Kernel Learning Algorithm for Increasing the Performance of Cross Sensors

Sruthi P. P.[1], Prof. V. Gopi[2]

[1]II M.E (Applied Electronics), PSN College of Engineering and Technology, Tirunelveli, Tamil Nadu India.
[2]Dean of ECE Department, PSN College of Engineering and Technology, Tirunelveli Tamil Nadu India.

***Abstract*—** *There are many approaches for non contact biometric authentication. Some of them are face, finger prints, palm and voice. In this iris recognition is most popular and provides better authentication. Since many manufacturers are developing different sensors the usage of cross sensors for iris recognition is having great importance. When new sensors are used, the re-enrolling of users every time is expensive and time consuming. When different sensors are used it causes a cross-sensor matching problem. In order to reduce the cross-sensor performance degradation we propose a new technique using SVM technology. For learning about the transformations we introduce new learning algorithm called kernel learning algorithm. This algorithm can be utilized for sensor adaptation to improve the performance and accuracy of cross sensors. This provides fast and accurate iris recognition system. When the iris images for training and testing are acquired by different iris image sensors, the recognition rate will be degraded and not as good as the one when both sets of images are acquired by the same image sensors.*

***Keywords*—biometrics, cross sensor matching, Hough transform, kernel algorithm, sensor adaptation.**

I. INTRODUCTION

Today fake identity is the main issue faced by the world. The non contact biometric recognition system provides great security for all the purposes such as banking transactions, re-enrolling etc. There are many non contact biometric recognition methods. Comparing to the recognition systems using the biometrics face, voice, fingerprints, and palms, the iris recognition system gives better performance. The iris is unique for each person and it stay unchanged for a long period.

We can see that the sensors for acquiring iris patterns have been upgraded and new sensors have been developed. Due to the sensor mismatch problem the performance of the cross sensor is less than the performance of the same sensors. In order to improve the performance of cross sensors we use an algorithm called the kernel learning algorithm. The algorithm is is supported by SVM (Support Vector Machine) technology.

The iris pattern is recognized by the iris recognition system. It comprises of specific characteristics such as cornea, filament, crypts, freckles, pits, radial furrous and striations. When we compare with other biometric features Iris pattern is more unique stable and reliable with age comparing with other biometric features.

II. RELATED WORKS

Many different methods are used for improving the accuracy of iris recognition system. Some of them are Heterogeneous Eigeniris And Sparse Representation, LBP (Local Binary Patterns) based classification, Circular Symmetric Filters etc. But these are having some drawbacks like computational complexity, less reliability, less accuracy etc. While using the cross sensors the sensor performance is reduce.

III. PROPOSED SYSTEM

The same sensors used in iris recognition system is having better performance than the cross sensors. In the proposed system we use a sensor adaptation algorithm to increase the performance of the cross sensors. The algorithm used is known as kernel learning algorithm. The transformations of iris biometrics can be represented using kernel function. This is called as kernel learning methods.

The main components of iris recognitions systems are iris image acquisition system, iris image segmentation system, feature extraction system, and template matching. This is the popular approach for iris recognition which was developed by Daugman and it is named as Daugman's iris recognition approach.

The architecture of the proposed system is shown in the Fig. 1. It consists of segmentation system, feature extraction system, sensor adaptation algorithm and decision making.

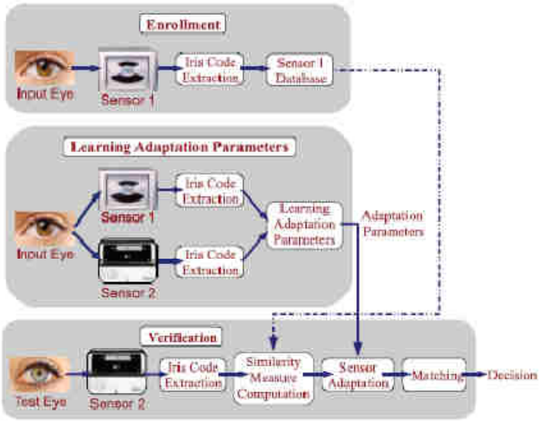

Fig.1: Architecture of IRIS recognition system

3.1. Image Acquisition System

There are different types of image acquisition systems. They mainly differ in type of sensors, the type and location of illumination, optical configuration and the acquisition distance. Hbox system by Global rainmakers Inc**.,** Eagle-eyes system by Retica, LG2200, LG4000 etc are some of the popular iris acquisition systems. Since there is large increase in the iris recognition systems large number of acquisition systems are available.

Databases of Iris:

Mainly there are two publically available databases. They are

- CASIA database developed by Chinese Academy of Sciences Institute of Automation
- Iris bath database developed by University of Bath

Here we are taking the CASIA database. It consists of more than 300 images of iris.

3.2. Segmentation System

Segmentation can be defined as the technique to remove the pixels obtained by the eyelashes and eyelids. It is also used to remove the pixels caused by the light reflections. In the proposed system segmentation is performed using two algorithms. The contour processing to detect the inner boundaries of iris and the Hough transform to detect the outer boundaries of iris. In order to find the edges of upper and lower eyelids we use ellipse. It is mapped into a grid.

3.3. Feature Extraction

The test image has to be compared with the stored image. For this comparison the features of the iris has to be extracted from the image and it must be quantized to bits. This binary representation is called iris code. Here we are using 1D log Gabor filter. The phase response of the Gabor filter is quantized to form the iris code. If the grid point is inside the iris region the mask bit is given value one and if the grid point is outside the iris region the mask bit value is given as zero.

3.4. Sensor Matching

The VASIR algorithm is commonly used for same sensor matching. We saw that the performance of cross sensors is lower than that of same sensors. In order to increase the performance we introduce a sensor adaptation algorithm called Kernal learning algorithm is used.

3.5. Kernel Learning Algorithm

In machine learning, kernel methods are a class of algorithms for pattern analysis, whose best known member is the support vector machine (SVM)..For many algorithms the data in raw representation have to be explicitly transformed into feature vector representations via a user-specified feature map. In contrast, kernel methods require only a a similarity function over pairs of data points in raw representation.

Kernel methods owe their name to the use of kernel functions, which enable them to operate in a high-dimensional, implicit feature space without ever computing the coordinates of the data in that space, but rather by simply computing the inner products between the images of all pairs of data in the feature space. This operation is often computationally cheaper than the explicit computation of the coordinates. This approach is called the "kernel trick". Kernel functions have been introduced for sequence data, graphs, text, images, as well as vectors. Algorithms capable of operating with kernels include the kernel perceptron, support vector machines (SVM), Gaussian processes, principal components analysis (PCA), canonical correlation analysis, ridge regression, spectral clustering, linear adaptive filters and many others. Any linear model can be turned into a non-linear model by applying the kernel trick to the model: replacing its features (predictors) by a kernel function.

IV. EXPERIMENTAL SET UP

About total 180 images of the iris are taken form 30 subjects to form the training data. The experimental set up has three main parts. They are Enrollment, Learning adaptation parameters, and Verification. During the Enrollment the iris image obtained by the SENSOR1 has undergone the feature extraction technique and the iris code is saved in the data. Many users are enrolled and the iris codes of all the users are stored in the DB (Data Base).

ISSN: 2349-6495

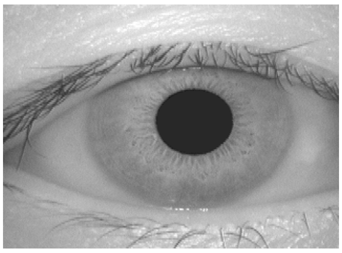

Fig .2: IRIS image

During the Learning adaptation parameters, the iris codes are extracted from the iris images acquired by the SENSOR1 and SENSOR2 using feature extraction technique. This iris codes are used to find the adaptation parameters using the Kernel learning algorithm.

These adaptation parameters are used during the Verification Process. The iris image of the test eye is taken by the SENSOR 2 and the iris code is obtained. The comparison between the test eye and the stored images is done using the similarity measurement.

The hamming distance is obtained and the sensor adaptation is performed using the adaptation parameters. The decision is taken according to the hamming distance obtained.

V. RESULT ANALYSIS

The fig.3 and fig.4 shows the MATLAB output for the same images and different images respectively. If the test image is same comparing to one of the images stored in the database then the output will be shown as matching. If the test image is not same comparing to the one of the images stored in the database then the output will be shown as not matching. We obtain 99% accuracy.

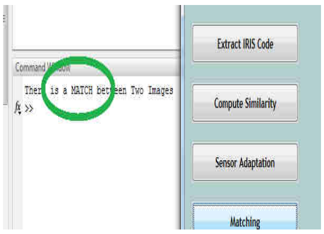

Fig.3. The MATLAB output for same images

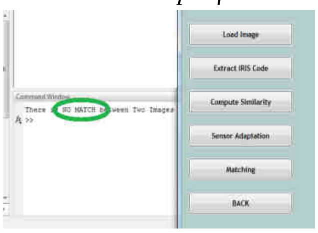

Fig.4.The MATLAB output for different images

VI. RESPONSE OF CROSS SENSORS BEFORE SENSOR ADAPTATION

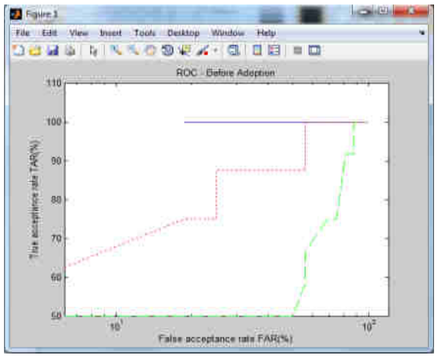

Fig. 5. ROC of cross sensors before adaptaion

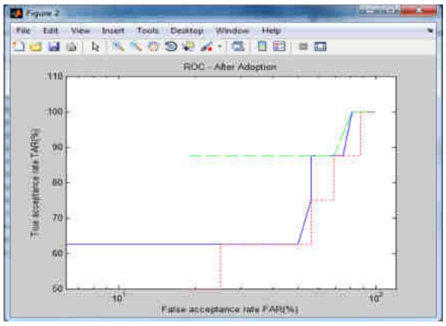

Fig.6. ROC of cross sensors after adaptaion

The sensor adaptation algorithm is used for cross sensors.The ROC of cross sensors before adaptation and after adaptation is shown in the below given Fig 5 and 6 respectively. Interpretation: The figure shows three lines, one Blue, green and red. Blue shows severe error; Green shows no error; Red shows slight error. TAR is very low for before adaptation stage and TAR is very high for after adaptation stage.

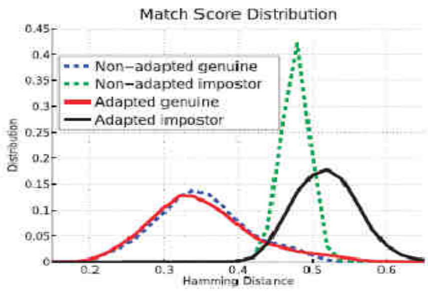

Fig. 7. Match score distribution of same sensors and cross sensors before and after adaptaion

Form this we can understand that the performance of the cross sensors is increased compared to the same sensors. The sensor adaptation algorithm is giving better result in case of cross sensors.

VII. CONCLUSION

In this paper we introduce a new sensor adaptation method in iris recognition system. The sensor adaptation is done using the kernel algorithm. The cross sensor performance drop during the re-enrolling or due to the usage of multiple sensors can be reduced using this kernel algorithm. The recognition accuracy of cross sensors are found to be better than that of same sensors. Kernel dimensionality reduction and max margin classifiers and the finger print recognition system or face recognition system by using this adaptation method can be done as future work.

REFERENCES

[1] R. Connaughton, A. Sgroi, K.W. Bowyer, and P.J. Flynn, "A Multialgorithm Analysis of Three Iris Biometric Sensors," IEEE Trans. Information Forensics and Security, vol. 7, no. 3, pp. 919-931, June 2012

[2] S.S. Arora, M. Vatsa, R. Singh, and A. Jain,"On Iris Camera Interoperability," Proc. IEEE Int'l Conf. Biometrics: Theory, Applications, and Systems, 2012.

[3] Sgroi, K. Bowyer, and P. Flynn, "Cross Sensor Iris Recognition Competition," Proc. IEEE Int'l Conf. Biometrics: Theory, Applications, and Systems, 2012

[4] R. Connaughton, A. Sgroi, K.W. Bowyer, and P.J. Flynn, "A Cross-Sensor Evaluation of Three Commercial Iris Cameras for Iris Biometrics," Proc. IEEE CS Workshop Biometrics, pp. 90-97, 2011.

[5] F. Alonso-Fernandez, J. Fierrez, D. Ramos, and J. Gonzalez-Rodriguez, "Quality-Based Conditional Processing in Multi-Biometrics: Application to Sensor Interoperability," IEEE Trans. Systems, Man, and Cybernetics, vol. 40, no. 6, pp. 1168-1179, Nov. 2010.

.