Offline Text Document Authorization on the Basis of SIFT and SURF

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Abstract

This paper proposes a novel of text document authorization based on SIFT and SURF. It mainly consists of two stages enrollment and identification. In all stages SIFT (scale invariant feature transform) descriptors are extracted the scale and orientation (SOs) of the each sentences. At the same time SURF (speed up robust feature) will extract the scale and orientation (SOs) of the same word. These feature values are stored in the code book. In the identification stage SOs of input handwriting text documents are extracted and classify the document on the basis of lib SVM classifier. Experimental result consist of different English data sets (Iam, Firemaker etc). And by measuring the classification accuracy a comparative study is done on SIFT and SURF algorithms.

Keywords: Document authorization, SIFT, SURF, SVM, Word segmentation

I. INTRODUCTION

Document verification is the process used to recognize an individual’s handwritten documents. Writer identification is rooted in the older and broader domain of automatic handwriting recognition. There are several techniques or approaches that can be used to verify document authorization. A writer verification system based on handwritten text is expected to provide discrimination results equivalent to those obtained from signatures, since text has been reported to comprise rich and stable information [1]. Furthermore, a handwritten sentence can be determined and changed by the writer at will. In high security data systems like those involved in financial transactions, the first step towards reaching a specific person’s data is usually carried out by means of the personal identification (PIN) number. There are several techniques or approaches that can be used to verify document authorization, such as neural networks [2], Hidden Markov Models [3] distance measure [4], rule-based [5], and dynamic matching [6]. It mainly a writer identification system performs a one-to-many search in a large database with handwriting samples of known authorship and returns a likely list of candidates. This represents a special case of image retrieval, where the retrieval process is based on features capturing handwriting individuality. Every person uses personalized and characteristic shapes, called allograph, in this paper; we propose writer identification methods that aim to capture peripheral and also more central aspects of the writing behavior of an individual. Our methods operate at two levels of analysis: the structure level and the allograph (character-shape) level. SIFT and SURF algorithms mainly focus these features. Furthermore, very effective writer identification and verification is achievable by combining structure level and allograph-level features that together offer a fuller description of a person’s stable and discriminatory unconscious practices in writing. The papers organize as follows: In Section 2, we survey the recent research work on offline writer identification. Section 3 proposed method of this paper. Sections 4 describe the algorithm. And section 5 report the experimental analysis and result. Finally conclusion is presented in section 6.

II. RELATED WORKS

Compared to texture features, structure features have more stable for document authorization. So now a day’s researchers are more focus on structure feature of the image. Most of the structure feature focus on contour and allograph. Writer identification and verification methods failed in two categories: text-dependent and text-independent methods. The text-independent methods for writer identification and verification use statistical features extracted from the entire image of a text block. Said et al. [6], [7] discuss two method on the basis of texture independent approach such that multichannel Gabor filtering and gray-scale co-occurrence matrices. A similar approach has also been used on machine print documents for script [8] and font [9] identification. Sridhar et al. [10], propose a large number of features divided into two categories. Macro features operate at
document/paragraph/word level: gray-level entropy and threshold, number of ink pixels, number of interior/exterior contours, number of four-direction slope components, average height/slan, paragraph aspect ratio and indentation, word length, and upper/lower zone ratio. Micro features operate at word/character level: gradient, structural, and concavity (GSC) attributes, used originally for handwritten digit recognition. Mujahed Jarad [11] used artificial neural network to extract features of handwritten signature. Also calculate the False Reject Rate, the False Accept Rate, and the Equal Error Rate (EER). A feature selection study is also performed in [12]. Using a k-nearest-neighbor classifier, identification rates exceeding 92 percent are obtained in tests on a subset of the IAM database [13] with 50 writers, five handwritten pages per writer. The IAM data set will also be used in the current study.

III. PROPOSED METHOD

Proposed frame work mainly consists of two stages: enrollment and identification, as shown Fig1. In all of two stages first it will find out the key point and extract their descriptors and corresponding scales and orientations (SOs) from the samples. Initially on the basis of SIFT feature will be extracted the each sample and find the matching percentage on the basis of lib SVM classification. After that same sample applied to the SURF algorithm. Also find the accuracy of SURF on the basis of lib SVM classification. Finally SIFT and SURF algorithm combined and extracted the feature value and finds the accuracy on the basis of lib SVM classifier. Finally plot the comparison table of these three categories.

IV. ALGORITHMS

A. Word Segmentation:

Word level feature extraction is very important in handwriting image analysis. which required more time. On the basis of text line segmentation method it fails to segment some skew handwriting images, in which the text lines are not horizontal and hence may not be easily segmented.

Steps of word segmentation are follows
- Converting gray to binary image(I_b) using otsu algorithm
- Connected component are find out
- Filter I_b using isotropic LoG filter
- Assigning each connected-component in I_b to the nearest connected region form semi-word
- Merging semi-word we can get the word region
- Splitting the overlapping connected-components

1) Scale-Invariant Feature Transform (SIFT):

Scale invariant feature transform (SIFT), presented by Lowe [14] for distinctive scale-invariant features extraction from images, has been widely and successfully applied in many fields [15]. The SIFT algorithm has four major stages of computation:
(1) scale-space construction, (2) key point localization, (3) orientation assignment, and (4) key point descriptor extraction. In the first stage, the original images are decomposed into a Gaussian pyramid, and each level of the pyramid is called an octave, which is further decomposed into several sub-levels by convolving the initial image at the corresponding pyramid level with DoG filters with different variances. In the second and third stages, many stable key points are detected, and the locations, scales, and orientations of these key points are computed. In the last stage, a SIFT descriptor for each key point is generated. The key point detected using SIFT shown in Fig. 3. SIFT consist mainly four stages.
   - Scale-space extrema detection
   - Key point localization
   - Orientation assignment
   - Key point descriptors

Key points between two images are then matched by identifying their nearest neighbors. But in some of the cases, the second closest match may be very near to the first one. It may happen due to noise or some other reasons. In that case, ratio of closest distance to the second closest distance is taken. If it is greater than 0.8, they are rejected. It eliminates around 90% of false matches while discards only 5% correct matches.

2) Speedup Robust Features (SURF):

SURF is based on the hessian matrix. SURF is used to create a “stack” without 2:1 down sampling for higher levels in the pyramid which will result in images of the same resolution. SURF filters the stack using a box filter approximation of second-order Gaussian partial derivatives only due to the use of integral images. Considering the descriptors, SIFT is shown a good performance compared to other descriptors. The proposed SURF descriptor is based on similar properties. The first step in this is to fix a reproducible orientation based on information from a circular region around the interest point. And then we have to construct a square region aligned to the selected orientation, and finally extract the SURF descriptor from it. In order to be invariant to rotation, SURF is used to calculate the Haar-wavelet responses in x and y direction shown in figure 3. While the key point extraction based on SURF is shown in Fig. 2.

3) SVM Classification:

SVM is the technique used for data classification. It mainly consists of two stages training and testing. Each instance in the training set contains one target value and several attribute values. In the training time it will receive the all the data base value the main goal of the SVM in this paper to classify the authors. For this purpose it will create model which predict the target values of data instances in the testing phase which are given only the attributes. Each predict label consist so many feature values SVM compare each feature value with the input sample using suitable nonlinear mapping to a high dimension. The choice of the nonlinear mapping depends on the information available to the designer Here LIBSVM package [16] is used to solve the standard SVM problem in the learning framework of different video activities. For multi-class classification, we apply the one- vs -all training scheme.

\[\text{Interest Points}\]

![Fig. 2: key point detected using SURF](image1.jpg)

![Fig. 3: key pointed detected using SIFT](image2.jpg)

V. EXPERIMENTAL RESULTS AND ANALYSIS

The experiment was conducted by using IAM data base. In this data set consist of 260 different writer handwritten images. First at all the images are preprocessed then training and testing. Fifteen handwriting images of each author were taken for training purposes. Total 2000 handwriting images are considered in IAM data set. In this paper we initially consider 100 samples for training and 10 samples for testing. SIFT and SURF algorithms are used for the extracting the feature of these images. The descriptors like orientation, axes, location of interest points were analyzed. The classification is then done through the lib SVM classifier.
Table 1 will show the percentage matching on 8 samples against SIFT and SURF algorithms. From these 8 samples feature extraction on the basis of SURF is done also calculated the time required for each sample. Also these from these 8 samples feature extraction on the basis of SIFT and calculated the matching percentage and time. Finally the same samples extract the features on the basis of SIFT&SURF and calculate the matching percentage and time using lib SVM classifier. Finally analyzing Table 1 we can say that combined SIFT&SURF will perform highest accuracy approximately 88%. But SIFT and SURF will show almost same percentage approximately 84%. For measuring time SURF required 1/10th time of SIFT. Here time is more dominant then accuracy.

VI. CONCLUSION

This paper proposes a novel of offline text document authorization using multiple feature extraction method SIFT and SURF. SVM classifier is used for measuring the accuracy of the both SIFT and SURF algorithm. Form analyzing the Table 1 we can say that combined SIFT & SURF will give more accuracy and but have a higher complexity thereby resulting in slower retrieval. Individually the SURF algorithm produces high accuracy and less time but SIFT show same accuracy of SURF and required more time. The main reason for SIFT and SURF produce high accuracy these are invariant to scale, rotation and illumination change. The SVM approach only gives good classification accuracy result with multiple document authorization. And for probabilistic approach and complex procedure it’s a fastest classifying approach. This method is language-insensitive and can work well on different languages and hybrid languages, including some languages with complex structures, such as Chinese because system will only depend on the structure of the word, independent the texture of the word. Also the system further improved into signature analysis using high level feature extraction methods.

REFERENCES