**An Automated Signature Verification Model using Artificial Neural Networks:**

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**Abstract-This paper presents a classification method for identification of forged and real signatures using artificial neural networks based on extraction of prominent features responsible for uniquely identifying a signature and classify them in an automated manner once the intravariabilty of signatures is addressed through a thorough dataset that is exhaustive of all possible variations of signatures of the same person. The results show that a particular combination of features helps ascertain a fair degree of accuracy regarding the same.**

**Keywords: Artificial Neural Networks, Threshold detection, Harris Corner Detection, Cross-over loop points, Index points, Corner points,**

1. INTRODUCTION

In a country with a population of 1.4 billion people and approximately 45 crore bank accounts, one of the most crucial and yet tedious daily life problems is that of signature verification which till date is almost always done manually. This has various limitations including lack of accuracy and involvement of bias due to use of the naked eye and is overall a much more tedious and highly subjective method prone to errors. This is where the idea of using a neural network model to extract and compare features among the signature images is both novel and can prove to highly effective in the long run.

This model although novel has been touched upon by various researchers over the last few years and we have been fortunate enough to come across a few of them which has helped us shape our model into the state that it is today.

Signature Verification System using Different Algorithms by S. Priya, A.K.R.N.Supreeth, K. Somesh, A. Hruday Kumar[1] proposed a system for signature verification based on pixels and strokes introducing the harris corner algorithm.

A model by Rahul Verma, D.S. Rao [2]introduces the use of angle feature and pixel density for which has been been further improvised in our model using cross over loop points.

A paper by Jivesh Poddara , Vinanti Parikha , Santosh Kumar Bhartia,[3] is more about introducing geometrical parameters like axis, eccentricity and consequent use of deep learning all of which have been taken into account as raw material for our model.

Our model is an improvised version of all of the above papers along with a few novel ideas of our own and results and conclusion of our work shall be discussed further down this paper.

1. METHODOLOGY

The model we have proposed has the following distinct steps:

1. Creation of dataset

2. Pre-processing of input image

3. Feature extraction

4. Threshold determination

5. Use of ANN classifier

Since the same person can have different signatures at different times depending upon the mood, the type of pen , the colour used, use of caps, it’s very important to create an exhaustive dataset which takes into account this intravariabilty of signature. We have created a dataset involved ten signatures of each friend or colleague with a total of 55 people contributing 24 signatures each, 12 forged and 12 real which thus increases the accuracy of results.

The raw images obtained need to undergo noise removal and binarisation so as to enhance the features to be extracted.

Once the images have been pre-processed, we extract the following features decided through repeated trial and error so as to derive the most practical and accurate results:

* Axis: The ratio of the lateral and the longitudinal length of the signature
* Eccentricity: ratio of major axis and minor axis
* Skewness and kurtosis: statistical parameters which decide the shape of the signature, the peaked-ness and the degree of right or left alignment of the signature.
* Cross over loop points: every person generally writes a single particular letter in their signature with greater prominence than the others. This added weightage to this one letter is decided by use of cross over loop points which are essentially te number of times loop intersections are formed in that particular letter which greatly narrows down the scope of signature matching
* High intensity variation: Again a very important feature that takes into account variations in intensity due to difference in writing techniques or use of different pens, etc.
* Harris Corner Detection: Detects no. of corners in a signature using intensity algorithms as stated below.

E(u,v)=∑𝑤(𝑥, 𝑦)[𝐼(𝑥 + 𝑢, 𝑦 + 𝑣)−𝐼(𝑥, 𝑦)] ^2 W(x,y) is window function. I(x+u,y+v) is shifted intensity. I(x,y) is intensity

Harris corner can be defined as R = Det M – kTrace^2 M Where Det(M ) = λ1 λ2 Trace(M ) = λ1 + λ2 [1]

An artificial neural network model is created based on these features and the model is trained through backward propagation as different suitable weights are decided, by the model itself.

Threshold detection was initially done manually depending upon the accuracy of the output. That was later on automated directly by the ANN network depending upon the accuracy of the output.

1. RESULTS AND DISCUSSION

The above proposed model has produced varying results at different stages of its construction. Initially, the model was only 67 % accurate as the initial dataset was fairly small. Later on as new features were added and an automated threshold was decided, the model is now almost always above 85 % accurate for all scenarios. Of course, there is always scope for improvement as is in any other endeavour, and we shall continue to strive towards the same.

1. CONCLUSION

The proposed signature identification system is been based on some special features extraction. These features included high intensity variations and cross over points which uses a compact and memory efficient storage of feature points, which reduces memory overhead and results in faster comparisons of the data to be verified. This project helps in controlling human errors in signature verification and also makes the signature verification accurate, easy and faster. Here verification of these signatures can be done by choosing appropriate classification methods. Similar to other real world problems, no single approach may solve the signature verification problem perfectly, and practical solutions are often derived by combining different approaches. This technique can be added with any existing verification system for better result. It also makes the work easier for understanding and executing it by anyone without any knowledge of image processing. If any bank or any company uses this system the customers will feel much more secure and trustworthy.

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