CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

Literature survey is done before the formulation of the research aims and objectives, because we have to check if same research problem has been addressed.It involves a systematic and comprehensive analysis of books, scholarly articles and other sources relevant to a specific topic providing a base of knowledge on a topic. Literature reviews are designed to identify and critique the existing literature on a topic to justify your research by exposing gaps in current research.

The literature review plays a very important role in the research process. It is a source from where research Ideas are drawn and developed into concepts and finally theories. It also provides the researcher a bird's eye view about the research done in that area so far. Depending on what is observed in the literature review, a researcher will understand where his/her research stands. Here in this literature survey, all primary, secondary and tertiary sources of information were searched.

The purpose of a literature review is to:

- Provide foundation of knowledge on topic.
- Identify areas of prior scholarship to prevent duplication and give credit to other researchers.
- Identify inconstancies: gaps in research, conflicts in previous studies, open questions left from another research.
- Identify need for additional research.
- Place your own research within the context of existing literature making a case for why further study is needed.

2.2 Summary of Papers

Ahmad R. Dhaini, Manal Chokr, Sara Maria El-Oud, Maamoun Abdul Fattah, And Shady Awwad have discussed a paper[3] which describes method that employs image analysis and machine learning to automatically detect and measure corneal haze and demarcation line presence and depth in OCT images. The automated method provides the user with haze statistics as well as visual annotation, reflecting the shape and location of the haze and demarcation line in the cornea. Our experimental results demonstrate the efficacy and effectiveness of the proposed techniques vis-a-vis manual measurements in a much faster, repeatable, and reproducible manner. Using image analysis and machine learning, this scheme is able to automatically 1) validate OCT scans; 2) detect corneal boundaries; 3) detect and classify corneal haze; and 4) detect and measure the depth of the demarcation line, such that all these are performed in less than 1 second.

This paper proposes a new automated solution that employs customized image processing and machine learning methods to detect and measure corneal haze and demarcation line in OCT images for Keratoconus patients after crosslinking. The proposed solution has the promise to be employed as standardized method of care for stromal haze measurement of individual patients or in aggregate data for the purpose of longitudinal studies, and may improve clinical decision making after corneal surgeries such as crosslinking. The main drawback of this model is it cannot detect number of the OCT sessions needed by its own to detect corneal boundaries.

Sahar Jorjandi, Hossein Rabbani, Raheleh Kafieh, Zahra Amini, paper [4] presents a new statistical model is introduced for retinal layers in healthy OCT images. This model, namely asymmetric Normal Laplace (NL), fits well the advent of asymmetry and heavy tailed in intensity distribution of each layer. Besides, due to the layered structure of retina, a complete mixture model is addressed to model the whole layers together.

This study deals with a new statistical model for ocular OCT images of normal subjects. This model, namely asymmetric NL, is defined as a convolution of asymmetric Laplace distribution and normal distribution. According to numerical and visual results, this model has a well goodness of fit to data rather than symmetric NL one, except for 6th and 7th layers. The study also suggests to apply a mixture model with two components for these layers. It seems adding a new component for vessel shadows which observed in OCT images can be made a more compliance for final complete mixture model. Due to 11 layers of retina.

It is suggested a complete mixture model for whole layers of retina with 11 components. After designing this complete model, for a new OCT image, Expectation Maximization (EM) algorithm can be used to estimate the parameters of mixture model. Afterdetermination of the initial values of parameters, this iterative algorithm updates the values ofparameters in each iteration until they converge. With a specific and accurate model for healthyOCT images, this model would be able to distinguish between healthy and abnormal OCT data based on evaluating the goodness of fit which shows the potential of the proposed statistical OCT image modeling in this paper for classification of OCT data.

The goal of this study OCT denoising by using Expectation Maximization (EM) algorithm to estimate the parameters of the proposed mixture model and the drawback is the proposed asymmetric NL model is not able to fit to layers 6 and 7 accurately.

I.R. Hidalgo, P. Rodriguez, J. J. Rozema paper [5] describes a system which uses a support vector machine (SVM) algorithm in order to differentiate patients suffering from keratoconus from those who are healthy. The development environment use in the study is Weka open source software. Scheimpflug tomography was performed for all eyes byan experienced operator using the Pentacam HR, software version 1.20 r02. Based on these examinations, 22 topographic and tomographic parameters were selected from the commaseparated value files in the root folder of the Pentacam program, which are automatically updated each time an examination is either performed or opened. The chosen parameters are available in the most basic version of the Pentacam software and include aspects of the corneal curvature, eccentricity, anterior chamber, corneal volume, and pachymetry. Weka16is an open-source suite of machine-learning algorithms with a graphical interface that supports different data mining tasks, including data preprocessing before classification. The algorithm used for classification was SVM. Finally, accuracy was estimated using a 10-fold cross-validation (CV) method on the full data set.

In neural networks, a convolutional neural network (CNN) is one of the main methods of recognizing and classifying images. CNNs are currently used in applications such as object recognition and face detection. A CNN that is capable of diagnosing the keratoconus disease is implemented in this paper. The study has several limitations that can be addressed. The proposed machine learning models were trained on corneal data from Casia instrument and are thus, limited to this instrument. Further testing was beyond the scope of the current study. Most of currently available commercial instruments generate data that are not necessarily consistent.

For instance, while Casia generates around 400 parameters, Pentacam generates over 1,000 corneal parameters. However, the corneal topography the proposed model can be easily trained using other corneal data generated by other instruments such as Pentacam. The Casia ESI index as the ground truth rather than the clinical diagnosis labels was used. While this may not be equivalent to clinical diagnoses, ESI index provides an objective measure of cornea avoiding bias due to human assessment.

The VGG16 model was mainly stacked with a series of convolutional and pooling layers for image feature extraction and then connected to the fully-connected layer for classification. The InceptionV3 model reorganized the common convolutional and pooling layers into the so-called Inception module, which comprised three convolutions and one pooling to widen the network layer to acquire more detailed image features and improve prediction accuracy. The ResNet152 model introduced the shortcut connection before and after convolutional layers to make a plain network into a residual network, which can build an ultra-deep network without problems of gradient vanishing or exploding to gain accuracy from the considerably increased depth. The limitations of this study are its retrospective nature and the limited number of patients for algorithm training.