CHAPTER I

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1.1 MEDICAL IMAGE PROCESSING

Image processing algorithms and Computer imaginative and prescient techniques play wider role in clinical technology and they are pertinent to contemporary Ophthalmology. Medicinal imaging transfigured the area of medication by informing lucrative healthcare and competent analysis in all key ailment expanses. Medical imaging enables in physicians plus scientists to apprehend ability existences redeemable facts the use of less invasive strategies. Applications could understand an advanced image, that sequentially resource a doctor in perceiving viable aberrations. The system suggests inside the image which needs more interest for a medical doctor for the fact they may be unusual. These technologies referred to as Computer based Diagnosis (CBD) structures show that CBD may be useful for the progress to diagnose the precision of the doctors.

The impacts as well as the influence of images on revolutionary civilization, expertise, and era are remarkable. The picture dispensation has turned out to be a crucial requirement in the present day technological know-how and technology that many duties could no longer done tried not including it. Digital picture dispensation is an associative challenge which attracts the coactive tendencies concerning assorted inculcations applied in geology, miniature, stargazing, scientific imaging, processor visualization and assorted additional areas. Continued and rapid profligate development in automatic scientific depicting, the concomitant trends and techniques evaluating and system based analysis have impelled medicinal representation to maximum vital miniscule areas in systematic representation. Medical replica exploration is an expanse of investigation which attracts exhaustive hobbies of researchers and doctors which shields replica dispensation, design reputation and system envisioning. Medicinal replica dispensation entails to perceive the virtual pictures with the goal to supply electronic apparatus with a purpose to contribute the appraisal and envisioning the exciting cytology and functional edifices. The progress
accomplished in this area in current centuries has substantially promoted treatment obtainable to the humanity in the hospital.

Software cardinal ophthalmic image delivered today has a prospect to process the image of the retina to facilitate help technical analysis with a remedy. Automatic prediction of the pictures of the retina and its images utilizing the cardinal picture examination has advantages. Due to advances in computerized data generation, scientific analysis can be done more effectively to enable the medicine to examine medicinal statistics and imageries accurately. Creating a system assisted analytic equipment clinical pictures procured quick abode currently. Escalating the automated method of examining the retinal pictures to analyze them in expediting the system based analysis of ophthalmic disorders. Significance toward the automated ophthalmic ailments identification enlightening is escalating with the emergent technology along with the simulated picturing and calculating current. Nevertheless, utmost crucial individual occasion which attracts the broader interest related to scientific investigation network is designated for understanding and identifying the ophthalmic ailments. The preliminary episode grants certain some circumstantial evidence of anatomical aspects in the ophthalmic sicknesses.

1.2 EYE ANATOMY

An Eye is the most intricate human organ and is associated with a digital camera in the ophthalmology with 1 inch wide, 1-inch-deep and 0.9 inch tall, with an identical function to that of a movie camera. As soon as any image that is reflected on the retina, will be transformed to the optic nerve in the brain, realizing the precise image. The analysis of the structure in the inner photo formation has been described by the “Guyton and Hall” in the year 1986[1]. The Major components of the human eye are illustrated with cross-section is shown in figure 1.1by “R F Mansour, E. Md. Abdelrahim “in the year 2013[2].
Like the Digital camera, the human eye also consists of 3 essential components that are perceptibly similar to Camera opening. By transforming the proportions of the scholar, the colored iris controls the quantity of light inflowing the eye. The pupil is found larger in darkness permitting the utmost expanse of brightness reach the pupil, avoiding an extra quantity of light. Similarly, the light is also controlled by the aperture in a digicam. Considering the incomparable expanses, the eye ciliary muscle redesigns the flexible lens. To emphasis on the objects at an extraordinary and ordinary distances, the zonular fibers in ciliary muscle of the eye redesigns the elastic lens and loosens and thicken resulting into the refractive power being intensified with the objects exceedingly perceived. The distant objects are focused when the lens relaxes into a skinny shape. In an eye, the inner layer is the retina, includes the light transform into neural pointers. Consequently, the light travels through many complex organs in the human eye creating a clear cut vision. Forrester et al (2001)[3] expounded the specific principal image shaped inside the macula could be particularly mild by profound vicinity, the width of it inside is 5 to 6 mm that is the valuable place in the retina of the eye. The macula is located in the center with spherical - shape entitled fovea, where we can discover the cones absolutely. In the light we can find that the cones photoreceptor cells are discerningly subtle to one kind of wavelength. The principle artery and vein is found emerging within the retina at the beginning of the macula.

Considering the Optic Disc (OD) as the primary features in the retinal, the fundus photo is found three to four mm away to the nostril facet by transforming the
proportions of the scholar. It is found in oval shape vertically with mediocre size of 1.92mm vertical and 1.76mm horizontal. The optic cup is denoted as a vital melancholy in the variable length. The head of the optic nerve is positioned with the ganglion cell axons in the optic nerves of the eye. At this point, the light sensitive rods or cones are not exposed to the light stimulus to retort. The physiological blind spot is caused with a break in the visual field. At the optic disc, millions of nerve fibers are found running into the optic nerve from the retina. The nerve fibers which are sensitive are damaged and begin to die with the increase of fluid strain in the eye. The nerve fibers are deceased; the disc begins to change itself into a hole pushing the optic nerve into the shape of a cup or curve. The complete vision loss can also occur with great and extended stress. Substitute in form, color or depth of OD is considered an attribute assorted in the ophthalmic pathologies explicitly used to analyze the irregular competences in glaucoma.

In the normal fundus, OD is the optimistic character with the scarcely oval (elliptical) perpendicularly silhouette with assorted dimensions, varying from individual in size from one tenth to 1/5th of the pictures. In the images of the color fundus, the disc looks yellowish or white from the retina in the vicinity of the blood of the optic nerves in the blood vessels. A million nerve fibers are found entering, contracting and forming the optic disc or papilla.

With an assistance of the connection with the neuron layer fraternity, in the choroid, nerve fiber layer and the nutritious proposal of the retina can be furnished. The obtainable anatomical components (optic nerve head, macula, fovea and capillaries), emphasized in Figure 1.1, are the pertinent edifices in the retina of the eye, with its diseases for the images, proportionate to the ratio and its destruction.

1.3 INFIRMITIES ENGENDERED IN OPTIC DISK AND OPTIC NERVES

The following are the assorted infirmities affected in the OD and optic nerves

- Retinopathy in diabetes
- Glaucoma
- Aphasia & Hyperplasia
- Syndrome glory in the morning
- The Pit Optic nerve
- The nerve tissue and Ischemia infraction

The reduced visible acuity, visual impairment, and blindness, are caused with multiple reasons. In the early stages, at times the glaucoma could be extremely sluggish without any pain, discomfort or variation in the vision. It can be controlled successfully if detected early with certain simple examinations. Severe glaucoma can lead to extreme pain, headache, and nausea as well as foggy imaginative and prescient with coronae circular illuminations, with no remedial rectification. The eye sicknesses in diabetes is the principal cause for visual disorders usually associated with the cardiac variations. Influence of diabetes and glaucoma on the visual Conception and perceptive are displayed below in the figure 1.2 from Venderbilt eye institute [4].

![Figure 1.2: Influence of Diabetes and Glaucoma on Visual Conception](image)

(a) Regular Visualization
(b) Optic disk irregular
(c) diabetes retina

1.4 RETINOPATHY IN DIABETES

Micro vascular hassle of diabetes is Diabetic retinopathy (DR), inflicting the retinal deformities. Nevertheless, salient symptoms are not found initially, mostly the rigorousness is found in the later stages. There can be a complete vision loss, in case
of negligence. Inside the retinal capillaries, the diabetic retinopathy usually demonstrates insignificant modifications. The minutest noticeable deformities, Microaneurysms (MA), appear as insignificant red dots, weakening the retinal capillaries, with furthermore rupture causing hemorrhages, looking moreover as tiny crimson dots ambiguous that of MA or huge spherical-fashioned blemishes with asymmetrically outlined.

Moreover, the DA escalates the penetrability of the capillary separators ending in the edema and Hard Exudates (HE) in the retina, the perceptible symbol, Exudates, of are fat enlargements dripping from the debilitated blood vessels and seem yellow in color with appropriately borders described, failing which the blood vessels are found clogged in the retina. They are referred to Soft Exudates (SE) or infarcted nerve fiber layers. The new congested capillaries with lack of oxygen consequences vision loss. The levels demonstrated in the below figure 1.3 indicate neovascularisation by Anam Tariq, M.Usman Akram in the year 2013[5].

![Figure 1.3: Diabetic Retinopathy Indications](image-url)
Therefore, the four abnormalities found in the retina of a diabetic retinopathy or the four extractions that are going to extract are as follows. Figure 1.4 shows the abnormal features of retinal image from vision and eye care health [6].

1. **Blood Vessels**
   Blood vessels of a diabetic retinopathy patient undergo extra branching and these vessels go thinner and thinner or narrower.

2. **Exudates**
   With varying sizes, shapes or patches, the Exudates are found to be hard white or in yellowish colour. The Exudates are found occurring, when the lipid or fat leaks from abnormal blood vessels.

3. **Microaneurysms**
   The small red dots called Microaneurysms are the saccular pouches engendering in the local distension of capillary walls. Causes haemorrhages in the thin to rupture effortlessly.

4. **Optic discs**
   The bright round section of the optic disk is where the blood vessels originate. The geometric round shape of the optic is irregular.

![Diabetic Retinopathy](image)

**Figure 1.4: Abnormal Features of Retina Image**

1.4.1 **Phases of the Diabetic Retinopathy**
   The Non - Proliferative Diabetic Retinopathy (NPDR) or background retinopathy and Proliferative Retinopathy (PDR) are the division into two stages depending on the severity of diabetes.
Figure 1.5: Phases in the Non-Flourishing Retinopathy

The Figure 1.5 illustrates the non-proliferative retina from vision and eye care health [6]. Minor NPDR is an initial stage of the disease and non-existent indications. In NPDR, microaneurysms are the condition where the blood vessels in the retina are debilitated imposing minute swells to obtrude in the panels. In the later stages, the blood vessel which nourishes the retina is congested, shunning the blood delivery completely in the final stage. Conveying the warnings to the structure to grow novel blood vessels for sustenance. Failing untreated leading into proliferative retinopathy.

Comprehensive proliferative retinopathy in diabetes is revealed in Figure 1.6 from vision and eye care health [6]. The absolute outcome will definitely lead to permanent blindness.

Figure 1.6: Proliferative Retinopathy

Observing acnes or floaters in the vision, blurry vision, trouble in clearly seeing in the night or dark or vacant areas are some of the significant indications of retinopathy in diabetes.
1.5 GLAUCOMA (OPTIC DISC FEATURE)

Glaucoma can be delineated as a multi factorial optic neuropathy damaging the optic nerve fibers and ensuing diminishing the visionary and prescient leading to permanent sightlessness. Incessantly, Risk is always found in appraising the disorder considering an extended method to analyze and manage the disease until the final stages. This is deliberated to be second major prominent cause for blindness in the world, impacting many people.

The ocular high blood pressure is found incessantly elevated with the Intraocular Pressure (IOP) being deprived of any concomitant optic nerve damages. The glaucoma is suggested for the standard visual view defects related to the regular or low IOP, Equally in the time period normal or low tension.

The disease glaucoma engenders while augmenting intraocular pressure ensuing both with the eye’s drainage structures malfunctioning. This occurs when the fluid travels in higher pressure than in the regular condition in the retina, leading to the damage in the optic nerve axons behind the eye with vision loss, with an increase in the intraocular strain above 21 mmHg causing glaucoma. The character expands and damages the nerve harm at an exceedingly little strain, at the same time as some other individual might also have excessive eye pressure for years and yet by does not suffer much damage. Patients at times do suffer with deficiency to identify colors or peripheral vision which can be rectified by consulting an ophthalmologist.

1.5.1 Significance of Identifying the Optic Disc Changes

Through the optic nerve in the eye, the retinal nerve fibers is found transmitted as the visible signs from the photoreceptors in the brain. Which can be visualized through an ophthalmoscope called optic disc. The optic nerve can be damaged in assorted ways in glaucoma, Irrespective of the damage and visual view defects to optic nerves in glaucoma.
Optic Nerve Head (ONH) can be examined, which is extremely significant in analyzing and detecting the damage. Greater the misplacement in the rim amid the disc and the cup, better the probabilities of glaucoma.
Glaucomatous damage is a significant sign of identification with the appearance of the optic disc, with assorted changes in it. The prognosis of glaucoma is one of the techniques to perceive it. The most commonly located aspects of glaucomatous damage are the concentric amplification of the optic cup, notching and dissimilar comparable patterns. The evaluation is usually deliberated as the optic cup to the disc ratio of the optic nerve. The vertical vocalization of the optic disc cupping takes place with the extra excavation within the vertical course. Nevertheless, the irregularities of CDR have different illnesses with the reason and are consequently not trustworthy. Precise and prompt discovery of disc trade facilitates the clinician to opt the scientific assortments to screen the patients, to consider and the categorize glaucomatous individuals.

![Figure 1.7: Differentiation of the Fundus Images in the Normal and Glaucomatous Disc](image)

The measurement of the internal pressure in the eye can be a decisive factor to discover glaucoma in the patients, usually assisted with the tissue lack in the neuron retinal rim in the optic disc and a resultant affluence in the optic cup size projected in the Figure 1.7 by Monica Gandhi, Suneeta Dubey in the year 2013[7]. Prominently, the individuals inside the systematic assortment can suffer with this disease in future.

Probably, one of the patients with an initial CDR with 0.5 may have concentric expansion of the cup with the CDR of 0.6 in the huge disk. A sophisticated analysis with computer assisted judgment affords the specialist with fatal evidence. The changes in the optic disk typically ascend into asymmetrical extra fast development when compared to the others. The cup has a tendency to lengthen vertically which leads to improved vertical cup-to-disc ratio, when the optic nerve damage is found.
progressing. Untreated the glaucoma that is neglected can lead to enduring damage to the optic nerve with ensuing sight loss, can be rectified if diagnosed well in advance.

1.6 EXAMINATION OF THE EYE CLINICALLY

The direct, oblique ophthalmoscopes and bio microscope with oblique lenses are the core paraphernalia in a scientific eye examination, where the ophthalmoscope, including the illumination source and corrective lenses, with the insignificant rays utilize replicate or prism, by the medicinal skillful personnel to diagnose the defect. The binocular lenses are engaged to inspect the contemplated light (stereoscopic photo) by focusing high intensity condensing lens to the affected person’s eye to detect the issue. In the medical headband, the illumination source and the binocular lenses are hooked up. The statement system and the illumination system are incorporated into bio-microscope; extensively magnifying it emits focal mild managing the apertures and the slit mechanism in the human eye.

1.6.1 Imaging of the Fundus

Meditated light is the process, where the imaging of the fundus is defined with the projected tissues in the system of 2-D exemplification of the 3-D fundus projection. The eye imaging is the process leading to a 2-D photograph, with the intensities representing the amount is contemplated as mild. The retinal camera or digicam is a microscope with a specific low strength with an attached digicam intended to picture the internal flooring, entailing the retina, optic disc, macula, and posterior pole.

The optometrists, ophthalmologists and skilled scientific professionals use the fundus camera for pursuing progress of an ailment and to analyze the disease or the screening packages, which can be magnified fifteen times with the direct ophthalmoscope. It can engender the inverted image magnified 2 to 5 times. The fundus images are always most desired for their diagnostic modality, as they are dependable, inoffensive and user friendly, when compared to the appraisal of regular ophthalmoscope, allowing to record the analytic statistics and furthermore empowering the proficient consultation subsequently. As believed by Hutchinson et al (2000)[8] regarding the attention fundus images implications in an advanced sensitivity charge, with a sophisticated recognition rate in an ordinary eye fundus. Using the evaluation algorithms, the automated prognosis of diabetic retinopathy offers a smooth to document pictures in
transportable layout. Figure 1.8 illustrates the eye camera from Alqattawi, Khawad in the year 2010[9].

![Figure 1.8: Camera of the fundus.](image)

The eye fundus cameras are available in two variants, such as non-mydriatic and mydriatic cameras, with the prefix denoting the constraint for dilating the students with eye drops. For the screening functions, The Non-mydriatic fundus cameras that are smaller and suitable are utilized, nevertheless the picture is worse with a smaller FOV. Consequently, when there is a necessity of superior precise examination, the mydriatic cameras come into depiction. In this procedure, the fundus digital camera and the top is placed into the instrument’s head for relaxation being placed in the front, with the Light engendered with the flash lamp emitted into the eye of the patient expending the optical mirrors & lenses, the slight reflection is caught with the digicam sensor. Due to the retinal transparence and the intensity of the penetration, light emitted rely on the wavelength, the preferred retinal structures are accentuated with the ophthalmic filters. The diabetic retinopathy can be diagnosed with an alternative color pictures called crimson-free eye fundus images.

The precept of monocular oblique ophthalmoscope is a predominant aspect on which the ophthalmic status of the fundus digicam. The indoors surface of the eye is depicted by the fundus digicam in a perpendicular and magnified vision. Whereas, the customary digicam depicts only 30° to 50° of the retinal vicinity, with an escalation of 2.5x, permitting only a couple of variations, via increased or supplementary lenses from 15° providing 5x magnification to a hundred and forty°. The observation & illumination structures follow dissimilar paths. An insignificant analysis is intended
through lenses in a chain with a doughnut-shaped orifice, transient with an imperative opening to figure an annulus.

The doughnut formed in the illumination machine is the result of the insignificance fleeting through the un-illuminated hole. Due to the impartiality in the two structures of the light paths, the light supply captured within the shaped picture is found with minimal reflections. The picture creating emissions endure concerning the low power-driven telescopic eyepiece. In the illumination machine while the picture is taken, a duplicate interrupts the route, empowering the light in the flash bulb to bouncing to attention. A digicam devoted to an unintended ophthalmoscope, it intends concerning photographing the photograph of the fundus of the attention. The photograph of the fundus can be viewed and recognized by the observer through the mirror flipped inside the optical direction of the detecting microscope, ensuring the image captured for absolute consideration. The regular requirement of the fundus camera is considered to be augmented about four mm with the FOV expansion up to 45°. It offers a goal photographic report of some situation of the interior of the eyeball (fundus) utilized to take the anterior section of the eye pictures. The internal area of the attention can be captured using a specialized virtual camera in the fundus digicam, countenancing precise coloration simulated pictures of the colored surface for instantaneous appraisal with impending mention. The cannon non-mydriatic fundus camera with a 45° FOV is used to take the pictures sent by the Guntur government eye hospital, found captured by eight bits of the color aircraft at 768 x 584 pixels, with 540 pixels FOV circular diameter approximately.

The spot statistics and a benchmark for impending is offered by the Fundus photographs, permitting monotonous descriptions recognized & chronicled without considerable effort, assisting to diagnosis the disease in advance, observing the results of the treatment with respect to vision intimidating deviations initiated by common complications related to the health. Picture facilitates to detect and manage certain ailments like the disorders mentioned above. Moreover, with the utilization of simulated photography, with superior images, can be stored, repossessed certainly they can be transmitted automatically to other web sites will be extremely accommodating for the impending further study. The picture of the retina can be perceived with a
fundus digital camera, which has a large microscope with a gaggle of lenses, with exceptionally low resolution to perceive the intact retina while Optical Coherence Tomography (OCT) focusing naives bits in the retina that are exceedingly small, with no requirements in the intense computational of OCT.

Subsequently, the complete ensuing modalities or procedures are associated with the fundus imaging classification:

i) Photography of the fundus (red-free photography)
The quantity of the reproduced brightness is the representation of the image intensities of a specific waveband.

ii) Photography of the Color fundus
The spectral sensitivity of the sensor determines the quantity reproduce R, G, and B Wavebands represents the Image intensities.

iii) Photography of the Stereo fundus
The quantity of the reproduced light from with the dissimilar view angles for depth resolution represents the Image intensities.

iv) Imaging of the Hyper-spectral
The quantity of the reproduced light of manifold specific wavelength bands represents the Image intensities.

v) Ophthalmoscope Laser Scanning (OLS)
The quantity of the reproduced single wavelength laser represents the Image intensities.

vi) Adaptive optics
The quantity of the reproduced laser light optically amended by demonstrating the abnormalities in its wave front represents the Image intensities.

1.6.2 Modalities in the Alternate Diagnostic
The fluorescein angiography & OCT play a decisive role in the DR analysis in accumulation to the scientific eye examination & eye fundus pictures. As expounded by Margolis and Kaiser (2008)[10], the fluorescein angiography is a fluorescent dye inserted in the universal move of an affected individual by the method of emitting mild into the patient’s eye in precise wave duration with the activated fluorescent residences in the dye. The light emitted enthuses the dye particles into the advanced
energy level, returning the molecules to the original nation discharges light with a lower electricity. The usage of eye fundus photography is captured. The angiogram is referred to obtained image. The fluorescein angiography offers precious facts with the circulation movement of the dye in the ocular vasculature.

The dimensional in two cross-sectional pictures in the ocular tissue systems is engendered by the OCT. The light and the perpendicular spatial course spread the dimensions of the path. The apparent retinal systems, the deeper tissue layers’ time propagated is found longer, throughout the ocular tissue, the broadband beam of mild (laser) is scanned. The systematic 3D modernization of the retina is devised with the Optical coherence tomography (OCT) photographs in several axial scans and the usage of several OCT pix. The other adaptive optics modalities in ophthalmoscopy, are coloration Doppler imaging, retinal thickness analyzer and scanning laser polarimetry are the fluorescein angiography is a technique used by the ophthalmologists using fluoresce in with a fundus digicam.

1.7 DIAGNOSING THE DISEASE
The optic disk testing entails the capacities of the intraocular straining with the goniometry, modifications in eye length or shape, frontal compartment angle exam or gonioscopy. Examining the optic nerve to check the prospect of potential damage or changes in the vascular alteration, rim look and internal cup to disc ratio. The visual ophthalmic disability in adults is quite-common in DR. It can be analyzed with the medical examination of eye and its fundus images. Preference will be given to the eye fundus photography for the initial fitness; with the retinal fundus photographs are not available. To boost the eye examination, the fluorescein angiography and optical coherence tomography are applied with an Alternate modality. The ophthalmic ultrasound is used in case the retina fails to reach and even the light fails to be traversed into the eye. If the retinal disinterest is found due to PR, and is not even detectable with the ultrasound. At this time when the diabetic retinopathy is not found diagnosed with the laboratory tests. Either retinal images or direct ophthalmoscope is utilized by the primary health care to identify it.
1.8 SCREENING
The visual impairment can be prevented when retinopathy can be identified well in advance through screening. The procedure of detecting and grading DR from retinal pictures is found extremely monotonous and time consuming as well. Therefore, it is splendid practice to amplify a programmed DR screening system with the capacities of discriminating the individuals without a few assorted retinal deformities. Initially, no prominent indications in DR are identified but they develop with time in future. An enormous scope of a cost-effective screening is very essential. This is a remedial process to identify and treat the ailment even after its effects. The diabetics with DR, should endure a systematic screening to identify and treat it successfully. Without the necessity of specialist reviews, a computerized method should be utilized to evaluate the fundus images.

1.9 DESCRIPTION OF THE PROBLEM
It facilitates an effort to detect the eye diseases and diabetes with the retinal images, utilizing by the actual image dispensation algorithms, offering the connection amid the blood sugar values and analogous characteristic standards in the usual and unusual cases as well. Lot of papers has achieved the maximum operational with both in single or double feature from this survey. The retinal disorders such as additional progression in the blood vessels, exudates, microaneurysms & shape of the optic disk. None of the paper is found acquiesced in all four competencies of the retinal abnormalities so far, featuring the severity in diabetics, related to the blood sample values or the competence values of each range. This proposed work involves finding all of the 4 features of the retinal sickness. Expending the image processing algorithms, the level of damage can be analyzed in the diabetics, evaluating the effects by comparing the results.

1.9.1 Objectives
Huge demand is found for the skilled personnel with these new imaging techniques in the retinal evaluation, which do certainly never offers high indifferences to administer a superior quality screening tools which are found exceptionally expensive. Consequently, to identify the disorder in the diabetics, a non-invasive and inexpensive technique has to be administered. Controlling the growth of the disorder, with an early detection via normal screening and well timed intervention will be exceptionally
useful. Realizing the significance of vision, we should keep away from losing the imaginative and prescient capabilities. This is completable via removing the retinal substitutes. In several methods, the human eyes influence the membrane and the retina creation.

The study of feature extractions is supported by the analyzation of the disorders extracted from the image process algorithms with the latest technological advances based on the 4 algorithms. The level of severity of the disease can be analyzed with the output effects of those four extractions. Consequently, the treatment can be accomplished in advance saving the eyesight, with an offered relationship between the blood sugar readings and the anomalous structures of the retina. With these available details the ophthalmologists can analyze the defects and otherwise as well.

Utilizing the monocular fundus images, the diabetic retinopathy can be detected well in advance is the prime objective of this thesis. The identification of disease pathology in human eyes to lower the effect in the diabetics. The retinal blood vessel morphology in fundus photographs is a significant sign of the eye diseases. The presence of the exudates and bright lesions in the macula is a definite sign of diabetic retinopathy.

To evaluate the damage of the disease, a clinical conclusion patron scheme should be premeditated to extract the momentous structures like the optic disc, Microanysms, retinal blood vessels, exudates etc. With an automatic process to decrease the individual difference, identify weak exudates and envision the disease brutality with a noteworthy enhancement with a practical understanding, should be done by the system, irrespective of inconsistency in clarification intensities, color and quantity of the noise.

For an enhanced action strategy can be provided to the ophthalmologist, with an automatic clinical patron method can be facilitated to diagnose the eye disease and diabetic retinopathy that is realistic to efficient, in the population to screen and identify the diabetic’s disease in the early stages, to monitor the advancement of the disease, minimizing the observation time as well.
1.9.2 Problem Definition

The qualitative examination of the eye extra reproducible and objective can be done with the Retinal image evaluation is based on computational strategies. By the way of examination an alternative way can be detected by the concern medical persons to analyze and to set up a standard. The visual loss and perception of the illness growth are the two types of retinal disorders that can be evaluated with these images.

Certain disorders like hypertensive retinopathy, diabetic retinopathy etc can be detected with an automated retinal image analysis. The fitness care is one of the important aspects in diabetics. To detect the irregularities and exclude the vision damage in the patients. Usually the diabetics are found suffering with the sight threatening and imposing DR, realizing it in the later stages when it highly impossible to be rectified. It can be detected initially with the blood vessels, Microaneursyms and exudates.

Approach based on the Pixel
i) Clustering methods can be used for Detecting exudates.
ii) Utilizing the histogram technique, Quantification can be done with an Image based approach.
iii) The blood vessels can be detected utilizing kirsch edge detection.
iv) The Microaneursyms can be detected by utilizing the morphological operations.
v) The textural features and anatomical feature can be extracted from the segmented image.
vi) To classify the normal and abnormal retinal images, the SVM classifier is used.

1.10 APPLICATIONS

Fundus pictures grading are always found repetitive and time consuming. The ophthalmologist’s attention analysis necessitates, is always found vulnerable to errors. Instinctive image appraisal methods on retinal image delivers a huge remedies to the complications. The ranking method automating facilitates extra patients to be screened and referred to the corresponding analyses, letting the ophthalmologists to afford additional period for the suffering patients. The computerized method facilitates the other medicinal examiners to ascertain the ophthalmic disorders and diabetic retinopathy cases without necessitating the other professional ophthalmologists. The
primary detection of eye disorders and DR cases can be carried out in rural areas with
the assistance of the trained health workers and accomplishing mobile health camps as
well.

1.11 THESIS ORGANIZATION
Chapter-1 deals with the introduction of the components of eye perception, eye
diseases and diabetic retina disorders with their implications in the human eye. Along
with the additional description of the inadequacies of the prevailing benefits of
automated eye fundus image examination for diagnosis.

Chapter - 2 deals with the momentary literature review associated to prevailing
procedures of optic disc extraction, optic cup to disk ratio, Microanysrms extraction,
exudates identification, learning classifiers, along with the Shortcomings of the current
algorithms to detect the eye disorders and retinopathy.

Chapter - 3 deals with the algorithm for the segmentation of retinal features, along
with the disc boundary accuracies in images and datasets are examined and matched
with the other few procedures as well. Chapter- 3 deals with the algorithm for retinal
features detection from blood sample values with the experimental results expounded
with the quantitative analysis as well. The stages of diabetic are diagnosed evaluating
the diagnostic parameters, along with an approach explicated to diagnose the diabetics
using segmented and textural features pursued with the sorting of images and a GUI to
provide the designed image analysis as well.

Chapter – 4 deals with the automatic detection of exudates, texture features, and pixel
based approach in quantitative analysis, extraction of structural and image sorting
expending the SVM approach along with the experimental outcomes with performance
procedures presented for pixel and image-based methods. All these achievements,
conclusions and future avenues of investigation are also overviewed in this chapter.

1.12 SUMMARY
This section affords the summary of visual perception components and diabetic
difficulties with their inferences to visualization associated to the eye ailments with
their signs, the analytical techniques and procedures, inadequacies of the present
diagnosis system along with the prosperities of the automatic retinal image examination. The need for programmed analysis and detecting the early stages of the disease. Lastly, in terms of blood sugar values, the applications of the automatic discovery system to analyze the eye diseases and diabetic retinopathy are discussed as well.