Tongue as a Biometrics Entity

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Abstract—The authentication of a person using tongue is voting for the greater accuracy. Tongue the least gullible organ considered as an efficient candidate for person identification and authentication. Tongue print of every Human is different and unique. Besides being unique it the least manipulated organ it enhances the security for identification and authentication of a person avoiding mostly occurring forgery cases. The paper introduces the feature extraction using sharpening and edge detection for acquiring tongue for authentication. The methodology for the study of person identification using tongue print uses MSE.

Index Terms—Biometrics, Edge detection, Feature extraction, MSE, Sharpening, Tongue, Tongue print.

1 INTRODUCTION

So far, there had been various developments in the field of person identification and authentication. Biometrics developed a Single-modal (Fingerprint, Iris, Footprint, Face, Etc.) and multimodal (Combination of one or more Modalities) approach to for the same. Multimodal definitely over shading the loopholes of system single modality but itself left with own flaws. On the other hand, we can discuss a unique feature of human body – tongue Print for person identification. Adding another level of accuracy to person identification and authentication the paper communicates a new technique i.e. Tongue print analysis.

Adding another level of accuracy to person identification and authentication the paper communicates a new technique i.e. Tongue print analysis. The analysis follows the traditional sequence of identification steps for the study:

- Image acquisition
- Image registration and authentication
- Feature extraction and enhancement
- Matching
- Decision making

The paper uses a live capturing mechanism for unlocking the application for person identification. Following the setup though non-peculiar tongue prints of various persons are captured. For preparing the database, they are stored with a common specifications and scale. The Tongue image is thus enrolled as the ID given to individual image. Enrolled images are thus preprocessed to highlight the unique features of tongue. Just like the uniqueness of physiological features of various modalities of biometrics, Tongue Print of a person possesses uniqueness in itself. Tongue print of every Human is different and unique in this it has various traits. First, it has geometric feature with texture, which are unique and invariant for an individual. Second, the only internal organ is easily accessible for study. Third, it is the least manipulated organ, which enhances the security of identification, avoid mostly occurring forgery cases. Last, the involuntary squirm of the human tongue not only is a natural and convincing proof that a subject is alive, but it also be utilized for discriminating individuals [1].

The enrollment simultaneously deal with the authentication of the registered person. With the preprocessing the baseline for feature extraction starts. For this, the major feature is highlighted using sharpening algorithm. To get the exact object the paper uses edge detection. The enhanced object using this two filters finally the comparison is carried out for authentication.

2 LITERATURE REVIEW

Making a way for a novel biometrics identifier, a dynamic tongue print identifier was introduced which uses both static and dynamic feature of the biometric [1]. Tongue biometric can purpose an exceptionally trustworthy means for individual identification and act as a universal biometric in all solicitations [18]. Finding point of correspondence between two images is one of the methodology for object recognition. As mentioned earlier there had been many physiological and behavioral aspects of biometrics had been implemented viz. face [2,3], iris [4,5], finger-print [6], palm-print [7], foot-print and gait [8], voice [9] and signature [10]. However, they are ineffective in combating identity fraud [11]. The multimodal Biometrics Study at different point of concern shows the importance of having a common baseline system for benchmarking of fusion level [12]. Nevertheless, pertaining the quality of least gullible tongue hold the dynamic feature for the study. The system

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implementing this with physiological and neural study describe crucial role of dynamic information in the human visual recognition process [13]. The finding of point of correspondence involves the two-way process detection of interest point also the description of interest point. Based on the Eigen values of the second moment matrix, Harris corner detector is probably most widely used [14]. Lindeberg [15] automatic scale selection allows selecting interest point with their own characteristics. A variety of descriptor had been introduced viz. Gaussian [16]. In context to Pixel analysis of images is incorporated at different prospect for which different image enhancement techniques by using their quality parameters (MSE & PSNR) is used and new erosion enhancement technique were established[17].

3 Preprocessing

The preprocessing for the work starts with building a database. The speculation is general, like other modalities of biometrics i.e. capturing and storing the data with and enrolled identification abbreviations. The other concern for preprocessing is to discuss the feature of tongue. The distinct patterns are observed of the tongue print during the study. Here we collate few tongue print based on Region of Interest (ROI). Since the pixel-by-pixel analysis is considers the ROI are extracted from different coordinates of the image. These ROI been thus incorporated for matching to the training image thus passing the criteria for the test image set. The ROI can be considered for the removing the outlier the for this purpose the paper acquire the sharpening of image. The enhanced image is thus put to an edge detection so that the ROI can be deducted. The fig 1 shows the different ROI.

4. Methodology

The methodology can be depicted in the form of a flow diagram. To begin with the process it describes the acquisition of image. Image manipulation will convert into appropriate format, finally the image will compared using MSE and the comparative result will be generated. Fig. 2 is the Block diagram for framework followed in the study.
Fig. 2 work flow of the proposed methodology

4.1 Image Acquisition

The fig. 3 shows the steps for the acquisition of the image for training database. The paper uses live capturing of tongue image. For capturing the intact webcam as well as external webcam can used. After acquiring, the image is passed for registration for preparing training dataset. The registration carried out will create a database for future referencing. Though any particular setup isn’t required but for capturing any image a proper illumination is the basic requirement. The following section describes the registration process.

4.2 Image Manipulation and Registration

Comparison is the base for identification and authentication in biometrics. Leading to this the enrolment of the images is important. This will prepare a training dataset. While the live capture carried out the images are in raw form, and the actual object thus needed to acquire. The process involve removing the outliers. The image manipulation is carried out by cropping, reshaping and resizing. The resulting image will the actual object for authentication of the person using tongue. This image is given with an ID for identification purpose and stored in the training data.

4.3 Feature extraction and enhancement

Though the image manipulation has given an appropriate object for comparison still there is possibility noise in image. To remove these noises from image different filters can employed. The paper consider image sharpening as a first filter. And
to get the exact feature the paper employs edge detection.

4.3.1 Image sharpening

Image sharpening refers to any enhancement technique that highlights edges and fine details in an image. Image sharpening is widely used in printing and photographic industries for increasing the local contrast and sharpening the images. Sharpening works by exaggerating the contrast of the object’s edges, giving the viewer the impression of distinct delineation [19][20]. A high-pass filter that extracts the high-frequency components first filters the original image, and then a scaled version of the high-pass filter output added to the original image, thus producing a sharpened image of the original.

4.3.2 Edge detection

Edge detection is a process of locating an edge of an image. Edges are significant local changes of intensity in an image. Edges typically occur on the boundary between two different regions in an image. Goal of edge detection to produce a line drawing of a scene from an image of that scene. Important features can be extracted from the edges of an image (e.g., corners, lines, curves). These features are used by higher-level computer vision algorithms (e.g., recognition).

4.4 Mean squared Error (MSE)

Let X1, X2,……, Xn be n random variables, i.e., a random sample from f(x|θ), where θ is unknown. An estimator of θ is a function of (only) the n random variables, i.e., a statistic θ = r(X1,……., Xn). There are several methods to obtain an estimator for µ, such as the MLE, method of moment, and Bayesian method. A difficulty that arises is that since we can usually apply more than one of these methods in a particular situation, we are often face with the task of choosing between estimators. Of course, it is possible that different methods of finding estimators will yield the same answer, which makes the evaluation a bit easier, but, in many cases, different methods will lead to different estimators. We need, therefore, some criteria to choose among them. We will study several measures of the quality of an estimator, so that we can choose the best. Some of these measures tell us the quality of the estimator with small samples, while other measures tell us the quality of the estimator with large samples. The latter are also known as asymptotic properties of estimators.

4.4.1 Mean Square Error (MSE) of an Estimator

Let θ̂ be the estimator of the unknown parameter µ from the random sample X1,X2,……,Xn. Then clearly the deviation from θ̂ to the true value of θ, |θ̂ - θ|, measures the quality of the estimator, or equivalently, we can use for the ease of computation. Since θ̂ is a random variable, we should take average to evaluation the quality of the estimator. Thus, we introduce the following

Definition: The mean square error (MSE) of an estimator θ̂ of a parameter θ is the function of θ defined by, and this is denoted as MSEθ̂. This is also called the risk function of an estimator, with (θ̂, θ)2 called the quadratic loss function. The expectation is with respect to the random variables X1, X2,……., Xn since they are the only random components in the expression. Notice that the MSE measures the average squared difference between the estimator θ̂ and the parameter θ, a somewhat reasonable measure of performance for an estimator. In general, any increasing function of the absolute distance |θ̂ - θ| would serve to measure the goodness of an estimator (mean absolute error, E(θ̂ - θ), is a reasonable alternative. But MSE has at least two advantages over other distance measures: First, it is analytically tractable and, secondly, it has the interpretation.

\[ \text{MSE}(\hat{\theta}) = E((\hat{\theta} - \theta)^2) = \text{Var}(\hat{\theta}) + (\text{Bias of } \hat{\theta})^2 \]

This is so because

\[ E((\hat{\theta} - \theta)^2) = E(\hat{\theta}^2) + E(\theta^2) - 2E(\hat{\theta}\theta) = \text{Var}(\hat{\theta}) + [E(\theta)^2] + \theta^2 - 2\theta E(\hat{\theta}) = \text{Var}(\hat{\theta}) + [E(\theta)^2] - 2\theta^2 \]

Definition: The bias of an estimator θ̂ of a parameter θ is the difference between the expected value of θ̂ and θ, that is, Bias(θ̂) = E(θ̂) - θ. An estimator whose bias is identically equal to 0 is called unbiased estimator and satisfies E(θ̂) = θ for all θ. Thus, MSE has two components, one measures the variability of the estimator (precision) and the other measures the its bias (accuracy). An estimator that has good MSE properties has small combined variance and bias. To find an estimator with good MSE properties, we need to find estimators that control both variance and bias. For an unbiased estimator θ̂, we have:

\[ \text{MSE}(\hat{\theta}) = E((\hat{\theta} - \theta)^2) = \text{Var}(\hat{\theta}) \]

Therefore, if an estimator is unbiased, its MSE is equal to its variance. The simulation to evaluate MSE will take the

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training data from the training data set and from test data set.

5 Results
The final step is decision-making is how the test data is matched to the training data. Here we have defined few parameters for depicting the observed results:
1. Percentage of similarity
2. Number of pixel matched
3. Number of pixels varied
4. Comparison time
The simulation considers taking an image and comparing with test image which could be the segment of the image or any differed image. The percentage similarity will give the percentage the number of pixels matched of test image to that of training image. The number of pixel matched will be plot. The plot will depict the comparison time. We can observe this point in the form of a bar chart. Fig.4 represents the bar chart for different parameters.

![Fig.4 Comparison Chart of two images](image)

6 Conclusion and Future Scope
The tongue pattern detection is one of the key point for the biometrics study. Considering tongue as one of the parameter for person identification is the goal of the study. Alternatively, we have achieved the feasible matching of images Using Mean squared error detection in colored pixel of the tongue images. On the verge of seeking accuracy, the images to be analyzed using different filters. As mentioned earlier the symmetry is still the key measure for further implementation. Also the employment of various filter before comparing the image will aging increase the values of the matching parameters. To reach at higher level of accuracy we can observe the tongue print analysis in RGB scale of image the live detection from the involuntary squirm of tongue promoting the accuracy to it. Considering the broader aspect of study of Tongue votes for its induction as a biometric parameter.

References