

A Survey: Enhanced Offline Signature Recognition Using Neuro- Fuzzy and SURF Features Techniques

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Abstract- Signature verification systems can be categorized as offline (static) and online (dynamic). This paper presents Surf features and neural-fuzzy techniques based recognition of offline signatures system that is trained with low-resolution scanned signature images. The signature of a person is an important biometric attribute of a human being which can be used to authenticate human identity. The human signatures can be handled as an image and recognized using computer vision and neural network techniques. And with modern computers; there is need to develop fast algorithms for signature recognition. Thus there are various approaches to signature recognition with a lot of scope of research. Therefore in this paper; off-line signature recognition & verification using neural-fuzzy is proposed, where the signature is captured and presented to the user in an image format. And signatures are verified based on parameters extracted from the signature using various image processing techniques. Then Off-line Signature Recognition and Verification is implemented with SURF features and Neural Fuzzy techniques in ANFIS in Matlab. The proposed algorithm can be used as an effective signature verification system. The proposed algorithm was successfully made rotation invariant by the rotation of the image. There are various techniques to signature recognition such as SVM, LDA, and MDA. In this paper, we will discuss all these techniques.

Keywords— Signature verification, Neural Network, Fuzzy logic, SURF, LDA, MDA and SVM

I. INTRODUCTION

In our world, tradition and accept mean for a person to identify and know himself either to another person being or to a computer system is based on one or more of these 3 general principles:

1. What the person knows
2. What he possesses or
3. What he is

The written signature is regarded as the primary means of identifying the signer of a written document based on the implicit assumption that a person's normal signature changes slowly and is very difficult to erase, alter or forge without detection. Then hand written signature is one of the types to authorize transaction and know the human identity compared with other electronic identification methods such as finger prints scan and retinal pattern screening. This is simpler for people to change from using the famous pen-and-paper signature to one where the hand written signature

is captured and verified electronically. Thus signature of a human is an important bio metric attribute of a person and is used for authorization purpose. And many approaches are finding for signature recognition with much of scope of research. Then here; we deal with an off-line signature recognition technique. Signatures are mixtures of special characters and flourishes and therefore most of the time they can be not readable. Then also intra personal changes and inter personal differences make it need to analyze them as complete figures and not as letters and words put together. Signature recognition is the process of identify the writer's identity by check the signature against samples keep in the database. Then result of this process is usually between 0 and 1 which represents a fit ratio (1 for match and 0 for mismatch). The signature recognition is used most important to discuss the ability of a computer to translate human writing into text. And this may take place in both ways either by scan of written text (off-line method) or by write directly on to a peripheral input device. Thus 1st of these recognition techniques, known as Optical Character Recognition (OCR) is the most important in the main stream. At last most scan suites offer some form of OCR; allowing user to scan hand written document and have them translated into basic document. And OCR is also used by few archivists as a method of changing large quantities of hand written historical document into searchable, simply-accessible digital form [15, 16].

The image matching methods can be roughly divided into two classes; one is the image matching based on image matching and feature matching. Matching method is use the figure grey value to find the space geometry transform between the images, this method can make full use of the message of the figure, so it is also known as the matching method based on integral figure content; it has no feature detection step; in the features match stage; the fix size window and even whole figure match are adopted in estimation; so the determination is simple and also easy to be performed. Therefore the figure retrieval that is depend on artificial note still remain insufficient, the farther study that adapts vision figure features has been come up and become the important study. Then content of this method is figure feature extraction impersonally; whether the retrieval is better or not depend on the accuracy of the feature extraction. Therefore the research depend on visual features is become the focus in the academic society. This feature of

vision can be classified by semantic hierarchy into between level feature and low- level feature. Low-level feature have all colour, texture and inflexion. Middle level includes shape description and object feature.

II. OVERVIEW OF SIGNATURE RECOGNITION

A problem of person identification and verification is an actively grow area of research. This method are numerous and are depend on different personal characteristic; sound; lips movement; hands geometry; faces; odours; gaits; iris; retinas and finger print are the more common user authentication methods. And all these psycho logical and behavior characteristic are called bio metrics [12]. The driving force of the progress in this area is above all; the growing role of the internet and electronic transfers in new society era. Therefore considerable number of application is concentrated in the area of electronic commerce and electronic bank systems.

The biometrics have a important advantage over traditional know techniques (namely passwords, PIN numbers, smart cards etc) due to the fact that bio metric characteristic of the individual are not simply transferable are unique of every person and cannot be lost; stolen or broken. Then choice of one of the bio metric solutions depends on many factors which include:

1. User acceptance
2. Level of security require
3. Accuracy
4. Cost and implementation time [10,11]

There are many method of off line signature recognition as given below figure 1.

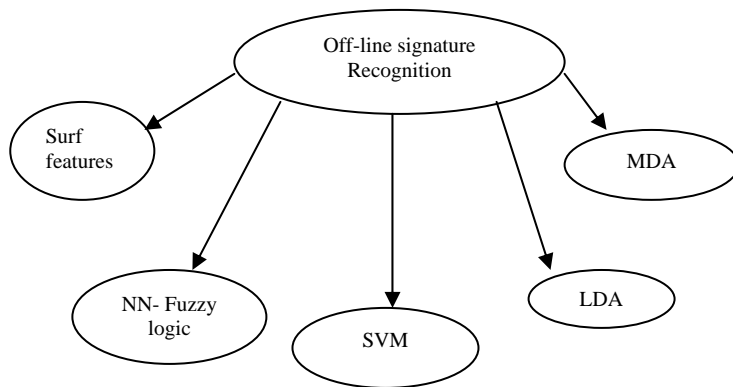


Figure.1: Different techniques of Signatures recognition.

The types of signatures verification review in this paper benefit the advantages of being high accepted by potential customers. The use of the signature has old history which goes back to the appeal of writing itself. Utilization of the signature as a known method has already become a traditional in the western civilization and is respected among all others. Then signature is a get proof of identity of the human in a transaction taken on their behalf. Then the users are more likely to approve this kind of computerized authentication method. Signature identification systems

different are in both their feature selection and the decision methodology. Therefore more than forty different feature methods have been used for signature identification. Feature can be dividing into two major methods: local and global. Global feature are feature related to the signature as a all; for instance the average signaling speeds; the signature bounding box and Fourier descriptor of the signatures trajectory. Then local feature correspond to a specific easy point along the trajectory of the signature. Signature recognition and identification involves two separate but strongly relate tasks: one of them is verification of the signature own; and the other is the decision about whether the signature is genuine or forged. Then also; depending on the need; signature recognition and identification problem is put into two major class: (i) On-line signature recognition and identification systems (SRVS) and (ii) Off-line SRVS. On-line SRVS requires some special peripheral unit for measuring hand speed and pressure on the person hand when it create the signature. Thus on the other hand; almost all Off-line SRVS systems rely on figure processing and feature extraction techniques.

III. NEURAL NETWORK

Neural network is database of inter connected neurons. This is use for universal approx. Artificial neural networks are made of inter connecting artificial neuron (programming constructs that mimic the properties of biological neurons). Artificial neural network may either be used to gain an understanding of bio logical neural network, or for solving artificial intelligence problems without necessarily create a model of a real biological system.

A. Architecture of artificial neural network

The basic architecture include of 3 types of neuron layers: input, hidden, and output. In feed-forward networks, the information flow is from input to output units, strictly in a feed-forward direction. The signal processing can extend over multiple layers of units, but no feedback connection is present. Recurrent network contain feedback connections. [12].

B. Artificial Neural Networks

Artificial neural network are made of inter connecting artificial neuron (programming construct that mimic the properties of biological neurons). Artificial neural network may either be used to gain an understanding of bio logical neural network, or for solve artificial intelligence problems without necessarily create a model of a real bio logical system. The real, bio logical nervous system is highly complex: artificial neural network algorithm attempt to abstract this massive and focus on what may hypothetically matter most from a signal processing point of view. Good performance (e.g. as measured by good predictive capability, low generalization error), or perform mimicking animal or person error patterns, can then be use as one start of evidence toward supporting the imagination that the abstraction really catch something important from the point of view of data processing in the brain [16].

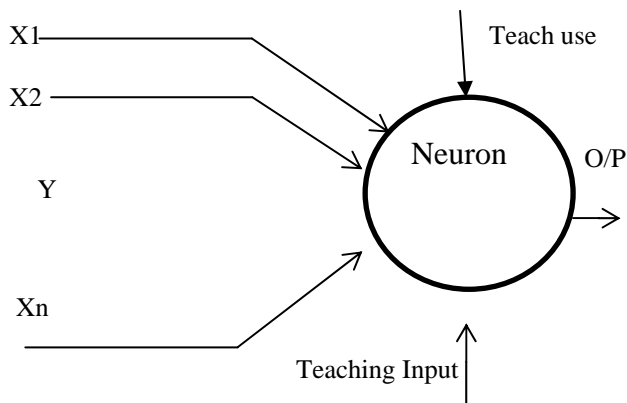


Figure 2: Neural Network

The other incentive for this abstraction is to reduce the amount of computation require to simulate artificial neural network, so as to allow one to experiment with bigger network and train them on larger data set. Application field of ANNs add system verification and controls (movable control, process control), sports-playing and decision making (back gammon, chess, racing), pattern recognition (radar systems, face identification, object recognition), serial recognition (gesture, sound, hand written text recognition), visualization and e-mail spam filter.

IV SUPPORT VECTOR MACHINE

The Support Vector Machine (SVM) is a state-of-the-art classification type introduced in 1992 by Guyon, Boser, and Vapnik. The SVM class is widely used in bio informatics (and other disciplines) due to its more accurate, able to determine and process the more-dimensional signal such as gene expression and exhibily in model diverse start of data .SVMs belong to the general class of kernel method. A kernel class is an algorithm that based on the signal only through dot-products. When this is the case, the dot product can be change by a kernel function which calculates a dot product in some possible high dimensional feature space. It has two advantages: First, the capability to generate non-linear decision boundaries using types designed for linear classifier. Second, the use of kernel function allows the user to apply a classifier to signal that have no fixed-dimensional vector space presentation. The prime example of such information in bio informatics are serial, either DNA or protein, and protein structures. Using SVMs effectively acquires an understanding of how they work. When train an SVM the practitioner need to make a numerous of decisions: how to pre process the information, what kernel to use, and finally, setting the parameter of the SVM and the kernel [1]. Uninformed choice may result in severely reduce performance. We aimed to give the user with an intuitive understanding of these choice and provide general usage guideline [7,13]. All the examples shown were produced using the PyML machine learning environment, which focus on kernel method and SVM.

V. NN FUZZY LOGIC

Here combine both Neural Network and Fuzzy algorithm to enhance the result as compare to previous work. At last here we use ANFIS tool i.e. combination of NN and Fuzzy.

VI SPEEDED UP ROBUST FEATURE (SURF)

SURF (Speeded up Robust Features) is a robust local feature detector; first presented by Herbert Bay et al in 2006; that can be used in computer vision tasks like object recognition or 3D reconstruction. And SURF is based on sums of 2D Haar wavelet responses and makes an efficient use of integral images. This uses an integer approximation to the determinant of Hessian blob detector; which can be computed extremely quickly with an integral image (3 integer operations). Therefore For features; it uses the sum of the Haar wavelet response around the point of interest. These can be computed with the aid of the integral image. SURF used in this approach to extract relevant features and descriptors from images. In SURF, a descriptor vector of length 64 is constructed using a histogram of gradient orientations in the local neighbourhood around each key point. Modified SURF (Speeded up Robust Features) is one of the famous feature-detection algorithms [1,2]. The panorama image stitching system which combines an image matching algorithm; modified SURF and an image blending algorithm; multi-band blending. This process is divided in the following steps: first; get feature descriptor of the image using modified SURF; secondly; find matching pairs; using correlation matrix; and remove the mismatch couples by RANSAC(Random Sample Consensus); then; adjust the images by bundle adjustment and estimate the accurate homographic matrix; lastly; blend images by Alpha blending. SURF approximates or even outperforms previously proposed schemes with respect to repeatability; distinctiveness; and robustness; yet can be computed and compared much faster. [3,4].

VI. LDA AND MDA

Linear Discriminant Analysis (LDA) is a techniques used for data classification and dimensionality reduction. In PCA, the shape and the location of the original data sets changes when transformed to a different spaces whereas LDA doesn't change the location but only tries to provide more class reparability and draw decision between the given classes. In discriminant analysis; two scatter matrices; called within-class (S_w) and between-class (S_b) matrices, are defined to quantify the quality[12]. The linear Discriminant analysis (LDA) is a classical algorithm that has been successfully applied and extended to various biometric signal recognition problems. The recent advancement in multi-linear algebra led to a number of multi-linear extensions of the LDA, multi-linear Discriminant analysis (MLDA), being proposed for the recognition of biometric signals using their natural tonsorial representation. In general, MLDA seeks a multi-linear projection that maps the input data from one space to another (lower dimensional, more discriminative) space.

VII. CONCLUSION

At last; in this paper discuss different techniques of signatures recognitions such as NN-Fuzzy, SVM, LDA, MDA and Surf features. But we can use best in all these which can give best result as compare to previous techniques. The advantage of using neural networks is that they can extract the most discriminative and representative set of features. We have presented a learning vector quantization neural network architecture based on varying parameters and eliminating redundant hidden layer units or blind neurons that learns the correlation of patterns and recognizes handwritten signatures. The proposed algorithm can be used as an effective signature verification system. The algorithm proposed was successfully made rotation invariant by the rotation of the image. The error rejection rate can further be improved by using better techniques for rotation, blurring and thinning.

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