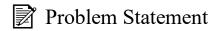# Signature Forgery Detection in Document Authentication Systems

Advancing Security: Machine Learning-Based

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📝 Problem Statement

In many sectors—banking, legal, government—handwritten signatures serve as a primary method of identity verification. However, forged signatures pose a serious threat to security and authenticity. The challenge is to develop an automated system that can accurately distinguish between genuine and forged signatures using minimal training data, especially when forgeries closely resemble authentic samples.

🎯 Objectives

- **Detect Forged Signatures**: Build a system that can classify signatures as genuine or forged.
- **Minimize Training Data**: Use techniques like one-shot learning to reduce the need for large datasets.
- **Improve Accuracy**: Achieve high precision and recall in distinguishing subtle differences.
- **Ensure Scalability**: Design a model that can generalize across different users and signature styles.

🔲 Approach

- **Data Collection**: Use a publicly available dataset (e.g., Kaggle's Signature Verification Dataset) containing genuine and forged samples.

- **Preprocessing**: Normalize images, apply data augmentation to simulate forgery variations.
- **Model Architecture**:
  - **Siamese Neural Network**: Trains on pairs of signatures to learn similarity metrics.
  - **CNN or VGG16**: For feature extraction and classification.
- **Training Strategy**:
  - Use one-shot learning to train the model with very few genuine samples.
  - Apply early stopping and dropout to prevent overfitting.
- **Evaluation**: Measure accuracy, precision, recall, and F1-score on test data.

✅ Expected Outcome

- **High Accuracy**: Models like Siamese networks and VGG16 can achieve up to 99% validation accuracy.
- **Robust Detection**: Capable of identifying forgeries even when they closely mimic genuine signatures.
- **Practical Utility**: Suitable for deployment in banking apps, legal document verification, and forensic analysis.