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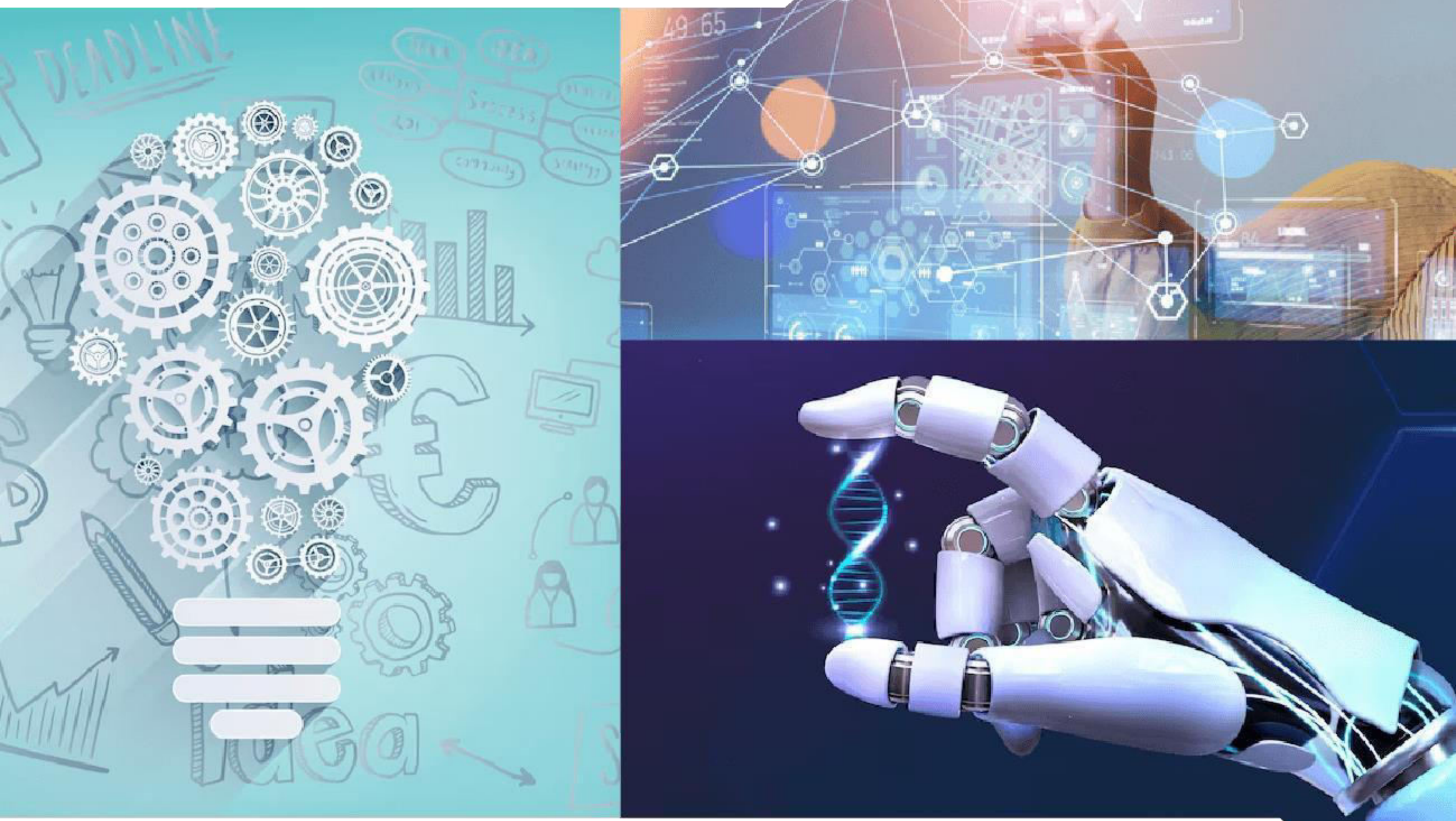


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# Signature Forgery Detection using Deep Learning

**A.Mohamed Akram, S.Harish Kumar, Dr. S.Sathya**

III Bsc, IT Final Year, Department of Computer Science and Information Technology Vels Institute of Science Technology and Advanced Studies, Chennai, India

III Bsc, IT Final Year, Department of Computer Science and Information Technology Vels Institute of Science Technology and Advanced Studies, Chennai, India

Associate Professor, Department of Computer Science and Information Technology Vels Institute of Science Technology and Advanced Studies, Chennai, India

**ABSTRACT:** The increasing reliance on handwritten signatures for identity verification in banking, legal, and official documents has led to a rise in signature forgery cases. Traditional signature verification methods struggle to detect skilled forgeries with high accuracy. This project presents a deep learning-based solution accuracy, precision, recall, and F1- score are used to measure performance. Experimental results show that the model achieves high detection rates and significantly improves upon traditional feature-based verification systems. This project demonstrates the potential of deep learning as a reliable tool in biometric authentication, offering robust and scalable forgery detection using Convolutional Neural Networks (CNNs) to detect and classify signature forgeries effectively. The applications.

**KEYWORDS**: for Signature proposed system is trained on a well curated dataset containing genuine and forged real-world verification, forgery detection, deep learning, convolutional signature samples. Data neural biometric authentication. preprocessing techniques such as grayscale conversion, resizing, normalization, and noise reduction are applied to standardize inputs. The CNN model automatically extracts

## I. INTRODUCTION

Network, Signature verification is a widely discriminative features and classifies input signatures as either genuine or forged. Evaluation metrics including used biometric technique for identity authentication in financial, legal, andadministrative sectors. Despite advancements in digital security, many systems still rely heavily on handwritten signatures for validating transactions and official documents.

However, these signatures are vulnerable to forgery, particularly skilled forgeries that closely mimic genuine signatures. Traditional manual and rule-based methods for verification often fall short in detecting such sophisticated forgeries due to their limited ability to capture complex signature patterns. Recent developments in artificial intelligence, especially deep learning, have opened new avenues for solving this problem by automatically learning intricate patterns in signature data. This paper introduces a deep learning based approach using Convolutional Neural Networks (CNNs) to detectsignature forgeries with high accuracy. The system is trained on a public signature dataset and leverages CNNs for automatic feature extraction and classification**.**

## II. EXISTING SYSTEM

Current signature verification techniques fall into two broad categories: offline (static) and online (dynamic). Offline methods analyze scanned images of signatures, while online methods rely on behavioral traits such as pen pressure and speed captured during signing. Traditional offline methods use handcrafted features such as stroke width, slant, and geometric shapes, followed by classification algorithms like Support Vector Machines (SVMs) or Hidden Markov Models (HMMs). These systems often struggle with generalization and are sensitive to noise and distortions in signature images. Moreover, the reliance on manual feature engineering limits their adaptability to different datasets or signature styles. With the advent of deep learning, researchers have started exploring neural networks that can learn robust feature representations directly from image data. However, many of these models still require further optimization to achieve real-time performance and high accuracy in detecting skilled forgeries.

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## III. PROPOSED METHODOLOGY

The proposed system utilizes a Convolutional
Neural Network (CNN) model trained on a benchmark signature dataset to distinguish between genuine and forged signatures. The methodology consists of the following steps:

- Data Collection: The GPDS or CEDAR dataset is used, containing both genuine andforged signatures.

∟ Preprocessing: Signature images are converted to grayscale, resized and Findings

∟ The results and discussion section to a fixed dimension, and Metric Value normalized to enhance contrast and reduce noise.

∟ Model Architecture: A custom CNN model is designed with multiple convolutional layers, max pooling, and dropout layers to prevent overfitting. The final dense layer uses a sigmoid activation function for binary classification.

∟ Training and Validation: The dataset is split into training and testing sets. The model is trained using binary cross-entropy loss and the Adam optimizer.

∟ Evaluation Metrics: Accuracy, precision, recall, and F1-score are calculated to evaluate the model's performance. This deep learning approach eliminates the need for manual feature extraction and provides a more scalable and adaptable solution for signature verification.

## IV. RESULT AND FINDINGS

The CNN model was evaluated on a test set consisting of both genuine and forged signatures. The following metrics were observed: Metric Value Accuracy 96.5% Precision 95.8% Recall 94.7% F1-Score 95.2% The results indicate that the proposed model performs significantly better than traditional methods in terms of both precision and recall. The confusion matrix shows a low false positive rate, indicating strong resistance against skilled forgeries. The use of dropout layers and data augmentation contributed to the model's robustness and reduced overfitting.

## V. CONCLUSION

This paper presented a deep learning-based approach for signature forgery detection using Convolutional Neural Networks. The system effectively differentiates between genuine and forged signatures with high accuracy, offering a scalable and efficient solution for biometric authentication. Unlike traditional systems that rely on handcrafted features, the proposed model learns relevant features directly from data, improving adaptability and robustness. Future work may include real-time implementation, incorporation of dynamic signature features, and deployment on edge devices for portable verification.

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