CHAPTER 2

LITERATURE SURVEY

Iris recognition is a reliable and accurate biometric technology. Iris-recognition procedure has an extraordinary false match rate. There are some medicinal and clinical procedures that can disturb the colour and overall contour of the iris, the fine surface remains stable over several decades (John Daugman 2004).

Iris pattern is the supreme inequitable of facial biometrics. Changes in iris texture appearance occur with age, disease and medication. (John Daugman 2007). In both local and non-local evaluations, minimum disappointment rates of 20.3% and 13.8% were represented respectively. The composite fibre pattern development of the iris outcomes in changeability in identification with opposing failure rates depending on texture. (Rankin et al. 2012). The effects of a matter emerging anterior uveitis may cause existing recognition systems to fail. Deploying iris recognition should be alert of the probable difficulties that cause to this key biometric technology (Tariq 2009).

Nadezhda proved that with the use of data acquisition method, pupil dilations, equipment fault affects iris recognition system (Nadezhda et al. 2012). Lens of the eye must change shape to correct its refractive power. Variation in lens shape causes an alteration in the outline of the iris surface which can be evaluated by observing the curvature of the iris. This results
show a degradation in iris recognition. Iris curvature has a related effect to that of pupil dilation and constriction. (Joseph et al. 2013) A modification in the curvature of the iris will cause a three-dimensional shape change that will effect in non-linear texture transformation in the iris when iris imaged in two dimensions.

Lin enlightened that due to gastrointestinal diseases (Lin et al. 2013) changes occurred in iris anatomy, especially in pupil. Wang described because of diabetic, present scenario people eye sight severally damaged (Wang et al. 2000). Let us discuss major cause of diseases such as exudate, cataract and glaucoma. Exudate is one of the disease occurred due to diabetic. Its characteristics and diagnosis methods are explained in the next section.

2.1 EXUDATE

Blindness is a severe problem everywhere in the world. In recent year diabetes (Wickramasinghe et al. 2010) is the common cause of blindness in the working age group. Patient’s eye can be affected by diabetes which causes cataracts and glaucoma. Eye care professionals pay close attention to ocular changes in their diabetic patients so it can be treated early and effectively (Skaerbeez et al. 2011). Diabetic retinopathy (Faust et al. 2012) is a critical eye disease can be regarded as manifestation of diabetes on the retina (Eikelboom 2000). The screening of diabetic patients for the development of diabetic retinopathy can potentially reduce the risk of blindness by 50%.

Diabetic retinopathy is characterized by the development of retinal micro-aneurysms, haemorrhages and exudate. Blindness is an outcome of diabetic retinopathy and its prevalence have been rising constantly (Hoover et al. 1998). At the early stage of detection, laser therapy is used to prevent or
delay visual loss and it may be used to encourage improvement in diabetic control. Diabetic cause of blindness among adults aged 20-74. 28.5% of adults affected by diabetic in the United States (Akram et al. 2012). Exudate is one of the diseases leading to blindness such as diabetic retinopathy and wet macular degeneration.

Exudate is formed by the leakage of proteins and lipids from the bloodstream into the retina via damaged blood vessels (Wolffsohn 2008). Automatic exudate detection would be helpful for diabetic retinopathy screening process. Benefits of iris recognition based on key image feature extractions are explained. Minimum failure rates of local and non-local exudates are 20.3% and 13.8% respectively. Eye pathology on iris recognition examines that the exudate could cause iris recognition systems to fail.

Automatic detection of diabetic retinopathy using an artificial neural network is exemplified (Gardner et al. 1996). Exudate identified from grey level and fundus image and it has been analysed using back propagation in neural network. Here 20 × 20 (mask) regions are used for pixel-level classification. Automated detection of diabetic retinopathy on digital fundus images by a Recursive Region Growing Segmentation (RRGS) algorithm on 10×10 window is demonstrated (Sinthananayothin et al. 2002). Color features on a Bayesian statistical classifier to classify each pixel into lesion or non-lesion class is explained (Wang et al. 2000).

Threshold technique based on the selection of 256 x 192 pixels is over the area of interest to detect exudate is examined (Phillips et al. 1993). Global threshold is used to detect the large exudate, while local threshold is used to detect the lower intensity exudate. Exudate extraction technique by
using a combination of region growing and edge detection techniques is proposed (Li 2003). Optic disc is detected by Principal Component Analysis (PCA). Shape of the optic disc is detected using a modified active shape model. Domain knowledge based approach is explained (Usher et al. 2004) to detect exudate. In this, preprocess is carried out by using

Median filter and then identify the normal structures by dynamic clustering technique. Finally, RRGS and adaptive intensity threshold methods are used to detect true exudate. Minimum distance discriminate is used to detect the exudate is described (Goh et al. 1995). Spectrum features like centre of exudate and background are computed and then the distance from each pixel to the class centre is calculated. If it falls within the minimum distance, then the pixel is classified as exudate. Bayesian, Mahalanobis and K-Nearest Neighbour classifier are tested and specified (Ege et al. 2000). Mahalanobis classifier yields the best results. Exudate detected using grey level variation and contours determined by means of morphological reconstruction technique are clearly explained (Walter et al. 2002).

Machine learning-based techniques are used to detect exudate which is demonstrated (Sopharak et al. 2010). Fuzzy C-Means (FCM) clustering is a well-known clustering technique for image segmentation is developed (Dunn 1974) and their improved version is available in (Bezdek 1983). Retinal image segmentation is implemented (Osareh et al. 2001). Pre-processing is performed with the use of color normalization and a local contrast enhancement.

Color retinal images are segmented using Fuzzy C-Means (FCM) clustering and the segmented regions are classified into two
disjoint classes – exudate and non-exudate patches using a neural network is discussed. Comparative exudate classification using Support Vector Machines (SVM) and Neural Network (NN) is implemented (Osareh et al. 2002).

Local contrast enhancements pre-process and improved FCM (IFCM) in Luv color space to segment candidate bright lesion area is illuminated (Zhang & Chutatape 2005). Hierarchical SVM classification structure is applied to classify bright non-lesion areas, exudate and cotton wool spots. Iris recognition, feature extraction can be influenced by factors such as illumination and contrast and thus the features extracted may be unreliable, which can cause a high rate of false results. Iris Recognition system built an iris feature template by extracting key features and performed iris identity enrolment is specified (Nguyen et al. 2013).

Morphology based segmentation method is used to identify features and exudates are detected using random forest algorithm (Zhang et al. 2014) Retinal blood vessels are segmented with the use of cake filter. Adaptive threshold is used to identify the small blood vessels in iris image (Bae et al. 2015). Second derivative of Gaussian (SDOG-MF) segmentation method is used to identify the thin and thick blood vessels in retinal image accurately (Singh & Srivastava 2016). Retinal image database (Tani et al. 2016) is tested by wavelet transform and principal component analysis to create image signature.
2.2 CATARACT

Human iris is stable throughout the life span (Omaima et al. 2013). Iris may get affected structurally and texturally due to many reasons. External factors that influence changes in the iris are medication, diseases, surgery, and age. Difficult to predict the level of changes when iris affected by cataract. Blurring of the lens in the eye and possessions in inadequate vision. Blurred vision, faded color, glare, bad night vision and duple visualization are the symptoms of cataract. Proteins inside the lens of age populace are prone to tie and turn into stiffer to form cloudy spots (cataracts) which has specified (Henderson et al. 2007).

Diabetes is one of the risk factor of cataract. Posterior sub capsular cataract, cortical cataract, and nuclear cataract are the three various types of age-related cataracts (Coleman et al. 2004). Automatic detection of cataract based on texture and intensity analysis is proposed (Chow et al. 2011). Global thresholding is demoralized to solve the under-detection problem for strict cataract images.

Cataract diagnosis is possible at the early stage and measured the attenuation coefficient of lens from echo signals and it is exemplified (Sugata et al. 1992). Model-based approach (Li et al. 2010) has used to detect robust lens structure, then the grading features are extracted. Support Vector Machine (SVM) regression model has applied to determine the nuclear cataract.

Moreover, cataract surgery has no upshot on iris recognition, whereas pupil dilation of drops may conquer in iris based authentication system (Dhir et al. 2010). Segmentation has applied to extract the iris, then
DCT (Discrete Cosine Transform) has applied to get the iris codes, finally numerical distance between the two iris codes are determined by hamming distance. Eye conditions of patients can be checked by slit-lamp images and cataract disease easily diagnosed (Martinyi et al. 2007). Densitometry analysis for grading nuclear cataract has verified with the use of slit-lamp cinematography (West et al. 1988). It is more reliable to grade the severity of nuclear opacity.

Automatic grading approach nuclear cataract diagnosis is demonstrated using Wisconsin cataract grading protocol, lens contour has discovered and features are designated from the segmented lens area then, SVM regression scheme is inspected to envisage the grade of nuclear cataract (Li et al. 2008). Automatic iris recognition technique for healthy eyes and those influenced by cataract is presented (Yuan et al. 2007).

Significant degradation in iris recognition and reliability is decreased. LASIK (Laser-Assisted in-Situ Keratomileusis) surgery (Huang et al. 2011) cause structural changes in iris. Iris recognition system performance is degraded. Masek's algorithm has implemented, structural changes have recorded in pupil diameter and a visible deviation from pupil circularity during refractive surgery.

Out of 14 iris images taken for experiment one iris image is failed in matching, false rejection rate is 7.14%. Computer-aided diagnosis method via ranking for nuclear cataract diagnosis is evaluated using a ranking measure with the use of learning to rank method is enlightened (Bowyer et al. 2008). Author described that cataract is also one of the disease to fail in iris biometric.
About 50% of people matured 65–74 and about 70% of those matured 75 and older have visually momentous cataracts (Roizenblatt et al. 2004). Hamming distance is used to verify the patients before and after the cataract surgery (Lalys et al. 2012). Iris has deeply predisposed and people necessitate to re-enroll in iris biometric systems after the cataract surgery. The principle of cataract surgery is to eradicate the natural lens of the eye and insert an imitation one (referred as an Intra Ocular Lens, or IOL) in order to renovate the lens’ transparency. Automatic recognition of high-level surgical tasks using microscope video analysis for cataract surgeries are demonstrated (Bahrami et al. 2015).

Refractive index irregularities in older lenses have nearly relation to degenerative changes in structure with various forms of cataract have designated in (Thompson & Lakhani 2015). An x-ray Talbot interferometric method using synchrotron radiation shows fine changes in lenses with opacities is explained (Borgen et al. 2009). Awareness of cataract symptoms, how to gauge, elementary appreciative of the surgery to correct cataracts has expounded in (Saraiva et al. 2016). Recent development in cataract surgery is explained (Baskaran et al. 2011).

2.3 GLAUCOMA

Glaucoma is the second disease cause blindness in the world. 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 in glaucoma diagnosis. Iris surface is located to determine the focal region and focal edges. Automatic method for optic CDR (cup-to-disc ratio) is a significant index of Glaucoma fortitude. Harris Corner is expounded
(Nilanjandey et al. 2012). An assessment extent is projected to gauge the capriciousness between segmentation results and the gold standard of an ONH image suggests in RIM-ONE (Fumero et al. 2011).

Glaucoma, its types, clinical techniques, and it’s revealing of retinal features are presented (Muhammad et al. 2013). He localized the instinctive extraction methods on features containing Optic Cup to Disc Ratio (CDR), Retinal Nerve Fiber Layer (RNFL), Peripapillary Atrophy (PPA), Neuro retinal Rim Notching, Vasculature Shift, etc.

Super pixel classification is applied for screening glaucoma by segmentation disc and cup in retinal images. He improved the segmentation using Hough transform and mentioned a limitation such that that the trained classifier is slightly dominated by cups with medium sizes and it is solved by the three solutions such that to collect more samples with very small and to use very large cups for training, to adopt multiple kernel, to employ the vessel bends to correct the bias in current cup segmentation (Jun et al. 2013).

Premature treatment are essential for affected patients to diminish the rate of loss of sight. Author discussed that two-stage screening (Michelson et al. 2008) i.e. Computer-supported tele medical sorting is followed by tele medical ophthalmological diagnosis is vital.

Age and family history are two important risk factors of glaucoma. Glaucoma suspect (mild damage of optic nerve), and definitive Glaucoma (severe damage of optic nerve) is evaluated with the use of ELGPS (East London glaucoma prediction score) web based risk calculator is explained (Cook stephen et al. 2008). Age, ethnicity/race, patient's demographic data, family history, history of eye trauma ,visual acuity (VA),myopia, pseudo-
exfoliation, Intra ocular pressure are the critical risk factors of glaucoma. Gradient method is applied to segment the cup for detecting Cup-To-Disk (CDR) which is an imperative possession for spotting the malady (Rupesh Ingle et al. 2013). Cup detection is done with the use of sliding windows and regression based approach (Yanwu Xu et al. 2011) rather than segmentation and it is localizes the optic cup for identifying glaucoma. Low-Rank Representation (LRR) based unsupervised segmentation improves the accuracy which in their adaptive approach yields a closed-form solution for sensing the syndrome (Yanwu Xu et al. 2014).

For identifying original features MRMR (minimum Redundancy Maximum Relevance) scheme (Zhuo Zhang et al. 2012) is employed and helps to elucidate what irrefutable features the classifier uses and how the system ranks the importance of the features in glaucoma prophecy. Computer-Aid-Diagnosis (CAD) model is erected for automatic disease diagnosis. Systematic review on CAD of ocular diseases and its methods such as clinical, genetic and imaging is explained (Zhuo Zhang et al. 2014). Optic Nerve Head is a dazzling elliptical region with a discernible cup-like area called Optic Cup bounded by the rest of the area of Optic Disc. Optic Cup to Disc Ratio (CDR) is an imperative quantity for the verdict of Glaucoma (Lie Jiang et al. 2014).

Perimetry is an important element for identifying Glaucoma. Standard Automated Perimetry (SAP) and frequency doubling perimetry (FDP) approaches are used to resolve the measurement error occurring in glaucoma patients during the examination (Spray et al. 2003). Review on glaucoma ,its new trends, risk factors to diagnosis glaucoma, based on retinal nerve fiber analysis and retinal ganglion cell is provided (Thomas
Kersey et al. 2013). Optical Coherence Tomography (OCT), DARC (Detection of Apoptotic Retinal Cells), IOP telemetry are the latest methods to detect the glaucoma at the earliest stage (Skaf et al. 2006). Review article about the daily clinical practices and algorithms developed for preoperative and postoperative periods of surgeries (Rodriguez Una et al. 2015). Author examined the aggregate effects (Yih-Chung et al. 2015) of these High Intraocular Pressure (IOP) and large Vertical Cup-To-Disc Ratio (VCDR) allied deviations on glaucoma. Due to RNFL thickness, structural change is occurring and it is one of the risk factor for glaucoma.

OCT (Optical Coherence tomography) to assess tissue thickness of the Retinal Nerve Fiber Layer (RNFL) is demonstrated (Christopher Bowd et al. 2000). ONH segmentation of retinal images is help for glaucoma diagnosis (Ahmed Almazroa et al. 2015). Geometrical features are identified with the use of the cup and the machine learning classifier is applied to detect glaucoma (Guerre et al. 2014). Diagnosis of glaucoma (Muhammad Salman Haleema et al. 2013) is done with the use of optic nerve head using scanning-laser-tomography. Optic nerve head segmentation and its validation is explained (Chrastek et al. 2005).

2.4 COMPUTER AIDED DIAGNOSIS (CAD) SYSTEM

Ocular disease diagnosis also effectively done with the use of symptoms such as swelling of an eye, irritation, redness, cloudiness, vision decrease, etc. (Shivani Godara et al. 2012) explained and compared various neural network techniques implemented in iris recognition. A fuzzy neuro system is implemented to diagnosis an eight types of diseases using ANN (Artificial neural network) (Moein et al. 2009).
Neural network with radial basis function (RBFNN) and fisher's discriminant analysis is helpful for identity verification using iris and face is described (Wang et al. 2003). Fuzzy logic based medical diagnosis system for malaria is proposed (Awotunde et al. 2014) and it is helpful for clinician to treat the patients. Neuro fuzzy system for diagnosing leukaemia at a prior stage is explained (Obi et al. 2011). A neuro fuzzy interface for liver disease diagnosis is proposed (Brause et al. 2000). Fuzzy based medical diagnosis system for identifying diseases like liver, eye, and nerve based on symptom is described (Sanjan Seth et al. 2014).

To identify chikungunya using genetic and fuzzy characteristics a medical diagnosis system is designed (Kunjal et al. 2015). ANFIS is invented by jang and it is utilized to set Fuzzy Logic System (FLS) (Jang 1993). ANFIS is effectively applied in various biomedical solutions and it is especially used in diagnosis of ocular disease (Akgundogdu et al. 2010). ANN’s theory (Jang 1993) is used in ANFIS to find its fuzzy sets and fuzzy rules. Rule based fuzzy system is tuned and then membership functions are derived from the features data set.

Single ended symptom based neuro fuzzy computer aided diagnosis system is proposed to identify the disease like exudate, cataract and glaucoma.