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# Survey on Author Identification Using Signature Verification

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***Abstract***

*Signature is generally used for identity verification of a person. It is considered as a symbol for identification of social, business and business functions that the term signature verification is of utmost importance as it may be victimized and might result in huge losses. Signature could be a behavioral biometric attribute that includes neuromotor characteristics of an individual in addition as socio-cultural influence. In this paper, survey is done for author identification using signature verification. Initially pre-processing of signature image is done. Further features are extracted based on the pre-processed data. Algorithm is applied on the extracted features and accuracy of signature is determined. Thus, signature is identified as genuine or forged and author is identified based on the genuineness of signature.*

***Keywords:*** *Signature, verification, author, pre-processing, features, Support Vector Machine, genuine, forged*

## 1. Introduction

Signature is representation of name of a person that is used as an identity proof. Written signature is universally accepted biometric for identity verification. It is a fundamental mechanism for authorization and authentication. Hence, recognition of signature is considered as a challenging job in forensics of document. There is a probability that the signature will be cast. Thus, the need for genuineness and verification of signature arises.

For verification of offline signature, Convolution Neural Network was used which is followed by fully connected layer. Its parameters are trained by different orders of magnitude. CNN is used in two different configurations; first in hybrid classifier as feature extractor which is followed by end to end classifier using Siamese network [1].

Signature verification is required in various banking sectors, government organizations, finance and other sectors such as security and forensics. For this, various features of signature need to be analyzed. SpeedUp Local features were used for analysis purpose which gives clues about which features are exclusively considered for analysis [2].

Online signature is a trait which is used for the verification of a person's identity. Hidden Markov Model is technique which is successfully used for online signature recognition and verification. It uses small number of observations and time series modeling required proper definition of states [3]. This depends on signature curve which depends on velocity value of pen. It is decomposed as high or low partition considering the velocity value. Partition depending on pressure and velocity is done using Hidden Markov Model.

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The procedure for extracting features depends upon the pre-processed signature image. Centre of gravity can be used as one of the feature preprocessed signature image [4]. For identification of a person's handwritten signature, techniques for extracting features from signature images are essential. For this clustering is one of the techniques used for verification. Clustering includes combination of data points which is divided in groups of clusters. The elements in a cluster are related to each other than elements in another cluster. In clustering, the term 'more similar' means it is near by some proximity measures[5].

## 2. Motivation

The general problem statement for signature verification can be stated as considering a set of signature images develop a model which will differentiate between genuine signature and forged signature. Signature verification system widely focuses on the detection of one or more class of cast signatures. Mean forgery is done when a forger has unrestricted access to at least one or a lot of samples of the writer's actual signature. An off-the-cuff forgery is done once the forger is aware of the writer's name, however it doesn't have access to a sample of the signature. Random forgery can be any random scribble, a genuine signature or a top-quality forgery for alternative author. Identification of a signature consists of identifying the signature of an individual from other signatures, whereas verification or recognition desires to recognize whether a given signature is associate degree manifest or a false claimed identity. Signature verification models are developed to allow automatic identification and analyze the genuineness of signature.

## 3. Literature Survey

Avani Rateria and Suneeta Agarwal [1] presents verification of signature using 3-layer convolutional neural network which is succeeded by connected layer. Its training parameters consists of different orders of magnitude. Here, feature extractor is used in hybrid classifier method and Siamese network. Verification of the signature is done by Support Vector Machine algorithm.

Muhammad Imran Malik, Marcus Liwicki, Andreas Dengel, Seiichi Uchida, and Volkmar Frinken [2] presents a unique signature analysis which depends on part-based or local signature features. Local analysis of signature is done using SpeedUp Local features. It gives various ideas about the areas where these features should be examined while carrying out signature verification. Depending on the results obtained from local stability analysis, a unique signature recognition system was used which evaluates the system on openly available dataset which consists of signatures which are genuine, disguised and forged.

Saeede Anbaee Farimani, and Majid Vafaei Jahan [3] used online signatures for verification which was done using Hidden Markov Model (HMM). Earlier approaches were consolidating HMM and Gaussian Mixture Model, which leads to the issue of appropriate selection of state numbers of HMM. Its benefits are small number of readings and equivalent explanation of states which were used for modelling of time series. It divides the signature curve which depends on velocity value of pen which in addition is decomposed into high or low portions. Hand movement directions are extracted between two adjacent points of each partition. The final time sequence of directions are used for training purpose of HMM.

Htight Htight Wai, and Soe Lin Aung [4] present a method for feature extraction of offline signature recognition. Signature image present on lower right corner cheque is taken into consideration. Further the image is translated to binary form which is done by

Otsu's method which is then enclosed in a rectangle. A new extraction technique is used which depends on splitting of signature image. Interesting pixels of image are found and then center of gravity is calculated and image is further partitioned into four blocks and pixels of blocks are distinguished. Further blocks are again partitioned and a total of 64 sub blocks are accomplished which leads to extraction of three features from every sub block.

Samit Biswas, Debnath Bhattacharyya, Tai-hoon Kim, and Samir Kumar Bandyopadhyay [5] proposed method for offline hand written signature verification. They proposed a method for feature extraction of offline signature images which is further used for recognition and verification. Use of clustering technique was done for verification purpose.

Mohitkumar A. Joshi, Mukesh M. Goswami, and Hardik H. Adesara [6] proposed use of low-level stroke features which was initially used for detection of Gujrati words and further used for offline signature recognition and verification. This analysis was implemented on ICDAR 2009 Signature Verification Competition dataset. It comprises of forged and genuine images of signature. Verification of signature was done by Support Vector Machine having with 3-fold cross validation. Equal Error Rate of 15.59 was achieved which was further compared with 2009 ICDAR signature verification or recognition competition result.

Derlin Morocho, Aythami Morales, Julian Fierrez, and Ruben VeraRodriguez [7] presents various strategies for elaborating automatic signature verification. This paper included crowdsourcing to constitute performance which is used for signature verification purposes. It also includes semiautomatic signature verification system using attributes. In this paper, they have demonstrated use of attributes for signature verification.

Kamlesh Kumari and V.K.Shrivastava [8] presents how efficiently the image processing-based feature extraction techniques capture the properties of handwritten signature features that could be described algorithmically. Parameters used with knowledge model affect the accuracy of Automatic Signature Verification are also described.

Rashika Shrivastava and Brajesh Kumar Shrivash [9] presents verification of offline signature by Support Vector Machine (SVM). Features like Gabor filter, discrete wavelet transform, etc. were extracted. This technique is divided into three forms. Pre-processing was done in first stage which includes filling of holes, banalization and box limit fitting. Second step is extraction of features which consists extraction of Gabor filter-based elements which is done for recognition of distinct signatures. Last step includes signature verification by using Support Vector Machine as classifier for recognition of signature.

Kruthi.C, and Deepika.C.Shet [10] proposed signature verification by scanning signature images and pre-processing it by applying binarization, complementation, filtering, thinning and edge detection methods. Further, the features including center of gravity, centroid, calculating count of loops, normalized area and finding horizontal or vertical profile were extracted and stored in database. Later, the values from database was provided to support vector machine and classification or verification of signature as genuine or forged was done depending on the value of feature.

Kamlesh Kumari, and Sanjeev Rana [11] proposed recognition and identification of signature by extracting features pretrained Convolution Neural Network approach. All the analysis was conducted on signature images from three dataset (SigComp2011) (Dutch, Chinese), SigWiComp2013 (Japanese) and SigWIcomp2015 (Italian). The results concluded that the features extracted from pretrained Convolution neural network along with Support Vector Machine as classifier gave better results than that of Decision Tree.

Anjali.R, and Manju Rani Mathew [12] proposed verification of signature by calculating gray level features of the signature images when it is distorted by complex background which is further trained by applying neural network classifier along with Support Vector Machine. Signature verification includes issues by segmenting signature from image document. This issue was resolved by calculating gray level distortion and further segmenting the original signature from complex background. Further, training of the image is done by neural network using feed forward back propagation algorithm as well as Support Vector Machine.

Amir Soleimani, Kazim Fouladi, and Babak N Araabi [13] worked on cursive behavior of Persian signature by proposing a framework for offline signature recognition using histogram of curvature along with histogram of gradient features. Calculating curvature for offline signature images when there is absence of temporal information was a complicated job. Discrete curvature estimator was used for this purpose which works using normalized gradient and its Jacobian matrix. For training purpose, Support Vector Machine was used as a classifier for predicting genuine signature and random forgeries.

Vaishali R. Lokhande, and Bharti W. Gawali [14] focused on underscores below signature, presence of dot on the letter, starting curves, ending strokes and disconnected streaks. Performance was calculated by dividing the signature image in five categories such as left, right, upper, middle and bottom. Artificial neural network along with structural identification algorithm was used for prediction of personality. Significance of the proposed work was to identify or recognize personality traits in various areas such as criminology, medical science and counselling.

## 4. Conclusion

Hence, to avoid forgery of signature in any of the public, private or other sectors; signature is classified recognized as genuine or forged based on the above-mentioned features. Based on the above-mentioned features Support Vector Machine, Neural Network algorithms helps to classify the signature as genuine or forged. This will result in determination of the signature that the signature is of the author specific.

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