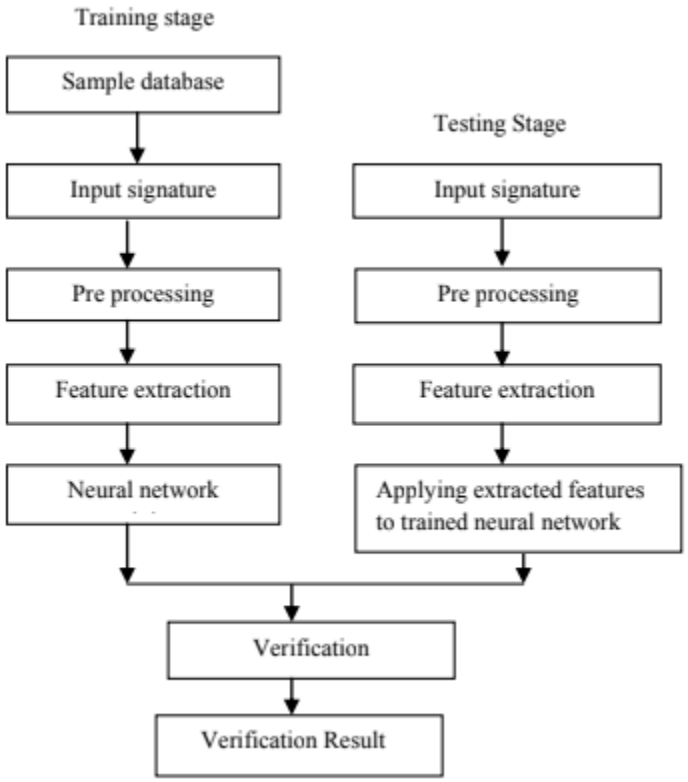

Figure 1: Block Diagram of handwritten Signature Verification [1]

Methodology:

The signature verification system follows a two-stage approach, as illustrated in the provided block diagram: the **Training Stage** and the **Testing Stage**.

1. **Training Stage**:
    - The system begins with a database of sample signatures, which are input for processing.
    - **Image Preprocessing**: The raw input signature is first preprocessed, including noise reduction and standardizing the image size.
    - **Feature Extraction**: Key features are extracted from the signature image, such as resized images, LBP features, and the normalised area of the signature. These features are critical in differentiating between genuine and forged signatures.
    - **Neural Network Training**: The extracted features are then used to train a neural network model, which learns to classify signatures as authentic or forged based on the patterns in the training data.
2. **Testing Stage**:
    - During the testing phase, a new input signature undergoes the same preprocessing and feature extraction process.
    - The extracted features are applied to the trained neural network model, which classifies the signature as either genuine or forged.
    - **Verification**: The final result is produced after the neural network outputs its classification, allowing the system to determine the authenticity of the signature.

Scope:

This project has the potential to significantly improve the security and reliability of signature-based authentication systems. The integration of geometric feature extraction (such as LBP and normalised area) with neural networks enhances the accuracy of verification, making it more resilient to forgeries. This approach can be applied in various domains, including banking, legal documentation, and any environment where signatures serve as a primary form of identity verification. With further development, the system can evolve to handle real-time authentication in high-security environments, enhancing trust in electronic and paper-based transactions.

References:

[1] Pansare, A., & Bhatia, S. (2012). Handwritten signature verification using neural network. *International Journal of Applied Information Systems*, *1*(2), 44-49.