Ocular Disease Diagnosis Based On LBP and Gabor filter

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Abstract— The earlier generation biometric security included writing and hand geometry, these methods are slowly becoming obsolete since they can be altered and manipulated. Various biometric features such as facial shape, hand shape fingerprint, sound characteristics and iris recognition have been proposed for human identification. Iris recognition is one of the most advanced technologies today than figure print recognition. This paper examines the effect of eye pathology on iris recognition and in particular whether eye disease could cause iris recognition systems to fail. LBP and Gabor filter Feature extraction technique are applied to extract unique features. This proposed iris recognition should be used to solve the potential problems that could cause in key biometric technology and medical diagnosis.

Index Terms— eye disease, eye pathology, feature extraction, human identification, medial diagnosis,obsolete ,unique features

1 INTRODUCTION

Biometric technology such as face, hand shape, finger print, palm print, face, tongue, breath, sound, and iris has been proposed for human identification In all appliances such as passport, border control, flyer service, premises entry, access to privileged information, computer login and business transaction person uniqueness can be of the key element. Impersonation is one of the serious security threats in today. This problem can be solved by secure authentication. Password, ID, Smartcard can be easily hacked or compromised every people. So there is a need of biometric technology and it provides premier protection against this problem. Iris recognition is superior than other biometric techniques used in the world, because it stand out a promising method for obtaining fully automated, secure, reliable ,more hygienic ,fast and uncomplicated identification system. It can be carried out by capturing and analyzing unique spatial patterns of the iris in the human eye.

In Iris recognition all the parts can be utilized including the eye, eyelids, and lashes, or a larger region including the eyebrow. Front layers of iris contain plentiful structures so that it gives a wealthy texture. Colored ring of tissue around the pupil is called as an iris in which light enters the central part of the eye.

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Iris can be used for iris recognition and diagnosis because it contains both structural and textural information. Due to some conditions such as medication, surgery, diseases or by light sources or rays or chemicals and effect on eyes in aging iris recognition sometimes failed. Anatomical characteristics of the iris will be reflected by the body health status and functional changes in the organs through the nervous system, the blood circulation system, and hormone changes. Healthiness can be reflected on the iris due to dilator and the sphincter muscles of the iris manage the size of the iris to alter the amount of light that enter pupil. This deviation of the iris surface significantly affects the quality of a match among the iris images.

Due to above factors and various diseases of eyes iris recognition sometimes failed .In this proposed method iris recognition can be analyzed along with the various factors in which diseases affected parts of the iris are identified and remedial actions are taken. So this method used for medical diagnosis and person identification.

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Ocular Disease analysis is given in the section II. Proposed algorithm is explained in section III. System design is explained in section IV. Results and discussions are given in the section V. Conclusion in given in the section VI.

2 OCULAR DISEASE ANALYSIS

Commonly occurring diseases are Burning Eye, Bloody Eye (Subconjunctival Hemorrhage), Contact Lens Problem, Cataract, Discharge eye drainage, Eyelid twitching, Glaucoma,eye disorders, Dry eyes, AMD, Sclerit, Neuro-ophthalmic Involvement (nerve damage), Diabetic retinopathy, Gastrointestinal iris diseases .

Heavy workload on computer and fatigue are the factors of burning eyes. Eye dryness, allergies, eyestrain, eye fatigue are the consequences of this disease. A burn of the eye (ocular burn) can involve the white of the eye (sclera), the mucous membrane that lines the eye (conjunctiva), the transparent outer wall of the eye (cornea), and the eyelid, as well as deeper structures inside the eye. The severity of the eye burn depends upon the cause of the injury, the duration of exposure to the agent, and the elapsed time before initiation of treatment. This can represent 7% to 18% of eye trauma seen at emergency departments in the US (Melsaether). Of these, 84% are caused by chemical agents, and 16% are from thermal causes (i.e., hot liquids, gases, or molten metals) (Melsaether)[1].Bloody Eye (Subconjunctival Hemorrhage) is a broken blood vessel in the white part of the eye. Tiny blood vessel below the clear surface of the eye (conjunctiva) ruptures. Retinal Vascular Lesions (blood vessel changes in the retina) is the most common form of eye involvement in lupus. The occurrence in lupus can vary depending on the population studied. The lowest incidence reported is 3%, seen in outpatient clinics, and the highest is 28% in those hospitalized for lupus-related complications [2].

Contact lens[3] problems raised due to bad hygiene and improper care of handling lenses. Long-term contact lens use can lead to alterations in corneal thickness, stromal thickness, curvature, corneal sensitivity, cell density, and epithelial oxygen uptake, etc. Other changes may include the formation of epithelial vacuoles and microcysts (containing cellular debris) as well as the emergence of polymegathism in the corneal endothelium.This problems can be eliminated by wearing fresh lenses . In patients who had worn contact lenses for approximately five years or more, a 30 to 50 µm reduction in central and peripheral corneal thickness has been recorded. This causes structural change in the iris[4].Cataract [5] is a clouding of the lens in the your eye and results in impact vision. Blurred vision, Faded colours, Glare, Bad night vision, Double vision are the Symptoms of cataract. Old and more than half of all people and over the age of 60 either have a cataract or have had cataract surgery. Due to this problem retinal structure has been changed. Cataract formation is one of many destructive changes that can occur with overproduction of oxidants, possibly in concert with deficiencies of an important protective anti-oxidant called glutathione. Glutathione occurs in high levels in the eye and helps clean up these free radicals. Low levels of UVB radiation can eventually cause changes in the lens, including pigment changes, which contribute to cataract development.

Eye Drainage[6] is nothing but moisture that leaks from the eyes and dries, causing eyelashes to mat together. Drainage can be caused by irritation, a foreign object in the eye or infection. This is the result of an eye infection caused by virus or bacteria and lesser extent fungus, parasites or other organisms. Eye drainage occurs with almost every type of eye infection, including pinkeye or conjunctivitis. Eyelid twitching[7], Blepharospasm, or Myokymia, is referred to as an eye muscle spasm. Above mentioned problem really applies to any abnormal blinking or involuntary twitching of the eyelids caused by uncontrolled contractions of the muscles around the eyelids (dystonia).This is caused by stress, tiredness, eye strain or fatigue. Nerve problems can be caused due to twitching of the eyes. needing medical attention.Glaucoma [8] is an optic nerve disease and which diminishes vision. Peculiarly high intraocular pressure inside your eye is a source of this disease. open angle glaucoma and angle closure glaucoma are the two common ways of glaucoma. Glaucoma type and the degree of closure are the factors used of glaucoma diagnosis. Iris surface is located to determine focal region and focal edges. The experimental results show that the existing method can correctly classify 87.3% open angle and 88.4% closed angle. It can correctly classify 75.0% grade 1 and 77.4% grade 0 for angle closure cases.[9]

Eye disorders [10] diseases causes are cataracts, iridocyclitis and corneal haze. Iridocyclitis is an inflammation of the iris (the colored part of the eye), while corneal haze is a complication of refractive surgery characterized by the cloudiness of the normally clear cornea. Dry eyes [11] effect on 20 percent of people with lupus have Sjögren's syndrome in which the tear glands do not produce sufficient tears to lubricate and nourish the eye. This will result in damage to the front surface of the eye and impaired vision.Age-related Macular Degeneration[11] (AMD) will cause 90 percent of Age-related Macular Degenerations.Sclerit[11] is produce painful red eye condition is caused by inflammation in the white sclera (outer) layer of the eye. This occurs in approximately 1 percent of people with lupus and may be the first sign of the disease. Neuro-ophthalmic Involvement (nerve damage)[11] is a Cranial nerve palsies can result in double vision, poor eye movement and alignment, poor pupil reflexes, and droopy eye lids. Lupus optic neuropathy occurs in 1-2% of people with lupus. Slow progressive vision loss also can result in more rapid loss of vision from lupus optic neuropathy.

Diabetic retinopathy [12]is a kind of disorder which occurs due to high blood sugar level. This and this cause blindness. And this is one of the complications caused by diabetes. As indicated by the name, diabetic retinopathy appears in the retina, which is the tissue. Since diabetic retinopathy causes changes in the eye, the disease may affect the vision. In Diabetic retinopathy the blood vessel becomes weak and due to this vessel lea lesion , which may be occurring at the early stages of Diabetic retinopathy , so that preventive measures can be taken to prevent blindness. This is the leading cause of blindness among adults

aged 20-74 years in the United States and estimated to affect 28.5% of US adults with diabetes[13].Exudates[14] are symptoms of diseases leading to blindness such as diabetic retinopathy and wet macular degeneration. Exudates are formed by the leakage of proteins and lipids from the bloodstream into the retina via damaged blood vessels.Gastrointestinal diseases [15] cause structural changes in the iris.Iridology methods based on structural and textural changes in the local iris areas are regarded as promising in health surveillance and sub health diagnosis. The main idea of iridology is that the health status will be reflected on the iris due to two reasons. First, the anatomical characteristics of the iris bring about great variability to the iris. There are two muscles which are called the dilator and the sphincter muscles that control the size of the iris to adjust for the amount of light that enters the pupil. The geometrical structure changes in irises that are caused by gastrointestinal diseases, and on measuring the observable that are related to roundness, diameter, and other geometric forms of the pupil and the collarette. Pupil- and collarette-based features are defined and extracted. Iris analysis studies the relationship between human health and changes in the anatomy of the iris.

John Daugman [16]commercially deployed iris-recognition algorithm, his Iris Code, has an unprecedented false match rate (better than 10−11 if a Hamming distance threshold of 0.26 is used, meaning that up to 26% of the bits in two Iris Codes are allowed to disagree due to imaging noise, reflections, etc., while still declaring them to be a match). While there are some medical and surgical procedures that can affect the colour and overall shape of the iris, the fine texture remains remarkably stable over many decades. Some iris identifications have succeeded over a period of about 30 years.

John Daugman [17] system performed with perfect recognition on a set of 75 eye images; however, tests on another set of 624 images resulted in false accept and false reject rates of 0.005% and 0.238% respectively. Therefore, iris recognition is shown to be a reliable and accurate biometric technology.Iris pattern is the most inequitable of facial biometrics. Changes in iris texture appearance occur with age, disease and medication. In both local and non-local comparisons, minimum failure rates of 20.3% and 13.8% were noted, respectively. The complex fibre pattern formation of the iris results in variability in identification with differing failure rates depending on texture.[18]

Eye pathology on iris recognition examines whether eye disease could cause iris recognition systems to fail. The principal outcome measure was that of mathematical difference in the iris recognition templates obtained from patients' eyes before iris recognition was remarkably resilient to most ophthalmic disease states, including corneal oedema,iridotomies (laser puncture of iris) and conjunctivitis. Problems were, however, encountered in some patients with acute inflammation of the iris (iritis/anterior uveitis). The effects of a subject developing anterior uveitis may cause current recognition systems to fail.Those developing and deploying iris recognition should be aware of the potential problems that this could cause to this key biometric technology [19]. Iris also having the problem when the disease affected iris cannot be process. To give better way of processing in iris recognition even though iris is affected, the system will detect the pupil from the eye image after that only identify the outer boundary of iris as well as inner boundary of iris using the Daugman rubber sheet model convert the Cartesian form into polar form. Here structural changes can be present before anf after the detection.[20]

Iris pattern is widely accepted as a stable biometric feature, some evidences on the aging effect of iris system. This experimental results demonstrate the decrease of iris recognition performance along with increased elapsed time based on two iris recognition system (the modified Masek algorithm and a commercial software VeriEye SDK).Performance for VeriEye decreased from 97.5% TAR at 0% FAR for time lapse less than 180 days compared to 93.3% TAR at 0% FAR for time intervals greater than 720 days with iris recognition utilizing 7,628 iris images from 46 person.[21]. Lens of the eye must change shape to adjust its refractive power. A change in the curvature of the iris will cause a three-dimensional shape change that will result in non-linear texture change in the iris when imaged in two dimensions.[22]

3 PROPOSED ALOGRITHM

The following steps are involved in the proposed project
Image Acquisition, Pre-processing, Template generation,
Feature Extraction, Pattern matching, Disease Recognition, Performance analysis. Fundus camera can be used to capture a iris image in which retina state can be monitored and digital image of the retina can be stored and analyzed later by a specialist. Pre-processing is used to improve the image such that it increases the chances for success of other processes and this is used for enhancing the contrast of the image, removal of noise and isolating the objects of interest in the image [23].Canny edge detector can be used to fine accurate parameters of pupil and limba. The next step, is to encode the iris image from two dimensional brightness data down to a two dimensional binary signature, referred to as the template. This, the input date are passed into two directional filters to determine the existence of ridges and their orientation. In RED (Ridge Energy Direction) algorithm the radial extent of the iris is normalized in order to account for pupil dilation. Each row in the unwrapped iris image represents an annular region surrounding the pupil, and the columns represent radial information. Feature Extraction [24] takes the input data will be transformed into reduced representation set of features (also named feature vector). Transforming the input data into the set of features is called feature extraction [25].
LBP, Gabor are the various feature extraction algorithm used in this proposed method. Transforming the input data into the set of features is called feature extraction[3].Local binary patterns (LBP) is a type of feature used for classification in computer vi-

sion. This is combined with the Histogram of oriented gradients (HOG) classifier which improves the detection performance considerably on iris images. Gabor filter algorithm is provides an adequate texture information for different frequency bands and this are optimized by tuning the parameters with the particle swarm optimization method. This filter encode face shape over a broader range of scales. Matching between the newly acquired image and database representations is pattern matching. To calculate the similarity of two iris codes, Hamming Distance method is used. Lower Hamming Distance means the higher similarity. Disease Identification is performed after pattern matching in both iris. Iris features are matched then there is no disease, otherwise disease can be identified with the use of disease recognition phase.

Fisher linear discriminate classifier searches for projected vectors that best discriminate different classes in terms of maximizing the ratio of between classes to within class scatter and classify genuine and imposter vector. Performance analysis is done with the use of conventional metrics method and image quality metrics. In conventional metrics method statistical analysis done with the use of PSNR (peak signal to noise ratio), SNR (Signal to noise ratio).Image quality is a structural based method in which one image quality can be compared with over another image. Iris features are matched then there is no disease, otherwise disease can be indentified from the features.

4 SYSTEM DESIGN

System design gives the details of the over all design of the proposed work. Figure 1 shows the design steps of the proposed work.

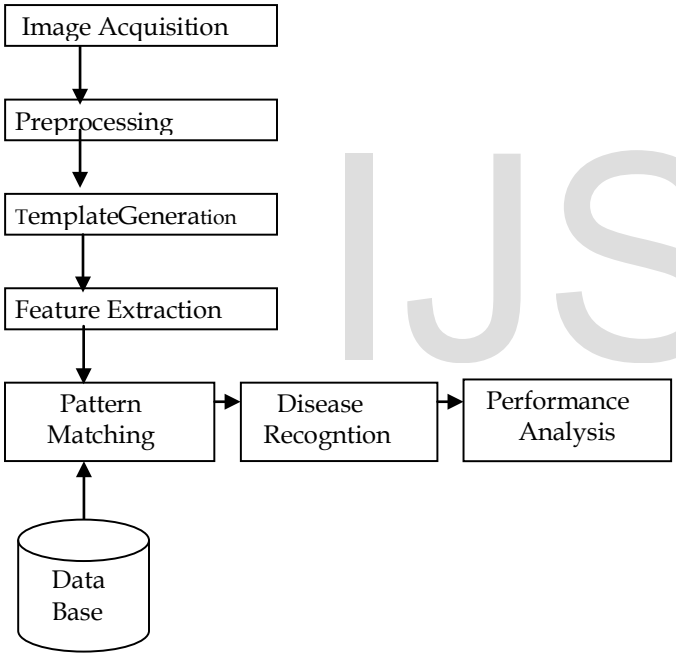

Fig. 1. System Design

5 RESULTS AND DISCUSSION

The proposed LBP and Gabor technique was tested on iris images. Simulation and experimental numerical values are obtained using the image processing tool in MATLAB 7.1. The following numerical results are obtained..Before and after the treatment the iris can be compared.

5.1 Local Binary Pattern

In LBP (Local Binary Pattern) features are firstly extracted from the original iris expression images. The LBP operator was introduced as a complementary measure for local image contrast, and it was developed as a greyscale invariant pattern measure adding harmonizing information to the "amount" of texture in images. This algorithm is applied for FERET database images. Outputs Left eye and right eye image are shown in figure2 and figure3.

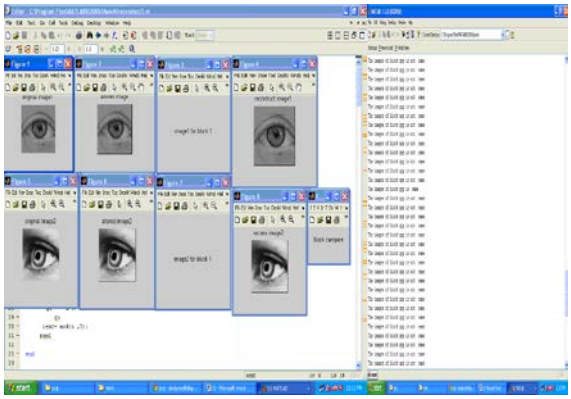

Fig. 2. Iris matched

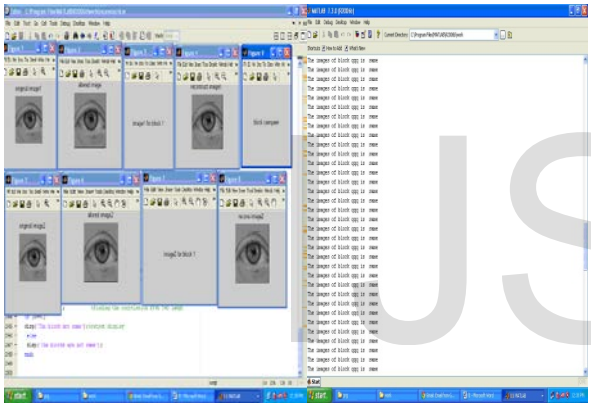

Fig. 3. Iris matched

5.2 Gabor filter

Gabor filter .can provides adequate texture information for different frequency bands which can be effectively represented and offer a good performance. It is used to extract the features and it can be matched to fine the disease affected area of the iris. Figure 4 and Figure 5 shows the results obtained from the two iris images can be matched and unmatched.

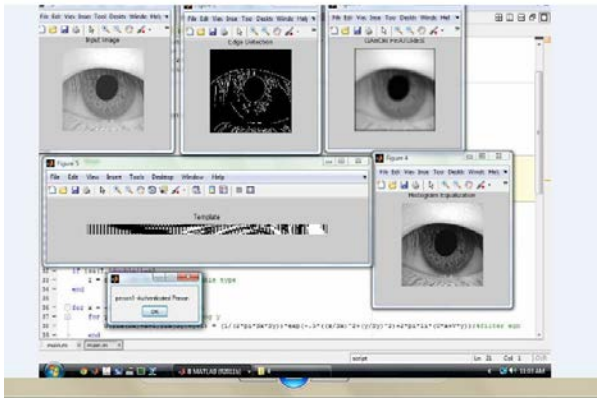

Fig. 4. Iris matched

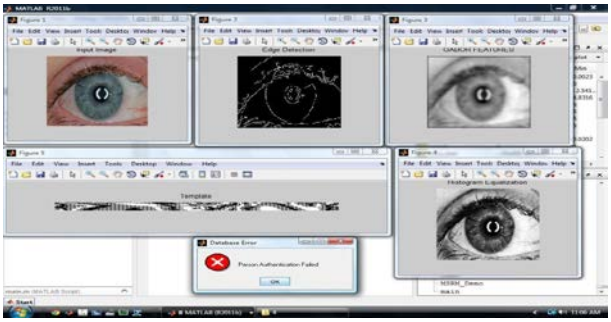

Fig. 5. Iris unmatched

5.3. Performance Analysis

Importance of quality verification is originality matainence after some processing. In this work database iris image is maintained as the same iris image after applying a filtering process for further recognition. Image quality was verified by the use of popular metrics used for evaluating imperceptibility of the iris images are signal-to-noise ratio (SNR) and peak signal-to-noise ratio (PSNR), which are based on mean square error (MSE) between the original iris image and filtered images. The results obtained using the following equations is listed in Table 1 where $I_{m,n}$ and $\sim I_{m,n}$ original iris image and filtered iris image respectively

TABLE 1
Visual Distortion Metrics

CQ	$\sum_{m,n} I_{m,n} \sim I_{m,n} / \sum_{m,n} I_{m,n}$
PSNR	$M\,N \sum_{m,n} I_{m,n}^2 / \sum_{m,n} (I_{m,n} - \sim I_{m,n})^2$
SNR	$\sum_{m,n} I_{m,n}^2 / \sum_{m,n} (I_{m,n} - \sim I_{m,n})^2$
IF	$[\sum_{m,n} (I_{m,n} - \sim I_{m,n})^2 / \sum_{m,n} I_{m,n}^2]$
MSE	$(1/MN) \sum_{m,n} (I_{m,n} - \sim I_{m,n})^2$
NC	$\sum_{m,n} I_{m,n} \sim I_{m,n} / \sum_{m,n} I_{m,n}^2$
BER	(Original iris image-Filtered iris image)/Total number of bits
CC	$\frac{\sum_{m,n} I_{m,n} * \sim I_{m,n}}{\sqrt{I_{m,n}^2} * \sqrt{\sim I_{m,n}^2}}$

Note: CQ, correlation quality; IF, image fidelity; NC, normalised cross correlation; and CC correlation coefficient

Correlation coefficient is essential for mapping and ranging purposes. Individual quality measures are not reliably associated with the strength of treatment effect across studies and medical areas. Although the use of specific quality measures may be appropriate in specific well-defined areas of the medical field, it cannot be generalised to all clinical areas or meta-analysis (Pan et al. 2004). Image fidelity is a process used to deliver an image accurately, without any distortion or information loss. Image fidelity output depends upon our ability to detect the difference between images (Klimeck, Yagi, Deen and McAuley 2002). .

SNR measures are easy to estimate the quality of a reconstructed filtered iris image compared to the original image. Higher measure signifies a poor result. PSNR is a measure of peak signal to reconstruct image. PSNR values are measured in decibels. $I_{m,n}$ represent a pixel of the original image f(x, y) and $\sim_{Im,n}$ a pixel of the filtered iris image. MSE gives the results of degradation, which was introduced at the pixel level. The higher MSE shows more degradation.The benchmark for the parameters are: (1) CQ and NC must be high, (2) IF, MSE,NMSE, BER must be low. The LBP and gobar filter algorithm does not cause any visible change on theoriginal image.For all metrics showed that the input vectors are identical for original and filtered image.So futher iris recognition

6 CONCLUSION

We have proposed an ocular disease diagnosis system with the use of LBP and gobar filter. We prove that structural changes occur due to various diseases easily identified with the use of this proposed work. We have successfully tested the algorithm with different metrics with original image and filtered image. We prove that iris image quality is good. This proposed work is used recognition for person identification and check whether iris is affected or not and to identify the disease affected part of the human eye. This proposed method is robust and effective and to perform the task of suggesting diagnosis of iris and authentication.

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