A Study of Data Mining Techniques in Glaucoma Detection

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***Abstract*- Glaucoma is that the second leading eye disease for blindness after cataracts and its detection is important to stop visual damage. Glaucoma is that the third leading explanation for blindness in India. Some frameworks are accustomed to detect the glaucoma in early stage using data mining and other techniques. Automation method to stipulate and locate blood vessels in image of the ocular fundus could be a tool useful to eye care specialist for purpose of treatment evaluation [1]. Using these styles of techniques the system will identify the glaucomatous eye which is ready to predict the progression of glaucoma. Because of this type of techniques the assisting ophthalmologist can detect and diagnose the glaucoma in earlier stage in order that our society will fight against the killer vision. This process of diagnosis and detection will be achieved through various data processing technique and algorithm like classification, clustering, association and fuzzy decision tree etc., during this study attributes like age, vital sign, diabetes, case history of assorted patients. With the assistance of this dataset can predict the accuracy result for glaucoma. In this approach of data mining patients can easily identify whether there are chances of getting glaucoma or not.**

***Index terms*- Glaucomatous, Aqueous humor, blood vessels, Data mining, Dataset, Data transformation, Knowledge Discovery Technique.**

INTRODUCTION

People from both rural and urban areas suffer from eye diseases such as Diabetic Retinopathy, Glaucoma, Cataract and Macular Degradation based on age etc. Glaucoma is a complex disease which will damage the optical nerve and also leads vision loss. If a person didn't take proper initiative then it causes blindness. It is otherwise called as "The Sneak thief of Sight". When intraocular pressure(IOP) increases in the eye then it leads to damage of Optic Nerve Head (ONH).This optic nerves are responsible to lift the image information signal to the brain. Due to this damage leads the loss of vision for a person. In a research it was identified that loss of retinal nerve fibers due to glaucoma so the texture analysis tool is used to measure the nerve fiber loss[2].Approximately 12 million people affected and nearly 1.2 million people blind from this disease in India. Aqueous humor is a fluid inside our eye, flows out of our eye through a mesh-like channel. The liquid builds up when this channel gets blocked. Sometimes, experts don't know what causes this blockage. But it can be inherited from parents. Less-common causes of glaucoma include a dull or chemical injury to the eye, severe eye infection, blocked blood vessels inside your eye and inflammatory conditions. Tonometry test is used to check the pressure in eye. It is painless test.

Secondary Glaucoma is the first common type of glaucoma, like cataracts or diabetes, causes added pressure in our eye. Normal-tension glaucoma is another type of glaucoma when people have blind spots in vision or damage of optic nerve even the eye pressure is in average range. It is also known as open-angle glaucoma. Pigmentary glaucoma could be a tiny bit of pigment from the iris, the colored a part of our eye, get into the fluid inside our eye and clog the drainage canals. So it is better to have a complete eye test with an eye specialist when a person is at the age of 40 and family history of glaucoma.

DATA MINING TECHNIQUES

A Large amount of composite data like patients, hospital resources, disease analysis, electronic record of patients, medical device is generated by health organization or Healthcare business. Healthcare services are based on the information and it can be improved with effective information support, including data modeling, retrieval and analysis [3]. Using all these parameter construct a dataset to check

the accuracy result for glaucoma. Data is processed from this large amount of data and it is analyzed for knowledge extraction for accuracy which is used for decision making of a person based on relevant information. Data mining techniques are used with the dataset with different attribute which is used to extract the information in health sector. Decision making process is implemented using this information to predict the accuracy for given attribute by real time example [4]. The major two forms of data mining are:

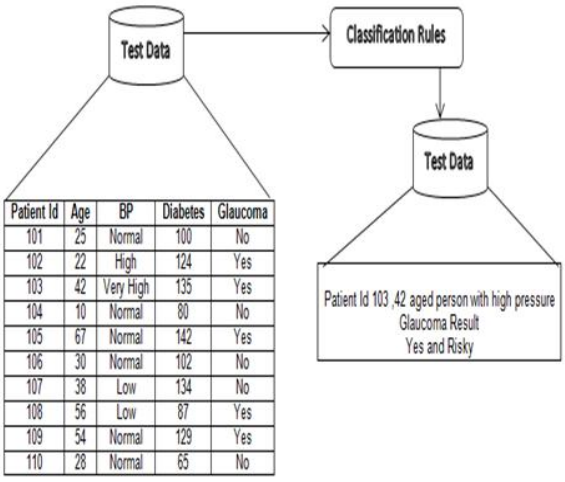
1. Classification: Doctor wants to analyze the data in order to know which type of glaucoma and whether they are risky or safe.
2. Prediction: To predict the treatment and treatment schedule whether it is emergency or not, for a patient based on their test result.

Thus it correlates a specific set of symptoms that are related to a particular disease extracted from medical history of patient, diagnose and predict the possibility of a typical disease, so as to detect it early as possible so that it can be cured in early stages without being much damage.

Data set can be created using data extraction from medical domains or an organization recorded in a database. Prediction or diagnosing of typical disease may do after data gathering with the help of classification and prediction data mining technique.Fig1 shows the Use of classification and where the test data is used to estimate the accuracy of classification rules.

The major issue is preparing the data for the classification and prediction. Preparing the data involves the following activities:

1. Data Cleaning: It is the process of detect, Identify and modify the inaccurate, incomplete data from the database.
2. Relevance Analysis: It is used to know the attribute relation using correlation analysis since the database may have the irrelevant attributes.
3. Data transformation and reduction: The data can be transformed by any of the methods like normalization, Generalization, wavelet transformation, binning, histogram analysis and clustering.



Patient Id	Age	BP	Diabetes	Glaucoma
101	25	Normal	100	No
102	22	High	124	Yes
103	42	Very High	135	Yes
104	10	Normal	80	No
105	67	Normal	142	Yes
106	30	Normal	102	No
107	38	Low	134	No
108	56	Low	87	Yes
109	54	Normal	129	Yes
110	28	Normal	65	No

Figure 1: Using classifier for classification

Glaucometer progression detection using HRT images is a new framework. In this Maximization algorithm the task of inferring glaucomatous changes used for the first time[5].The techniques of KDD(Knowledge Discovery in Database) using data mining tool and challenges that are related with data mining and the application of Data Mining are in e-business, retail and marketing [6].

DATA MINING PROCESS

The best interactive and iterative process is data mining. Data mining field addresses to use the data to discover new knowledge and improvement in process of decision making. Although data processing could be a powerful knowledge discovery technique, there are constraints within the way it may be applied, it's application dependent, different applications usually require different mining techniques, and data must be of a specific size and format. Some mining algorithms like rule-based learning systems, neural networks, decision trees, Bayesian networks, logistic regressions etc., are used in healthcare sectors with great success. To train the data for the learning process and used for automated diagnosis of glaucoma, the data mining technique called Machine learning classifiers are used. Linear discriminant analysis (LDA), Support Vector Machine (SVM) and recursive partitioning and regression tree (RPART) are some of the Machine learning classifiers are used widely for diagnosis of glaucoma [7][8]. Appropriate data mining algorithm like SVM, Naive Bayesian are

used for test the data that are obtained from Optical Coherence Tomography.

OPTICAL COHERENCE TOMOGRAPHY

Optical coherence tomography (OCT) is an imaging technique. This OCT is used for medical imaging and industrial nondestructive testing. It uses light waves to take pictures of your retina. With this OCT, the ophthalmologist can see each layer of the retina. Through this the ophthalmologist can measure their thickness for diagnosis and suggest treatment guidance for eye disease like glaucoma, age related macular degeneration (AMD), Diabetic retinopathy and others.

Before starting the OCT test, the specialist will drop the dilating eye drops in patient's eye which is used to widen the pupil and make easier for retina test. The patient will sit in front of the OCT Machine and rest their head on a support for scanning. This OCT machine will scan the patient's eye. This test may take approximately 5-10 minutes. Eyes may be sensitive to light for several hours after the exam since the eyes were dilated.

ANTICIPATION OF HEALTH DISEASE USING DATA MINING

The data mining is the most effective technique for anticipation of any health disease. This method is utilized with its different technique. We can construct the data entry table after the data collection which can run on the tool that provides the accuracy results of someone to be infected from a disease or not. The attribute name itself depicts the meaning of attribute. Wrong input of data entry will lead dataset interruption so should be very careful. Early stage of glaucoma prediction will be useful by collecting the attributes in right manner. Using a tool as mentioned before we can calculate the accuracy precision of a person suffering from that disease or not. Glaucoma is neuro generative disease which leads to vision damage if not predicted early. Using the mentioned attributes can predict the glaucoma.

CONCLUSION

To prevent the vision loss of the patient early detection of glaucoma is very necessary in healthcare department. Web Application is a part of data mining application has been increased with the accuracy of predicting disease gives more importance of these techniques. Data mining techniques in the existing are to detect the disease as earlier so that it will avoid vision blindness. From the mentioned attributes can conclude that a person can affect or affected by this disease or not. There were many tools like Weka tool, Rapid Miner Tool to conclude the accuracy precision for having chances of glaucoma disease. Using data mining techniques with effective result is major advantage to predict the glaucoma in earlier stage to reduce the chance of risky level.

REFERENCES

[1] Adam Hoover, Valentina Kouznetsova, Michael Goldbaum, "Locating Blood Vessels in Retinal Images by Piecewise Threshold Probing of a Matched Filter Response", IEEE Transactions on Medical Imaging , Vol.19, No. 3, March 2000.

[2] K. Yogesan, R.H Eikelboom, C.J. Barry, "Texture Analysis of Retinal Images to Determine Nerve Fiber Loss.

[3] Donald J. Berndt, Paul J. Hu, Chih -Ping Wei, "Introduction to the Minitrac: Database, Data Warehousing, And Data Mining in Health Care" , Proceedings of the 33rd Hawaii International Conference On SystemScience-2000.

[4] Dr. Varun Kumar, MD. Ezaz Ahmed, "An Emperical Study of the Application of Web Mining Techniques in Health Care", (IJACSA) International Journal of Advanced Computer Science and Application, Vol. 2, No. 10, 2011.

[5] Akram Belghith, Madhusudhanan Balasubramanian, Christopher Bowd, Robert N Weinreband Linda M. Zangwill, "Glaucoma Progression Detection Using Variational Expectation Maximization Algorithm",2013 IEEE 10th International Symposium on Biomedical Imaging: From Nano to Macro San Francisco, CA, USA, April 7-11, 2013.

[6] Ruben D. Canlas Jr., "Data Mining in Healthcare: Current Application and Issues", 2010 2nd International Conference on Computing, Communication and Networking Technologies, 9781-4244-6589-7/10/$26.00©2010IEEE.

[7] Optical Coherence Tomography Machine Learning Classifiers for Glaucoma Detection: A Preliminary Study – Zvia Burgansky-Eliash, Gadi Wollstein,Tianjiao Chu, Joseph D. Ramsey.
[8] "An Efficient Automated System for Detection using Fundus image" - k.Narasimhan, k.Vijayarekh - A Journal of Theoretical and Applied Information Technology15th November 2011. Vol. 33 No.1