ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 4, April 2015

Classification of Human Eye Image using Different Methods for Medical Applications

D. Ram Nivas[1], T. Manigandan[2]

PG Scholar, ME VLSI Design, P. A. College of Engineering and Technology, Coimbatore, India[1]

Professor and Principal, P. A. College of Engineering and Technology, Coimbatore, India[2]

Abstract: The image classification is the method of assigning one or more category labels to an input image pattern. The Eye image classification aims to classify the iris and pupil to an application specific category as drug effect detection, left to right classification and fake classification. Iris texture is regarded as a genotypic biometric pattern which is stable during life time so that iris recognition and classification are reliable methods for individual authentication. The framework includes iris image pre-processing, low level feature extraction, statistical representation and iris image classification. The eye image database consists of eye images collected from different Persons and are used for testing the classification system. The Pupil is helpful in the detection of effect of drug. The Support Vector Machine Classifier is the well established classifier. It can be used to predict the class labels. In addition to this the classification is done by using total number of key points extracted and Diameter of the pupil.

Keywords: Support Vector Machine, Key points, Descriptors, Pin Point, Dilated.

I. INTRODUCTION

Biometrics is one of the areas of research that has gained widespread acceptance as form of unique human identification and fraud prevention. The human iris is one of the best biometrics features in the human body for person identification. The use of the human iris as a biometric feature that offers many advantages over other human biometric features. The iris is the only internal human body organ that is visible from the outside and is well protected from external modifiers. The increasing demand of security in our daily life, iris recognition and classification has rapidly become a hot research topic for its potential values in personal identification. In fact, having two eyes with different features are normally very useful in improving the level of security of individuals.

Since each eye having different features. It is very easy to differentiate left eye from right eye. So that a person can access his data either by left eye or right eye. Just like biometrics, iris textures are useful in medical applications like detecting diabetics, cholesterol, effect of drug etc. The iris image classification and iris recognition can be globally regarded as the same problem of pattern recognition.

Iris classification is the classification of iris images into some pre-defined categories. The only difference is the definition of class labels at macro scale or micro scale. The class label is the identity of a person. In classification process, the class label corresponds to a group of subjects with similar properties of iris images.

II. EYE IMAGE CLASSIFICATION

A. Classification Using SVM Classifier

A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyper plane.

There are two data bases considered in the study

- Training database.
- Testing database.

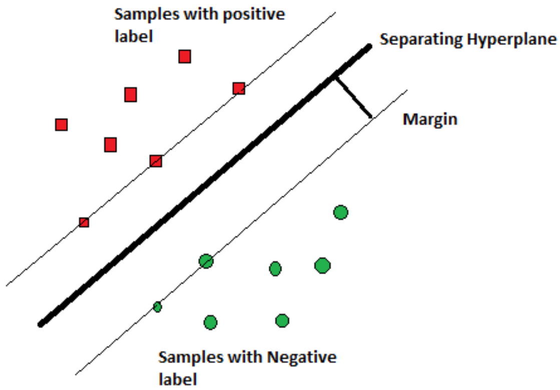


Fig. 1 SVM Classification process

The training database is the one used for learning the texture classes. The testing database is the other that needs to be classified is used for evaluation. The SVM Classification process is shown in the Fig. 1.

There are three stages in SVM classifier

- Data preparation.
- Training the classifier.
- Testing the classifier.

The data provided in the directory data consists of images and pre-computed feature vectors for each image. The JPEG images are contained in data/images. The data consists of three image classes.

The feature vector consists of SIFT features computed on a regular grid across the image and vector quantized into visual words. The frequency of each visual word is then recorded in a histogram for each tile of a spatial tiling. The

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 4, April 2015

final feature vector for the image is a concatenation of these histograms. The Fig. 2 shows the SIFT and Spatial Histogram.

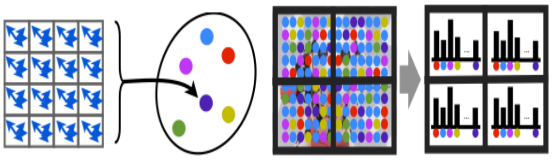


Fig. 2 SIFT and spatial histogram

The liveness training images will be used as the positives and the fake image as the negatives. The classifier is a linear Support Vector Machine (SVM). The Fig. 3 shows the Precision Recall Curve.

The Precision-Recall curve is computed by varying the threshold on the classifier and plotting the values of precision against recall for each threshold value. In order to assess the retrieval performance by a single, the Average Precision is often computed. Precision is the proportion of returned images that are positive. Recall is the proportion of the returned images that are negative.
SVM classifiers were faster to train. With respect to the best feature space size, SVM exhibits generally good performance for small or medium sizes, which surprises us as SVM is commonly said to best perform in very large feature spaces. High accuracy, nice theoretical guarantees regarding over fitting and with an appropriate kernel they can work well even if data is not linearly separable in the base feature space.

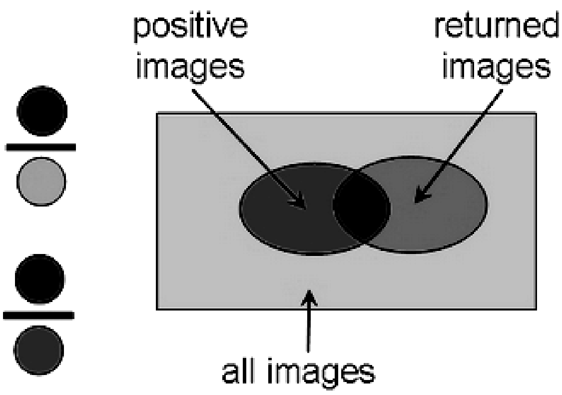


Fig. 3 Precision - Recall curves

B. Classification Using Total Number of Key Points Extracted. The two changes in iris patterns considered are:

- Pinpoint pupil.
- Dilated pupil.

The pinpoint pupil mainly occurs due to the effect of drug or poisoning. The dilated pupil is the situation which occurs during the time of head injury. There may be question that this can be recognized from naked eye view. But the importance here is, the depth of the effect of drug can be analysed. From the normalized image obtained key points are extracted. Calculate the number of key points extracted for each sample.

The key points are white in color, this indicates the iris. In case of the pinpoint pupil there will be more number of key points extraction due to the iris domination. But in case of dilated pupil the numbers of key points are less. This is clear from the below tabulation.. The Fig. 4 shows the flowchart for key point based classification.

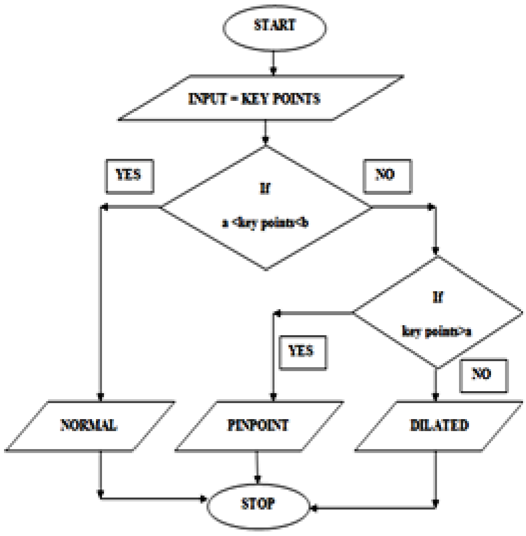


Fig. 4 Flow chart for key point based classification

C. Measurement of Pupil Diameter
The measurement of the diameter of pupil is useful in identifying the effect of drug in each patient. A particular drug can be detected. For example, person consuming cocaine has the pupil whose size is more than the normal pupil size. The Table I shows how the normal pupil differs from the infected pupil.

TABLE I: MEASUREMENT OF PUPIL DIAMETER

S.No	Diameter of the Pupil		
	Normal	Pin Point	Dilated
1	42.23	15.18	69.05
2	42.53	14.09	78.88
3	51.10	16.58	62.58
4	50.11	14.18	68.84

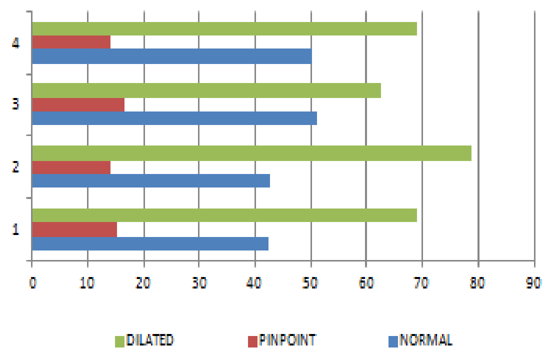


Fig. 5 Grouping of pupil based on its diameter

DOI 10.17148/IJARCCE.2015.4435

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 4, April 2015

The centre of the pupil is found out. The maximum distance from one end of the pupil to the other end is considered as the diameter.

III. RESULT AND DISCUSSIONS

The infected eye image, original and fake eye image databases are shown in Fig. 6 and Fig. 7. The samples are used for the purpose of training, testing and evaluation

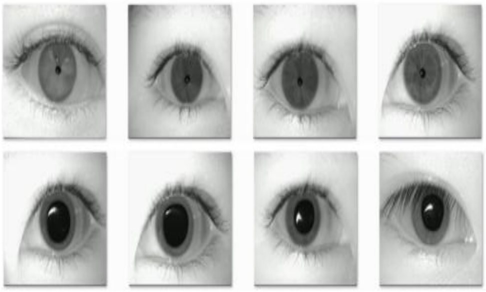


Fig. 6 Infected Eye Image Database

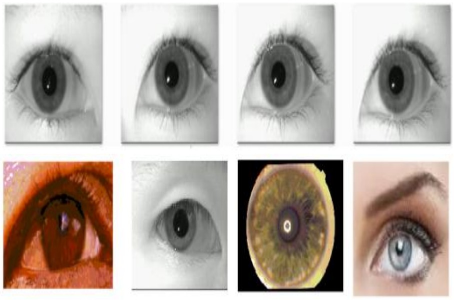


Fig. 7 Original and Fake Eye Image Database

Following are the steps involved in eye image classification process.

- The input image of eye is pre processed and it is converted into the localized image.
- The localized image is converted in to normalized image which contain useful features.
- The normalized image is resized using convolution of sigma and Gaussian coefficients and stored in three different octaves.
- From the first octave the Difference of Gaussian is calculated.
- The key points are detected. Magnitude and phase of the key points are found out and the SIFT descriptors are found out. The descriptors are the strong features which do not change.
- The descriptors obtained are essential for the classification purpose.
- The classification is done manually and by using different classifiers

The input image obtained from the database is converted in to gray scale followed by binary conversion with different threshold values. As a result of this we get separated iris and pupil regions as shown in Fig. 8.
The two images of different threshold values are anded to obtain the localized image as shown in Fig. 8. The localized image is further converted in to normalized image. The normalized image is resized to 512 x 512 size and it is converted in to double data type as shown in Fig. 9.

The resized image is then converted in to 3 octaves as shown in Fig. 10 and stored in the octave matrix. each octave is the outcome of image. Octaves are the convolution of gaussian coefficients and sigma values. The difference in gaussian is calculated and the key points are found out as shown in the Fig. 11.

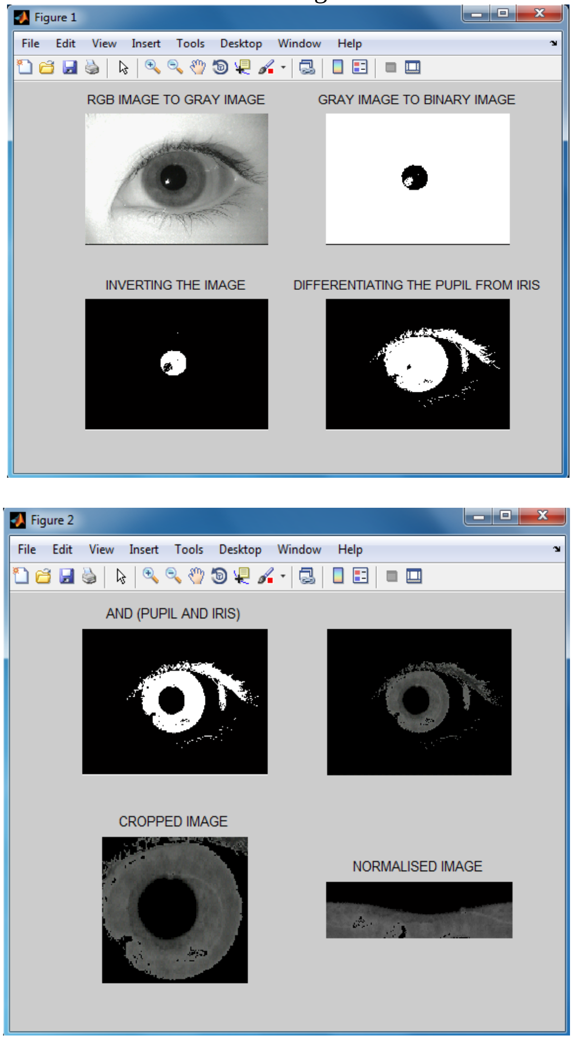


Fig. 8 Finding out iris and pupil region, normalized image conversion

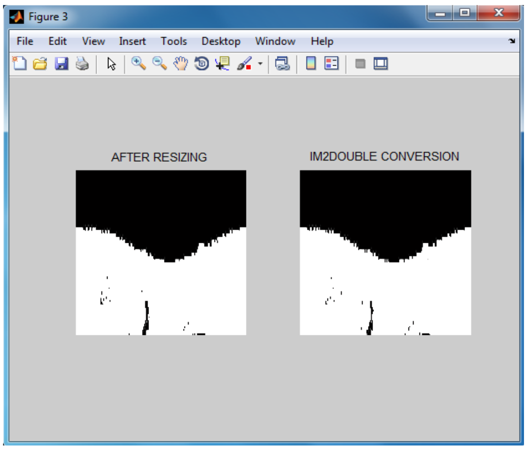


Fig. 9 Resizing

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 4, April 2015

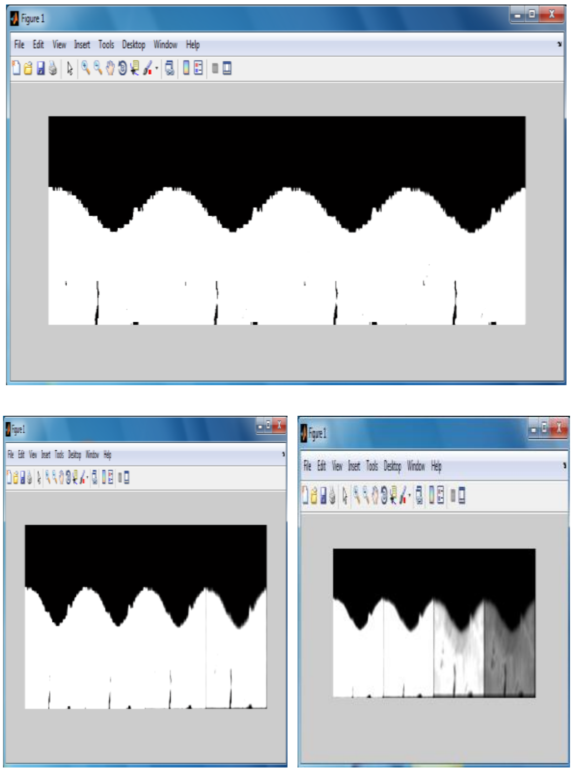


Fig. 10 Octave conversion

The Table II shows the number of features extracted and time taken during each process. It is observed that the person with the effect of drug or poison has a pin point pupil and head injury has dilated pupil. The iris area in dilated pupil is less so less number of features are extracted but the pinpoint pupil has more iris area resulting in extraction of more number of features. Normal value ranges from 500 to 620 key points. Pinpoint value ranges from value above 630 key points. Dilated value ranges below 400 key points.

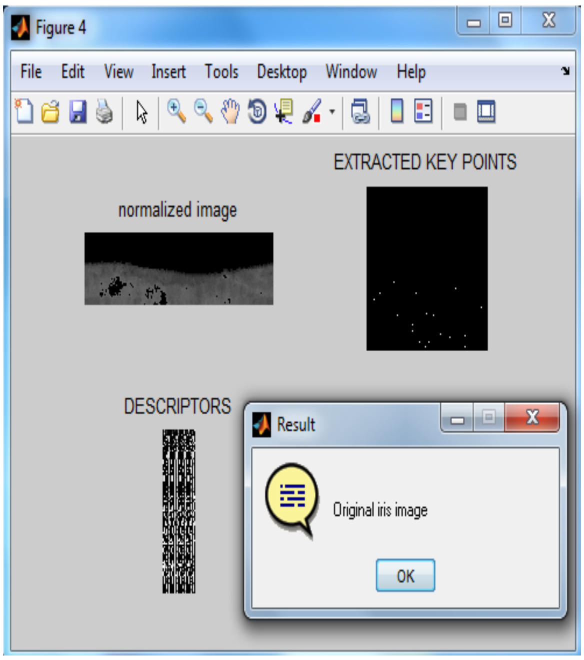
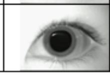


Fig. 11 Result

TABLE II: COMPARISON OF TIME AND FEATURES

S.N O	INPUT IMAGE	TIME TAKEN		KEY POINTS	RESULT
		PP & PC	KPT		
1		9.565	0.13	548	NLE
2		9.655	0.12	593	NLE
3		11.78	0.13	578	NRE
4		10.23	0.12	524	NRE
5		8.301	0.12	660	PP
6		12.15	0.10	176	DL

Where
PP&PC - Pre processing and polar coordinate conversion (sec)
KPT - Key point extraction in seconds
NLE - Normal left eye
NRE - Normal right eye
PP - Pin Point
DL - Dilated

IV. HARDWARE IMPLEMENTATION

The proposed system is implemented with the help of Spartan 3E XC3S250E Field Programmable Gate Array kit. The input is binary and it is fed in the form of signals from input switches. The output is recognized by the help of Light Emitting Diodes. 19 four input look up tables are used among 4896 with 1 percentage utilization. The number of slices containing the related logic is 100 percent. The memory usage is about 170 MB, With the speed of .2 seconds. And accuracy 100 percentage is achieved.

The hardware is shown in the Fig. 12. The simulation results for the hardware implementation are shown in the Fig. 13. The deviation of result from the normal value is noted.

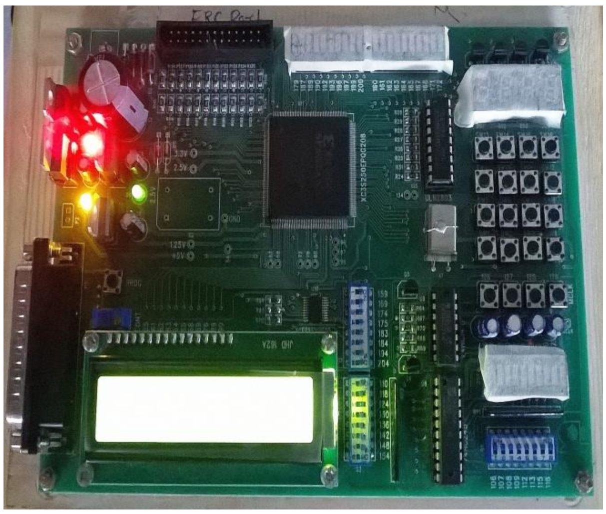


Fig. 12 Spartan 3E XC3S250E kit

DOI 10.17148/IJARCCE.2015.4435

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 4, April 2015

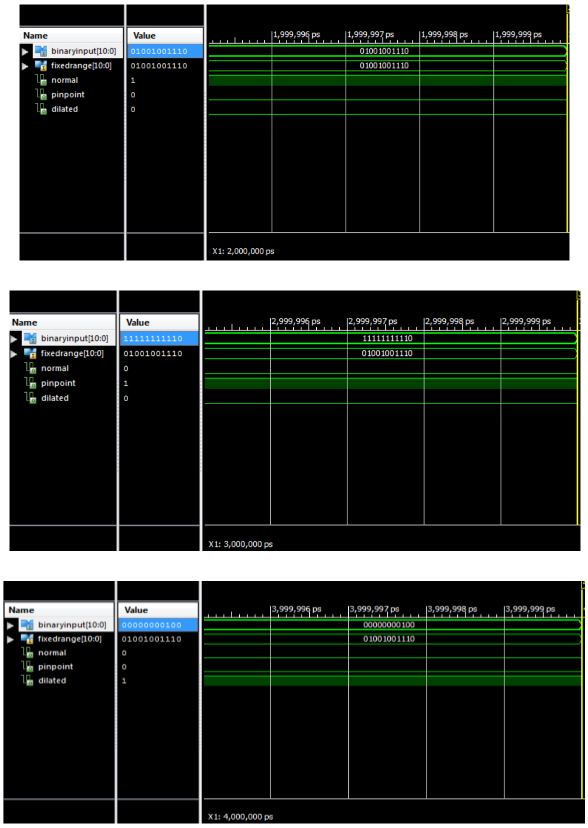


Fig. 13 Simulation results

V. CONCLUSION

The Human Eye Image classification system is successfully designed with the help of Support Vector machine classifier, extracted key points and Diameter of pupil. From the simulation results it is clear that the SVM classifier is easy to train and test, yielding the maximum accuracy in output. The designing of classifier is also less complicated. The time taken for the computation is in the range of 0.1 to 0.3 seconds. The classification from the key point extraction yields 98 percentage accuracy with the trained database with the time of 0.3 seconds in most of the trails.

REFERENCES

[1]. Donald F. Specht (1991), ‘A general regression neural network’, IEEE Transactions on Neural Networks, Vol. 2, No.6, pp. 568-576.
[2]. Daugman J. (1993), ‘High confidence visual recognition of personals by a test of statistical independence’, IEEE Transactions on Pattern Analysis And Machine Intelligence, Vol. 15, No.11, pp. 1148-1161.
[3]. Daugman J. (2004), ‘How iris recognition works’, IEEE Transactions On Circuits And Systems For Video Technology, Vol. 14, No.1, pp. 21-30.
[4]. He X. and Shi. P, (2008), ‘A fake iris detection method based on FFT and quality assessment’, IEEE International Conference on Bioinformatics and Biomedicine, pp. 1-4.
[5]. Lee E. and Kim J. (2006), ‘Fake iris detection by using purkinje image’, SPRINGER, pp. 397-403.
[6]. Lee. S, Kim J. (2006), ‘Robust fake iris detection based on variation of the reflectance ratio between the iris and the sclera’, IEEE International Conference on Bioinformatics and Biomedicine, pp. 1-6.
[7]. Ling Shao and Xuelong Li (2014), ‘Feature learning for image classification via multiobjective genetic programming’, IEEE Transactions On Neural Networks And Learning Systems, Vol. 25, No.7, pp. 1359-1371.
[8]. Ma L. and Zhang D. (2003), ‘Personal identification based on iris texture analysis’, Transactions on Pattern Analysis and Machine Intelligence, Vol. 25, No.12, pp. 1519-1533.
[9]. Nguyen D. and Aarabi P.(2006), ‘Real-time face detection and lip feature extraction using FPGA’ IEEE Transactions on Systems, Man, And Cybernetics—Part B: Cybernetics, Vol. 36, No.4, pp. 902-912.
[10]. Omaima N. A. AL-Allaf (2014), ‘Review of face detection systems based artificial neural networks algorithms’, The International Journal of Multimedia & Its Applications, Vol.6, No.1, pp.1-16.
[11]. Ovunc Polat and Tulay Yıldırım (2010), ‘FPGA implementation of a general regression neural network’, Digital Signal Processing-ELSEVIER, pp. 881-886.
[12]. Sun Z. and Tan (2009), ‘Ordinal measures for iris recognition’, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 31, No.12, pp. 2211-2226.
[13]. Tan C. and Kumar A. (2013), ‘Towards online iris and periocular recognition under relaxed imaging constraints’, IEEE Transactions on Pattern Analysis and Machine Intelligence, pp. 1-10.
[14]. Yongguo Mei and Josep Bassaganya Riera (2013), ‘Neural network models for classifying immune cell subsets’, IEEE International Conference on Bioinformatics and Biomedicine, pp. 5-11.
[15]. Youzhen Huang and Tieniu Tan (2013), ‘Feature coding in image classification - A comprehensive study’, IEEE Transactions On Pattern Analysis And Machine Intelligence, pp. 1-15.
[16]. Zhaofeng He, Tieniu Tan and Zhenan Sun (2009), ‘Toward accurate and fast iris segmentation for iris biometrics’ IEEE Transactions On Pattern Analysis and Machine Intelligence, Vol. 31, No.9, pp. 1670-1684

DOI 10.17148/IJARCCE.2015.4435