Invariant Iris Feature Extraction and Recognition For Smart Exam Hall Entry

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Abstract- Biometric recognition is the use of physiological and traits to identify an individual. Many biometric traits have been developed and are being used to authenticate the person's identity. Iris recognition systems are widely used and have proved to be efficient at individual recognition with high accuracy and nearly perfect matching. The iris features of two eyes of a same person are not similar making it more secure way of authentication compared to other biometric recognition system. The system is designed to pass only the users into the exam hall those are all verified by iris pattern recognition and block the unauthorized users. In the examination hall we proposed to use the iris pattern verification system to recognize only the authorized user. In the back end pre-processing, feature extraction, database matching are build in the Processor and the matched or mis-matched results will be displayed in the LCD which is front ended hardware level. The iris pattern capture from the subject is involved three phases. After recognition the output will be shown in digital devices comes under hardware part. The hardware part is an external feature which will have all the software inbuilt programmes for recognition. Here different databases namely CASIA, UBIRIS, IITD is used. When a person come in front of the camera(iris scanner) , the camera capture the eye and the software undergoes the techniques and match the sampled image with the total database stored in a memory chip and proved the results respective to the matched database. In Hardware implementation, Beagle board is interfaced with the LCD display to display the result i.e., authorized person/not. The machine learning algorithm's are compiled with the python language which is easily fused in the beagle board. The objectives of the proposed method is to implement a new type of smart exam hall entry, to reduce the tension about the ID cards and hall ticket for the students which is also reduce the work tension of the supervisor. The time consumption for the document / ID card verification is reduced by this method thereby we also reduce the other unnecessary malpractice.

Keywords: Iris recognition, DSIFT algorithm, k-nn classifier.

1. Introduction

The current scenario of entering the exam hall needs manual power to check the details of the examiner while entering into the hall. It takes time to check the details of everyone in the exam hall manually and the examiner need to keep the identity cards and hall ticket with them. In case, if the examiner is unable to get the proof with them they are not allowed to enter into exam hall and to attend the exam, meanwhile it creates tension to the hall supervisor and examiner. During the detail verification malpractice may be held without the knowledge of the supervisor. These problems can be sort out by smart hall entry. Smart entry refers to reduce the manual work while entering into the exam hall. Biometric identification plays major role in authentication a person's identity. The more securable among the biometric authentication is **iris recognition.** Iris recognition is free from age limits and has high security configuration. Iris pattern is recognised with seconds, time consumption is reduced. In this, the person's details is collected previously and stored in the database. While entering into the exam hall the person just need to stand before camera and the device shows the details about the particular person and mention that the person is authorized user or not by recognizing the iris pattern. The hardware device fixed before the exam hall is pre-programmed with Machine learning algorithms. It shows the result i.e., the person details and originality via monitor. The project comes under the biometric identification.

2. Literature review

Supriya G et al., [1] published a paper on "Efficient iris recognition by fusion of matching scores obtained by lifting DWT and log-Gabor methods of feature extraction"**.** By using the lifting DWT and log-Gabor algorithm, results in maximum maths and results in more accuracy compared to other iris recognition system. Lv Hanfei et al [2] (2015) published a paper on "Iris Image Recognition method based on Multi-feature". In multi-feature recognition time consumption for recognition is reduced.

Pengfei Cai et al., [3] published a paper on "An Eyelid Detection Algorithm for the iris recognition"**.** By using eyelid localisation algorithm which detect the eyelid effectively and quickly improves the speed about 4 seconds compared to other iris recognition. S. Joshua Kumaresan et al.,[4] published a paper on "Person identification with iris recognition based on Generalised Structure Tensor "**.** By using Generalised Structure Tensor the useless parts are masked and iris region alone is detected and the method achieved higher matching rates in iris authentication.

Jia Zhen liang et al., [5] (2015) published a paper on "Iris recognition based on block theory and self-adaptive feature selection"**.** To improve the performance of iris recognition a novel based on block theory and self-adaptive feature selection is proposed and results in improved iris recognition rate. Shideh Homayon et al., [6] (2015) published a paper on "Iris recognition for personal identification using LAMSTAR neural network"**.** In this novel a special type of neural network is used for recognition part and results in high accuracy especially when the primary steps are done well.

Anandhi et al., [7] published a paper on "Iris segmentation and detection system for human recognition using canny detection algorithm",2015**.** The canny edge detector performs better than others and has better results of noisy image, remove streaking problem and using minimum curvelets coefficients we can get up to 100% accuracy and reduced time consumption in identifying the iris.

Ishandeep singh et al., [8] published a paper on "Robust Iris recognition system based on 2d wavelet coefficients"**.** In this novel reverse biorthoganol wavelet transfom is used to extract the most deterministic pattern and achieved a accuracy rate of 99.2% and error rate of 0.09%.

3. Proposed methodology

3.1 Software Implementation

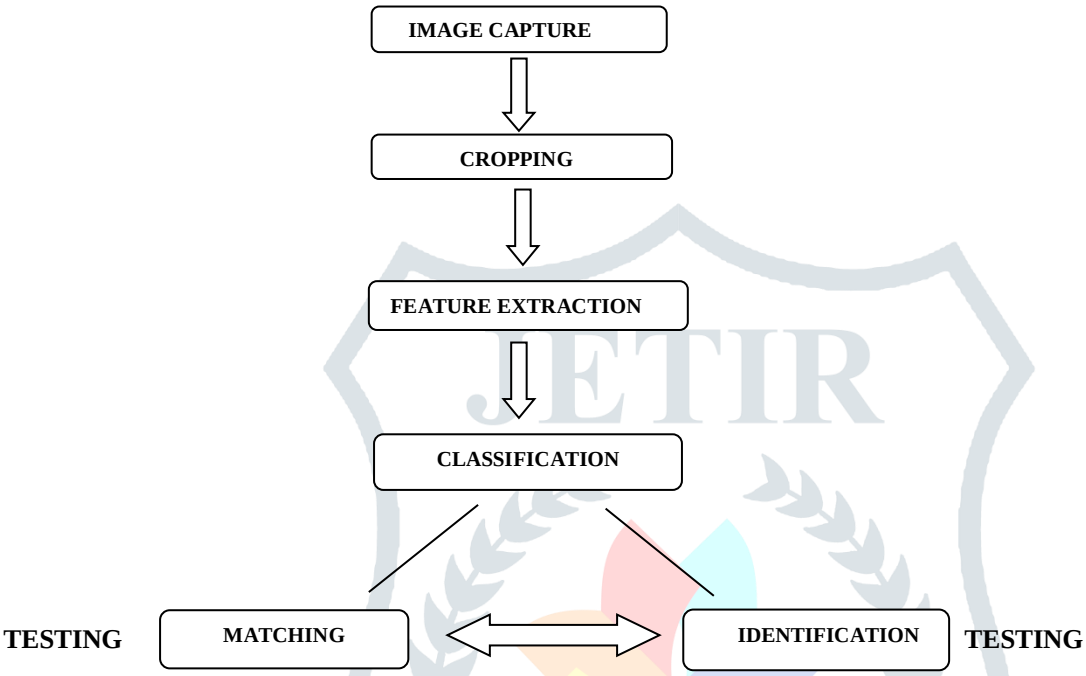


Figure 1: flow diagram of proposed methodology

3.1.1 Iris pattern Capture:

The main motivation of this project is to allow only the authenticated user into the examination hall. For that, a camera is fitted in front of exam hall to capture iris pattern. If a person stood in front of the camera it capture the individual iris pattern.

3.1.2 Image cropping and resize:

The Resize block enlarges or shrinks an image by resizing the image along one dimension (row or column). Then, it resizes the image along the other dimension (column or row).This block supports intensity and colour images on its ports. When you input a floating point data type signal, the block outputs the same data type. Cropping help us to remove the extra background rather than input image.

3.1.3 Feature Extraction

In this stage the extracted feature undergoes matching with iris pattern which are already stored with the details. This stage decides that whether the person entering into the examination hall is authenticated person or not. If the person is an authenticate user then the person is allowed to enter into the examination hall else the person is not allowed. The technique used for classifications is **Dense Scale Invariant Feature Transform algorithm**.

3.1.3.1 DSIFT algorithm

DSIFT implements a dense version of **SIFT**. This is an object that can quickly compute descriptors for densely sampled keypoints with identical size and orientation. It can be reused for multiple images of the same size.

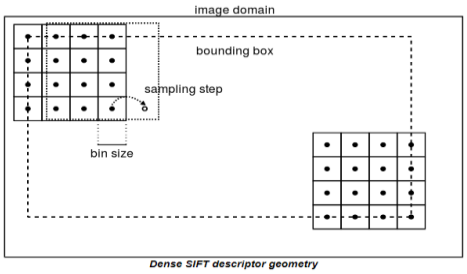


Figure 2: DSIFT descriptor geometry

By default, SIFT uses a Gaussian windowing function that discounts contributions of gradients further away from the descriptor centers. This function can be changed to a flat window invoking vl_dsift_set_flat_window. In this case, gradients are accumulated using only bilinear interpolation, but instad of being reweighted by a Gassuain window, they are all weighted equally. However, after gradients have been accumulated into a spatial bin, the whole bin is reweighted by the average of the Gaussian window over the spatial support of that bin. This "approximation" substantially improves speed with little or no loss of performance in applications.

3.1.4 Classification

3.1.4.1 k-NN Algorithm

The k-NN classifier first initialize the k and then it compute the distance for test instance, and each training instance. After that it sort the distances and take k nearest neighbors for applying the simple majority of class data. The k-NN classifier is comparing the objects by converting all features of the instances into numerical value for different types of data that is numbers colors, geolocation, Booleans etc., and it represent instances as vectors of features in an n-dimensional space. The k value will be chosen.

If k is too small then it is said to be over-fitting. The algorithm performs too good on the training set, compared to its true performance on unseen test data.

If the value of k is small then the result comes out less stable and it influenced by noise. If k is large then the result will comes the less precise and it has a higher bias of the classification.

$$K=\sqrt{2}\,n$$

The non- parametric method is used to find k-NN classification and regression. If k = 1, then the object is simply assigned to the class of that single nearest neighbor. The output is the property value of the object for k-*NN* regression. The resultant value is used in the average of the values of its k nearest neighbor classifier. The k-NN is the simplest algorithm for all machine learning algorithms.

The k-NN classification is a technique used to assign the contributions of the neighbors, so that the nearest neighbors can present more, to the average than the more distant ones. For example, each neighbor is a weight of 1/*D*, where *D* is the distance to the neighbor. The neighbors are taken from a set of objects for k-NN classification. This can be thought of as the training set for the algorithm, though no explicit training step is required. In the k-NN algorithm is a sensitive to the local structure of the given data.

4. Experimental results

4.1 TRAINING AND TESTING PHASE

It is a simple data division for Generating the training and testing data. You must first segregate the n-images of data. This data can then be divided in a typical 70-30 or 50-50 ratio of training, test & validation data. The data can be divided such that all classes have proportionate representation in both test and training. Feature vector in simple terms is just a collection of characteristics or features of an image. In case of images, they may be geometric features, texture features etc. Now, for machine learning you must provide the training data to the classifier so that it can build a model. This model can be validated and optimal kernel parameters can be selected. K-fold cross validation is the one of the simplest ways to choose the same. There are also several algorithms you can explore for selecting good (mR) features. Once your features and model are built you can test the classifier with the data and evaluate the accuracy of classification.

Table 1: For different values of training and testing counts the accuracy and time consumption

s.no	Training	Testing	Time consumption	Accuracy
1	500	499	253.94	87.3747
2	300	600	206.275	72
3	200	700	178.20	60.57

The table 1 shows the accuracy and time consumption of IITD images for different values of training and testing

4.1 Feature Extraction result using DSIFT

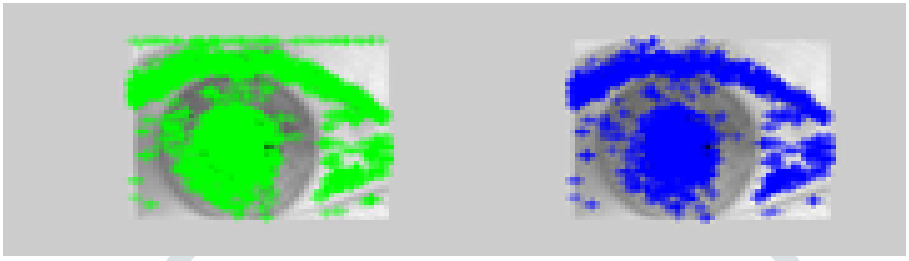


Figure 3: Result from DSIFT

Figure 3 shows the peak points extracted from the iris pattern using DSIFT algorithm .

Table 2: DSIFT recognition rate and time consumption for different database

s.no	Database	Time Consumption(secs)	Accuracy
1	CASIA	88.4454 (120 images)	77.1084
2	IITD	2445.82 (1000 images)	88.577

4.2 Comparative Results

From the above pre-processing and extraction methods the comparative results between different database are given below:

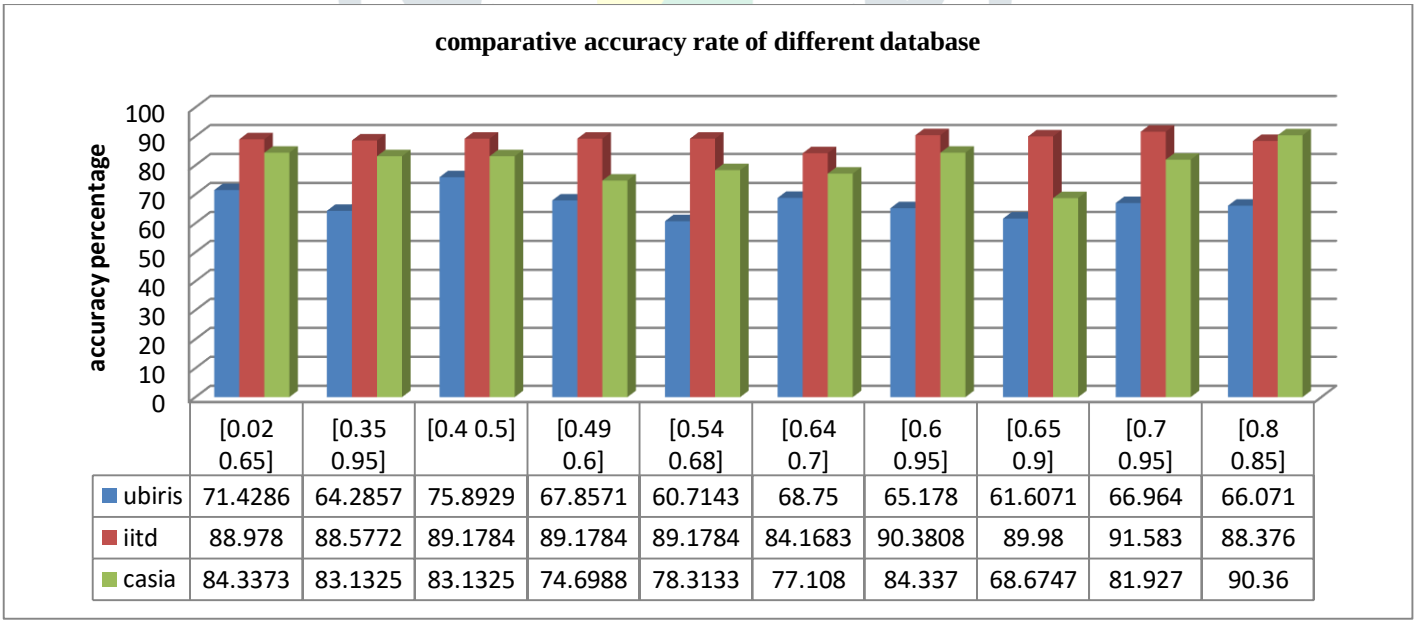
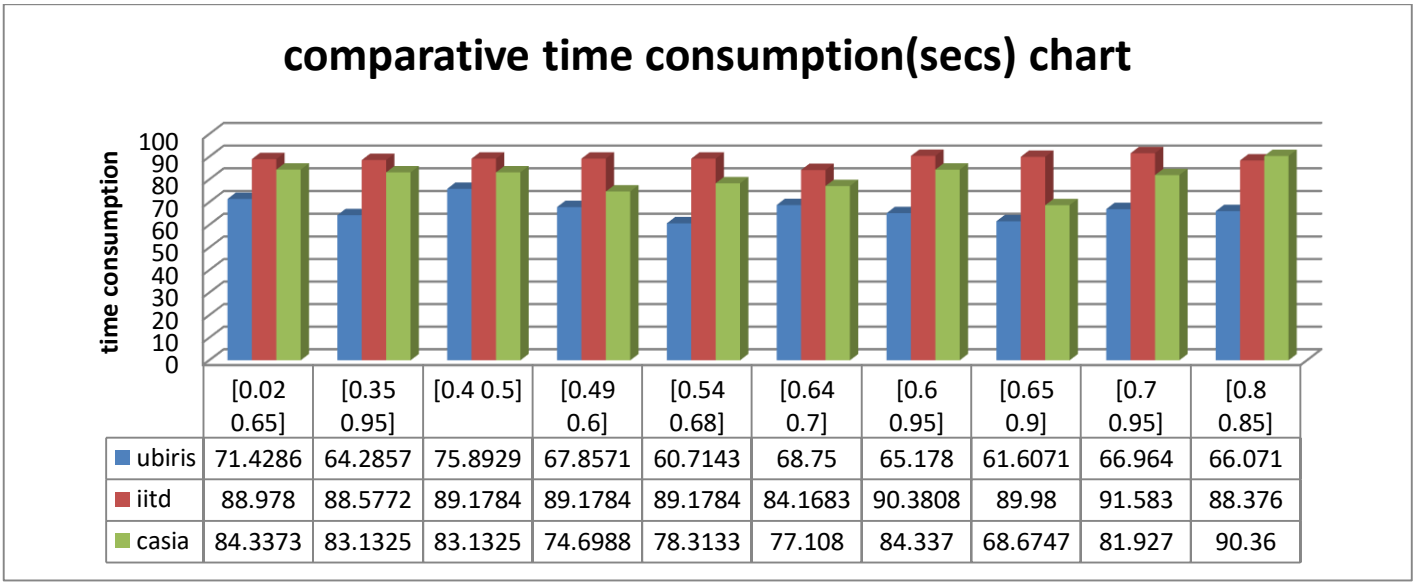


Figure 4: comparative accuracy rate of different database

The figure 4 shows the comparative accuracy rate for different database.



	[0.02 0.65]	[0.35 0.95]	[0.4 0.5]	[0.49 0.6]	[0.54 0.68]	[0.64 0.7]	[0.6 0.95]	[0.65 0.9]	[0.7 0.95]	[0.8 0.85]
ubiris	71.4286	64.2857	75.8929	67.8571	60.7143	68.75	65.178	61.6071	66.964	66.071
iitd	88.978	88.5772	89.1784	89.1784	89.1784	84.1683	90.3808	89.98	91.583	88.376
casia	84.3373	83.1325	83.1325	74.6988	78.3133	77.108	84.337	68.6747	81.927	90.36

Figure 5: comparative results of time consumption(secs) for different database

The above figure shows that the time consumption of same threshold values for different database while using the DSIFT extraction algorithm. The number of images used while training and testing are ,

s.no	Database name	Number of images
1	IITD	999
2	CASIA iris	377
3	UBIRIS	500

5. Hard ware Implementation

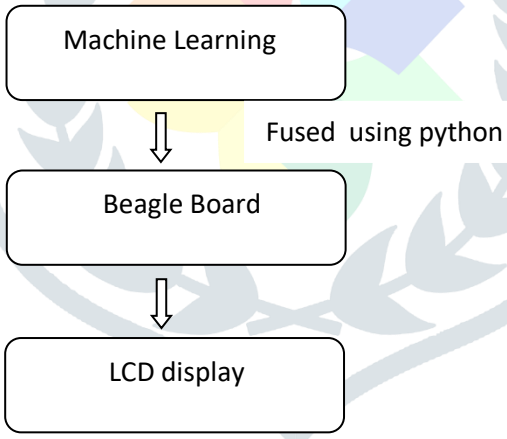


Figure 4: block diagram of hardware implementation

5.1 Machine learning

Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model of sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task. Machine learning algorithms are used in a wide variety of applications, such as email filtering, detection of network intruders, and computer vision, where it is infeasible to develop an algorithm of specific instructions for performing the task. Machine learning is closely related to computational statistics, which focuses on making predictions using computers. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a field of study within machine learning, and focuses on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics. In this proposed methodology, DSIFT is used for extraction algorithm and k-nn as classifier.

5.2 Fusion of ML in Beagle board:

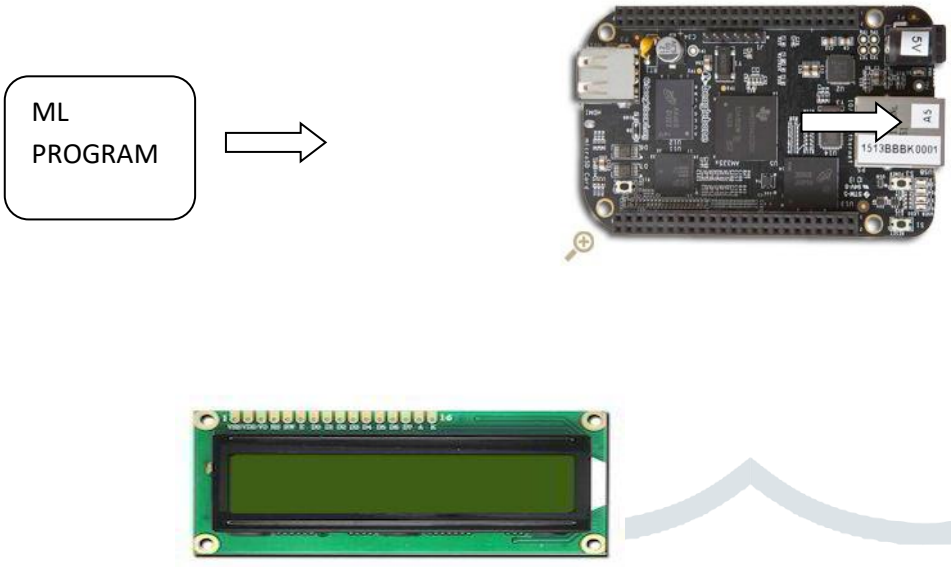


Figure 5: overflow of Fusion of ML in Beagle board

The software implementation are done with Matlab code and to bring those program in real time, we have to fuse the code in Beagle board. To fuse the matlab code into Beagle board we used python compiler. Python is user friendly to fuse the code into beagle board.

5.3 Beagle board interfaced with LCD

After the process of software and hardware phase the output from the Beagle board is fetched and the results are displayed via the LCD display which is interfaced with the Beagle board.

6.Conclusion

Biometric identification is mainly used for security purpose. In fingerprint recognition, there is a limitation in ageing and also the authenticated user cannot be identified, if the finger is wounded. In palm recognition, there is too ageing limitation. In face recognition, there is too ageing limitation. To overcome all these kinds of limitation, in this project an iris pattern recognition approach is proposed and verified. Among various image processing algorithm DSIFT algorithm is used to extract the clear image from the imadjust image which provided a good recognition accuracy the performance of our algorithm is evaluated using CASIA-IRIS, IITD and Ubiris database. From the above results it shows that the iris recognition provides 90% accuracy rate. The algorithm is use for different iris database and the experimental results chapter clearly shows that by using his algorithm we have achieved the accuracy recognition rate up to 90 % and the time computation is minimal. In future if the accuracy is increased to 100% then no one can do any malpractice. Thus only the authenticated user's alone allowed to enter into the examination hall through the classification stage. This reduces the tension of the students to be with the identity card and hall ticket in all examination and also reduce the supervisor's tension by verifying the person's identity at the entrance of examination hall and so the supervisor able to supervise the exam hall carefully by avoiding the malpractices. If this is succeed then the iris recognition can be used everywhere for security purposes.

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