Automated Writer Recognizer for offline Text using Scale Invariant Feature Transform Descriptor

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ABSTRACT
The Automated writer recognizer for offline text is to determine the writer of a text among a number of known writers using their handwriting images. Handwriting recognition (HWR) is a field where the writing styles of various writers with difficulties are encountered. The Handwriting recognition is derived from a neural network system for unconstrained handwritings. The proposed method offline text writer recognizer is based on scale invariant feature transform (SIFT) descriptor [7]. The writer recognizer which have methods involving a reduced number of parameters for creation of a robust writer recognition system Automated writer recognizer for offline text is very important for documents authorization and in forensic analysis. Writer identification is been a great areana for development in forensic analysis.

Keywords
SIFT, word segmentation, SIFT descriptor signature, scale and orientation.

1. INTRODUCTION
The Automated writer recognizer for offline text plays a vital role in identification for documents in various areas like forensic analysis and Banks with signature analysis. The writer identification has been new interest due to an increased need and effort to deal with problems ranging from crime to terrorist threats in forensic analysis. The paper addresses the automatic writer identification using scanned images of handwriting. The main idea is to reduce number of parameters and to create a robust writer identification system. In the process of automatic handwriting recognition, invariant representations of features are sought which are capable of eliminating variations between different handwritings in order to classify the shapes of characters and words robustly. The writer identification for handwriting analysis is wide research area [9]. The offline text writer recognizer is to determine the writer of a text among a number of known writers using their handwriting images. The proposed system uses a scale invariant feature transform method to extract the key point based structural features at word level from handwriting images, contains the structure based information of whole words and are insensitive to the aspect ratio and slant of the characters. To extract the word-level structural features of handwriting image and segments into word regions. Word segmentation is very important for handwriting image analysis. The writer identification, requires a specific enhancement of the variations which are characteristic to a writer's hand. The stable characteristic of individual handwriting gives the distinctive visual appearance of a handwritten in general view. The slant angle also corresponds to the direction in the handwritten script.

2. EXISTING SYSTEM
The existing systems for text recognition are structure based and texture based [3]. The texture-level methods that use directional methods like capturing size, curvature, regularity prove does not to be efficient. Schomaker has proposed an writer identification method in which the writer is assumed to act as a stochastic generator of ink-blob shapes, or graphemes [2]. The probability distribution of grapheme usage is characteristic of each writer and is computed by clustering but it did not produce adequate result. The existing system does not perform correction of slope and to normalize the size of text lines[4]. In the texture-based approaches for writer identification it takes handwriting texts as a special texture image and extracts the textural features. Said et al, Zhu et al and Hanusiak et al have extracted the texture feature using a grey-level co-occurrence matrix of handwriting images. Hanusiak et al have used hidden Markov tree for feature extraction [5] [6].Comparing the textural features with the structural features of handwriting are more intuitionistic, notable and stable for writer identification. Said et al and L. Schomaker have proposed edge-based directional features of handwriting [1] [12], i.e. edge direction distribution, edge-hinge distribution and directional co-occurrence which is does not consider slant and aspect ratio of handwriting. In early literatures, handwriting images are manually segmented, which is very time consuming and tedious [2]. Hence, now a days the structure-based approaches for writer identification are used. The existing structure-based approaches are based on the contours or the allograph fragments of handwriting, which may be easily affected by the slant and aspect ratio of the characters in handwriting [2]. Moreover, these approaches extract features from the allograph, which fail to extract the structural features between the allograph in the same words. However, when writing a document, the words are always taken as a whole and the structures of the whole word are stable and have a strong discriminability for different writers. Therefore, the structures between allographs in the same word are also important for characterizing writer's individuality.

3. PROPOSED SYSTEM
The proposed system automated writer recognizer for offline text uses SIFT algorithm to normalize the size of the text. Offline text writer recognizer methods have three stages of training, enrollment, and identification. SIFT extracts the key point based structural features at word level from handwriting images, which contains the structural information of whole words and is insensitive to the aspect ratio and slant of the characters. To extract the word-level structural features of handwriting image, segment the handwriting image in the form of word regions (WRs). Word segmentation is very important for handwriting image analysis.

3.1 Proposed System Architecture

The automated writer recognizer for offline text is based SIFT algorithm in order to identify writer individuality among the writers. As shown in the following Fig1. it consist of training,, enrolment, and identification stages. First the handwriting image is segmented into word region using word segment. The generation of codebook is done it uses vectors containing x and y coordinates of the normalized contours can be used to train a clustering algorithm. After training, a specific number of common fragments appearing in people's handwritings are determined. The results show approximately the same performance for these clustering methods. After construction of the codebook, the feature vector is calculated by an occurrence histogram, each of which corresponds to one codebook member. To construct this histogram, all fragments of the handwriting are first extracted and normalized. Then, for each fragment, the most similar member of the codebook is selected using a Euclidean distance function, and the corresponding is increased by one. Finally, the members of histogram are divided by the sum of them. Using the new method, the number of extracted fragments can be modified with changing the *gap* parameter. By decreasing this parameter, the number of extracted fragments increases. This increase is especially useful when a short text is available. SIFT are used to detect key points and extract their SIFT descriptor (SDs) as shown in following Fig2. Then feature matching is done in order to get the final

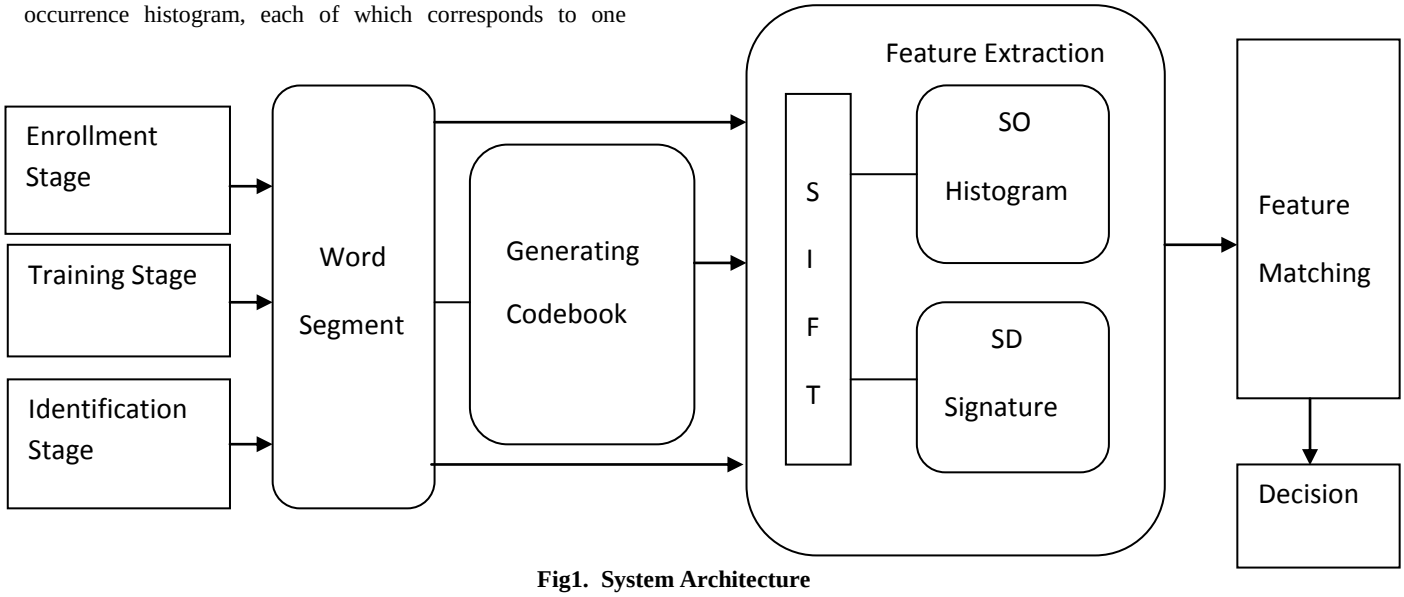

Fig1. System Architecture

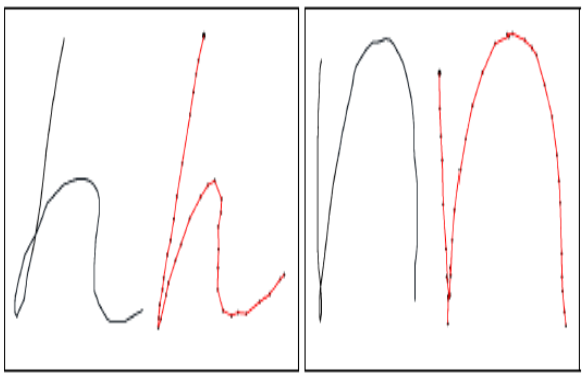

Fig 2. The key points detected in word region by SIFT

4. ALGORITHMS

4.1 SIFT Algorithm

The scale invariant feature transform (SIFT) algorithm proceeds as follows:

- Features are extracted from handwriting images.
- Scale-space construction: 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.
- Key point localization: Here many stable key points are detected of the handwriting image as shown in Fig 2.
- Orientation assignment: After detecting key points the locations, scales, and orientations of these key points are computed
- Key point descriptor extraction: In this stage scale invariant feature transform descriptor for each key point is generated.
- After key points of handwriting are computed then (SD) SIFT descriptor and (SO) scale and orientation are used. The SD are scale and rotation invariant which reflect the structures of image regions centered at the key points and SOs preserve the scale and orientation information of this structures.

5. MODULES

5.1 Word Segment Module

Recent automatic word segmentation techniques are based on text line segmentation. Firstly segmented text lines by using Hough transform, and then segment words from each text line according to the distances between the adjacent connected components in vertical project domain [8]. The word segment process first takes the original handwriting image (I) then convert that original image in binary image (Ib). Filter the binary image into filtered image (If). Then obtain a binary filtered image (Ifb). Semi-word regions (SWRs) are formed. Merge the image (WRs) i.e. form word regions and split overlapping of words.

5.2 Generate Codebook Module

Many word regions (WRs) are obtained from handwriting document image, after word segmentation. To obtain each WR, the SIFT algorithm detects a number of key points and extract their descriptors, scales, and orientations. Fig 2. shows an example of the key points detected in a word region by using SIFT. Large and varying amount of key points from different handwriting images are obtained. The generation of codebook is done it uses vectors containing x and y coordinates of the normalized contours can be used to train a clustering algorithm [10][11] . After training, a specific number of common fragments appearing in people's handwritings are determined. The results show approximately the same performance for clustering methods.

5.3 Feature Extraction Module

Here the feature of the handwriting images are extracted as follows:

5.3.1 SIFT Descriptor Signature (SDS) Extraction

- N is the size for SDS feature vector
- Compute the Euclidean distance as follows

$$\boldsymbol{ED_{ij}} = \sqrt{\sum_{K=1}^{L}\left(\boldsymbol{d_{ij}} - \boldsymbol{c_{jk}}\right)^2} \qquad (1)$$

- Compute the SDS vector as follows

$$\mathbf{SDS_i} = \frac{\boldsymbol{SDS}}{\sum_{j=1}^{N} \boldsymbol{SDS_j}} \qquad \mathbf{(2)}$$

5.3.2 Scale and Orientation Histogram (SOH) Extraction

- Initialize SOH feature vector with size M.
- Compute the index in the SOH feature vector
- Compute the final SOH vector as follows

$$\boldsymbol{SOH_i} = \frac{\boldsymbol{SOH_i}}{\sum_{i=1}^{M} \boldsymbol{SOH_j}} \qquad \mathbf{(3)}$$

5.4 Feature Matching Module

- The features of two handwriting images are used to calculate their dissimilarity using Manhattan distance as follows

$$\boldsymbol{D_1(u, v)} = \sum_{i=1}^{N} |\boldsymbol{u_i} - \boldsymbol{v_i}| \qquad \mathbf{(4)}$$

- The Chi-square distance is calculated which improves the importance of small value components as follows

$$\mathbf{D_2(x, y)} = \sum_{j=1}^{M} \frac{(x_j - y_j)^2}{(x_j + y_j)} \qquad \mathbf{(5)}$$

Then after normalized both *D*1 and *D*2 these two distances are then fused to form a new distance to measure the dissimilarity between two handwriting images as below:

$$\boldsymbol{D(I1, I2) = w \times D1(u, v) + (1 - w) \times D2(x, y)} \qquad \mathbf{(6)}$$

6. METHODOLOGY

The proposed method can be implemented as follows:

- Word segmentation: The handwriting image is segmented into word regions.
- Scale invariant feature transform algorithm: It has four major stages of computation: scale-space construction, Key point localization, Orientation assignment, and Key point descriptor extraction.
- The scale invariant feature transform is used to get the key points of handwriting, their SIFT descriptors, and the corresponding scales and orientations.
- Codebook generation: Cluster the SDs of the key points extracted from the training samples into N categories and represent each category with its center, which is called a code.
- SIFT Descriptor Signature extraction and scale and Orientation Histogram extraction is done.
- Identification stage: Here the feature matching of two handwriting images is done and hence recognition of writers individuality.

7. CONCLUSION AND FUTURE SCOPE

The automated writer identification using scanned images of handwriting and is to provide a computer analysis of handwriting individuality. SIFT uses appropriate representations, computable features capturing the writing style of a person from the scanned handwritten samples. The feature representation relies to maximize the separation between different writers. Automatic writer recognition using scanned images of handwriting is very effective. This method is based on SIFT key points and therefore insensitive to the aspect ratio and slant of the characters. SDS and SOH are very stable and can reflect the structures around the SIFT key points and hence have a strong dissimilarity to different writers. The automatic writer recognizer can be used for historical document analysis.

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