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# Real Time Signature Verification Using Convolutional Neural Network: A Review

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**ABSTRACT:** A human being signature can be used to authenticate human identity, the signature of a person is an important biometric attribute of its identity. To verify the identity of an individual Signature verification is a technique used by banks, intelligence agencies and high-profile institutions. The handwritten signatures is impossible to duplicate the handwritten signatures are unique for individuals and the technology is easy to explain and trust. The primary advantage that handwritten signature verification systems have over other type's technologies is that signatures are already accepted as the common method of identity verification. A lot of scope of research is there to elaborate methods of signature recognition. In this paper, a detailed literature reviewed is presented for implementation of Convolutional neural network for signature recognition & verification, where the signatures are captured and presented to the user in an image format. Using various image processing techniques Signatures are verified based on parameters extracted from the signature. For verifying signatures Convolutional Neural Network could be used effectively.

**KEYWORDS:** Component; image preprocessing, feature extraction; Convolutional Neural network training and testing; signature verification and recognition.

## I. INTRODUCTION

A behavioral biometric may be termed a signature, as it can modify depending on many essentials such as: frame of mind, exhaustion, etc. Automated signature recognition and verification have been the exigent aspects, for a long time, a true impetus for researchers. Into signature verification research has been energetically pursued for a number of years [1] and is still being explored (especially in the off-line mode) [2]. Signature recognition and verification involves two separate but strongly relevant tasks: one of them is identification of the signature owner, and the other is the decision about whether the signature is genuine or forged. Also, depending on the need, signature recognition and verification problem is put into two classes: (i) online signature recognition and verification systems (SRVS) and (ii) offline SRVS[15]. Prior approaches describes the novel system for off-line signature verification, in this novel system both static and pseudo dynamic features are extracted as original signal, which is processed by Discrete Wavelet Transform (DWT) for the purpose of enhancing the difference in time domain(DT) between a genuine signature and its forgery [4]. to improve the performance of the proposed system writer-independent model which reduces the pattern recognition problem to a 2-class problem, hence, makes it possible to build robust signature verification systems even when some few signatures per writer are available. Receiver Operating Characteristic (ROC) curves are used [5]. Using both off-line systems Experiments are carried out, involving the discrimination of signatures written on a piece of paper, and on-line systems, in which dynamic information of the signing process is also available [6].

The signatures are as an authentication method has already become a tradition in the western civilization and is respected among the others. The signature is an accepted proof of identity of the people in a transaction taken on his or her behalf. Thus the users are more likely to approve this kind of system authentication method [7]. Various classifiers, such as Support Vector Machines (SVMs) and Hidden Markov Models (HMMs), have also been successful in off-line and on line signature verification; SVMs providing an overall enhanced outcome than the HMM-based approach [9].



### A. Types of Signature Verification

Based on the definitions of signature, signature can lead to two different approaches of signature verification Technique.

#### 1) Off-Line or Static Signature Verification Technique

This Technique approach is based on static characteristics of the signature which are invariant. In this Technique signature verification, becomes a typical pattern recognition task knowing that image variations in signature pattern are inevitable; the task of signature authentication can be narrowed to drawing the threshold limit of the range of genuine variation. In the offline image signature verification techniques, images of the signatures written on a paper are obtained using a scanner or a camera.

#### 2) On-line or Dynamic Signature Verification Technique

This is the second type of signature image verification technique. This Technique is based on dynamic characteristics of the process of signing. This Technique verification Uses signatures that are captured by pressure sensitive tablets that extract dynamic properties of a signature in addition to its shape. Dynamic features include the number of order of the strokes in image, the overall speed of the signature and the pen pressure at each point that make the signature more unique and more difficult to forge. Application areas of Online image Signature Verification include protection of small personal devices (e.g. PDA, laptop), this Technique authorization of computer users for accessing sensitive data or programs and authentication of individuals [10].

### B. Types of Forgeries

- Random: these Technique signatures are not based on any Knowledge of the original signature
- Simple: these Technique signatures are based on an assumption of how the signature looks like by knowing the name of the signer
- Skilled: an imitation of the original signature image, which means that the person knows exactly how the original Signature looks like [3].

In image pre-processing step, training and testing signature images are passed into this step. The main purpose of this phase is to make signature image ready for extracting features. The pre-processing phase includes grey scale conversion and binarization. The image is converted into grey scale: Binary image is converted into grey scale to make process easier and feature extraction more accurate. Binarizing image: In this step, grey scale image is converted to black and white image using a reasonable threshold. This will make signature clearer as it will be in black and the background will be in white. Threshold filtering is considered the simplest way to binarize an image. Threshold filtering does image binarization by using particular threshold value and intestines of image pixel. All pixels in the signature image with intestines equal all higher than specified threshold value will be converted to white otherwise, all pixels with intensities lower than threshold value will be converted to black which will make signature image black and white. The filter accepts grey scale images for processing, and the optimal threshold values differ from image to image and are obtained after deep investigation of the trained image..

## II. RELATED WORK

Traditional bank checks, bank credits, credit cards and various legal documents are an integral part of the modern economy. They are one of the primary mediums by which individuals and organizations transfer money and pay bills. Even today all these transactions especially financial require our signatures to be authenticated. The inevitable side-effect of signatures is that they can be exploited for the purpose of feigning a document's



authenticity. Hence the need for research in efficient automated solutions for signature recognition and verification has increased in recent years to avoid being vulnerable to fraud [8]. Ali Karouni Bassam Daya, Signature verification and recognition using a new approach that depends on a neural network which enables the user to recognize whether a signature is original or a fraud. The user introduces into the computer the scanned images, modifies their quality by image enhancement and noise reduction techniques, to be followed by feature extraction and neural network training, and finally verifies the authenticity of the signature [11]. Suhail M. Odeh, An off-line signature verification and recognition system based on a combination of features extracted such as global features, mask features and grid features. The system is trained using a database of signatures. For each person, a centroid feature vector is obtained from a set of his/her genuine samples using the features that were extracted. The centroid signature is then used as a template which is used to verify a claimed signature. To obtain a satisfactory measure of similarity between our template signature and the claimed signature, we use the Euclidean distance in the feature space. The results were very promising and a success rate of 84.1% was achieved using a localized threshold [13].

**Table I: Contribution of various researchers.**

Author	Paper Name	What the did
Kruthi.C, Deepika.C .Shet,	Offline Signature Verification Using Support Vector Machine	Support vector machine developed using SMO and kernel perceptron, which are tested against both linear and polynomial kernel. The accuracy of the whole system is found to be 72.275 %.
Mrs. Madhuri R.Deore	A Survey on Offline Signature Recognition and Verification Schemes	As the input to the ANN is very large it may be complex and required more time. To avoid these we have to apply the Principal Component Analysis to reduce the wavelet coefficients.
Luiz G. Hafemann , Robert Sabourin	Analyzing features learned for Offline Signature Verification using Deep CNNs	The learned features are mostly useful to distinguish signatures on a “general appearance” instead of finer details. This make these features relevant for distinguishing random forgeries and skilled forgeries that are made with quick motion





Murat TaükÖran , Zehra Gülru cam	Offline Signature Identification via HOG Features	the hand signature identification process has been analyzed as one of the biometric security systems
Varun kamble	Handwritten Signature Recognition : A Convolutional Neural Network Approach	Model using Adam enhanced its versatility because it provided better validation accuracy over all 3 types of signatures.

### III. OBJECTIVES

Objectives are as follows.

1. To develop Offline signature recognition & verification System by using Convolutional neural network
2. The set of, previously collected signatures to verify a complete signature with the help of an average signature, which is obtained
3. To accurately characterize each hand written signature, thus offering better verification and recognition performance
4. To minimize the time required for Signature verification and recognition
5. To maintain the Security.

### IV. PROPOSED METHODOLOGY

Following steps are required to perform.

- A. Image pre-processing
- B. Feature extraction
- C. Convolutional Neural network training

#### A. Image Pre-Processing

Pre-processing of image represents a wide range of techniques that exist for the manipulation and modification of images. Image Pre-Processing is The first step in signature verification and recognition. For improved results and higher accuracy rates a successful implementation of this step produces.

#### B. Feature Extraction

For signature recognition and verification Feature extraction is the second major step. If we are to compare 2 images; there should be at least one measurement on which to base this comparison. The main function of this Feature Extraction is to generate features which can be used as comparison measurements. Feature Extraction the issue of signature verification is a highly sensitive process, more than one feature Extraction/measurement has to be generated in order to enhance the accuracy of the result.

C. Convolutional Neural Network Training Convolutional Neural networks - like human beings - depend on the idea of learning in order to achieve any task. Convolutional Neural networks learn through training on a large number of data, which enables them to create a pattern with time, that they will use later. Convolutional Neural networks are very helpful in detecting patterns that are complicated and hard to derive by humans or by simple techniques.. Just like the case of signature recognition, Convolutional Neural Network Training is very hard to tell



whether a signature is original or forged, especially if it is carried out by a skilled forger. For detect the differences is needed to achieve a decision on its authenticity a more advanced technique used. Convolutional Neural networks do not follow a set of instructions, provided for them by the author, but they learn as they go case by case.

### **Signature Recognition & Verification Using CNN**

Convolutional Neural networks are highly efficient when trained using a large amount of data. They are used in applications where security is most important.

For hand written signature recognition and verification several steps performed. In our proposed work basically we collect the scanned signature images of different users, basically we collect the 10 scanned images of individuals' actual signatures and there forged signatures. Hand written signature images are stored in a database which we are going to use in training & testing of CNN, In our proposed work we have to use an interface with scanner for getting an hand written signature image and These images are stored in a database. After preprocessing all hand written signature images from the database, features extraction will be used to extract various features of signature such as stroke, moment invariants, GLCM, color dominant, histogram that can distinguish signatures of different users.

The proposed methodology is as described:

1. Acquire the Signature images.
2. Image preprocessing.
3. Extract the various features.
4. Back propagation algorithm to train the system
5. Test the Signature image.
6. Take decision as originals or forgeries.



**Proposed System Design**

Figure1. Signature Recognition & Verification

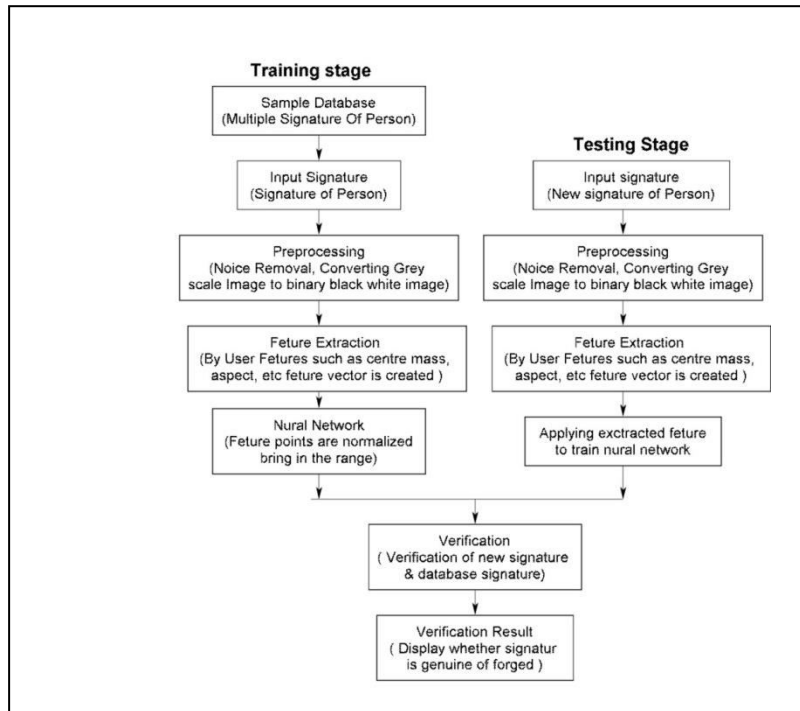


Figure1. Signature Recognition & Verification

**V. CONCLUSION**

This paper is focused on Offline signature recognition and verification. Signatures are verified based on parameters extracted from the signature image using various image processing techniques. The utility of signature verification is that it helps in detecting the exact person and proposed methodology is an approach that provides more accuracy of verifying signatures. This paper uses Convolutional Neural Networks for recognition and verification of signatures of individuals.

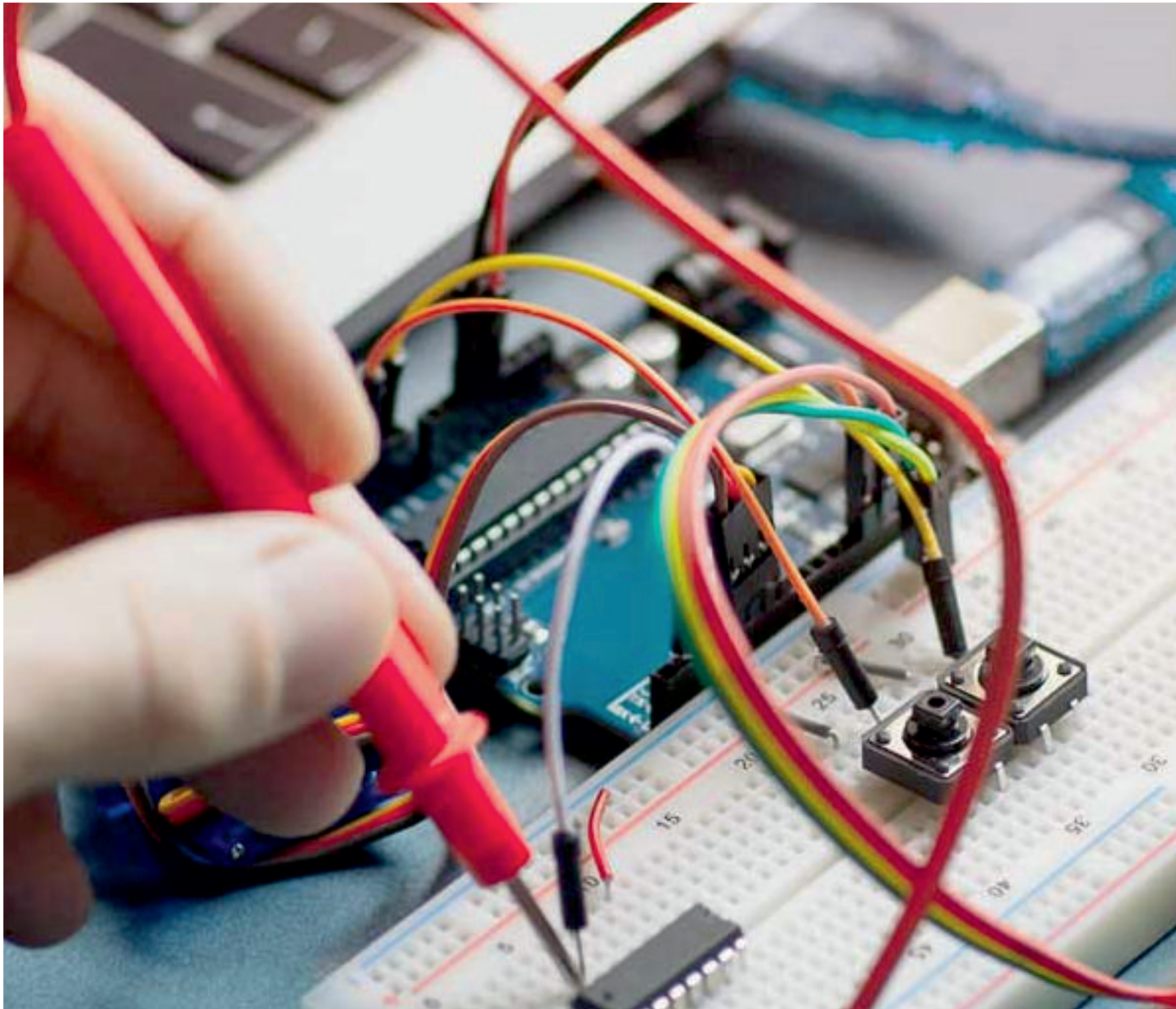
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