A Review On Detection Of Maladies In Retinal Blood Vessels Using Image Processing And Data Mining

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Abstract: In todays world human are full of varied diseases that cause injury of some or the opposite piece which degrades their operating speed. There are several eye conditions and sickness that may affects human eye which has eye disease, Cataract, Diabetic Retinopathy, and lots of alternative vision threatening diseases. It's become imperative to seek out either solutions to those diseases or observe them throughout early stages in order that they'll be prevented or cured. Blood vessels, one among the foremost important retinal anatomical structures are analyzed for identification of the many diseases. Retinal anatomical structure pictures are the foremost supply for ophthalmologists in segmenting the anatomical structures of the tissue layer viz. blood vessels, optic disc, macula and fovea centralis to spot eye maladies associated with tissue layer. This work examined varied progress created within the field digital image process and data processing formulas and listed out the open challenges in victimization such algorithm in the Indian medical knowledge set.

Keywords: Retina, Blood Vessels, Digital Image Processing, Data Mining

I. INTRODUCTION

Lots of individuals in rural and semi urban areas get suffered from eye diseases like Diabetic Retinopathy, Glaucoma; Age primarily based Macular Degradation and etc. machine techniques have nice impact within the field of drugs and Biology. These techniques facilitate the medical practitioners to diagnose any abnormality ahead and supply fruitful treatment. Retinal image analysis aid the ophthalmologists in detecting abnormalities in the retinal structures namely optic disc, blood vessels, macula and fovea thus diagnosing sight threatening retinal disease. Globally, it's calculable that a minimum of a pair of 2.2 billion individuals have a vision impairment or visual impairment, of whom a minimum of one billion have a vision impairment that would are prevented or has nonetheless to be self-addressed. The leading causes of vision impairment are

- uncorrected refractive errors
- cataract
- age-related degeneration
- glaucoma
- diabetic retinopathy
- Corneal opacity
- trachoma.

In this paper, surveyed the applying of assorted image process and data mining techniques used for detection of eye diseases.

A. IMAGE PROCESSING

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics or features associated with that image.Maintaining the Integrity of the Specifications.

B. MEDICAL IMAGE PROCESSING

To perform the medical image processing and disease detection, a sequence of image processing operations are required to improve quality of acquired image and to perform the detection.

II. DATA MINING

Data mining is the core step, which has resulted in the discovery of hidden but useful knowledge from massive databases. “it is the non-trivial extraction of previously unknown and useful information about data”. The two primary goals of data mining are prediction and description.

- Prediction involves some variables or fields in the data set to predict unknown or future values of other variables of interest.
- Description focuses on finding patterns describing the data that can be interpreted by humans.

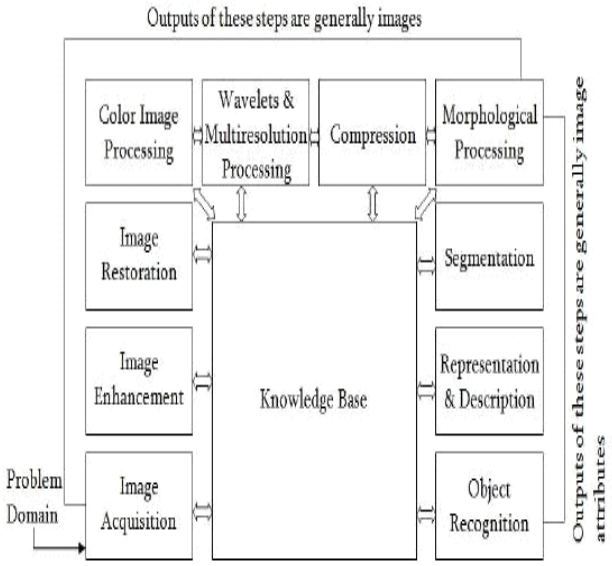

Figure 1. *Architecture of image processing and function involved.*

III. CURRENT WORKS IN IMAGE MINING

Image mining deals with the extraction of image patterns from a large collection of images. In image mining, the goal is the discovery of image patterns that are significant in a given collection of images. Image mining is synonymous to data mining concept. It is a set of tools and techniques to explore images in an automated approach to extract semantically meaningful information. R.Geetharamani (2017) concluded that there are three data mining classification techniques (k- means, Wavelet and Histogram techniques) can be used for the segmentation of optic cup through intensity thresholding, feature extraction, feature selection involving Naive Bayes classification of Reduced Error Pruning Tree for automatic detection of glaucoma. Dr. Karim Hashim (2017) applied an association rule and SVM classifier to automatically detect and realize the various lesions of diabetic retinopathy and its features. The specifications of the normal colour fundus images were analyzed and classified by the extraction method into normal or abnormal. The input images are enhanced by using mathematical morphological operation. An enhanced image is segmented using a threshold method to extract the blood vessels and optic disc. Fuzzy algorithm is used to segment exudates and to obtain region of interest (ROI). It is further hoped for the system to be expanded and improved by combining other medical features as well as other data mining techniques. A very detailed explanation of fuzzy c-means and neutrosophic approach was developed by Ishmeet kaur (2016). The various diseases detected in this technique are cotton wool spot, Exudates and lesions with the help of region growing neural network classification method. The segmentation of retinal blood vessels can help in diagnosing the retinal disease at the initial stage and thus aid in better treatment of patients. Calculations of performance metric were evaluated by using true positive and false negative values. Post processing technique should be enhanced to achieve the better result for the segmented images. Data mining techniques like decision tree, linear regression and support vector machine that have been used for diagnosis of Glaucoma in the retinal image was proposed by Kinjan Chauhan (2016). Comparative study of various data mining techniques and performance of decision tree, linear regression and SVM are used in the process of Glaucoma diagnosis. From the result it was observed that decision tree have given higher performance in terms of accuracy, sensitivity and specificity but still improvement can be made to support linear regression and SVM. Neelam D.Panse (2015) used Support vector machine (SVM) for classification of the retinal images into category of normal, DR, Glaucoma. This work specifically focus on the feature relevance and classification technique to accurately categorize the disease associated with retina based on the features extracted from the retinal images through image processing technique. Linear classifier is used to detect the categorise of retinal diseases as normal, Glaucoma and DR. The retinal blood vessels were segmented through colour space conversion and colour channel extraction, image pre processing, Gabor filtering, Image post processing, Feature construction through application of principal component analysis, k-means clustering and first level classification using Naive-Bayes classification algorithm and second level classification using C4.5 enhanced with bagging technique was applied by R.Geetharamani (2015). Through these experiments it was noted that average segmentation of healthy images was higher when compared to that of pathological images. Each image was affected by a different pathology and hence decreases in accuracy. An automatic system for screening diabetic retinopathy (DR) in teleopthalmology networks was proposed by Gwenole (2013). It combines image quality metrics, specific lesion detectors and a generic pathological pattern minor to process the visual content of high fundus photographs. The resulting system was evaluated in e-ophta. A Receiver Operating Characteristic (ROC) curve was built by varying a threshold on the abnormality risk provided by the system. Tele-ophta is the first DR screening tool that combines contextual information to generate referral decisions. Further steps to be taken to improve the sensitivity of ROC curve. A novel approach for automatic classification of fundus image is proposed by J.Alamelu Mangai (2013). This method uses image and data pre processing techniques to improve the performance of machine learning classifiers. Experiments were done on retinal fundus images using three classifiers Naïve Bayes NB, K-nearest neighbour KNN and support vector Machine SVM. Results shows that the NB outperform the other two classifiers still improvements can be made to support KNN and SVM classifiers. Two data mining techniques were compared by Mohd Hanafi (2009) to support the automated screening for Age-Related Macular Degeneration. In the first approach the images were represented in the form of spatial histograms that stored the colour information of the images while at the same time maintaining the spatial information of each colour value.

The second approach was founded on a novel hierarchical circular and angular image decomposition technique. Drawback of this algorithm is implemented on publicly available retinal fundus images. Mohd Hanafi Ahmed (2009) compared the operation of three alternative representations to support retina image classification with respect to screening process. The first used a time series which was coupled with CBR approach. The second used tabular representation and the third used a hierarchical decomposition mechanism to construct tree representation. The result indicates that the tree approach outperformed the other two approaches. Through this we concluded that it suits only for large scale screening process. Extracting Y – feature using articulated model and matching them with mutual information provide accurate matching pairs has been implemented on RANSAC based algorithm gives affine motion of any two image pair. Tae Eun Choe (2006) algorithm is limited to retinal images and not explored on general image patches to construct a mosaic. An automatic method to detect hard exudates, a lesion associated with diabetic retinopathy is proposed by C.I Sanchez (2004) by applied PCA and Gradient Vector Flow. But this method does not detect small hard exudates. Thomas Walter (2002) describes that exudates are found using their high grey level variation, and their contours are determined by means of morphological filtering techniques and watershed transformation with using only small data set of 30 colour images. Distinction between Hard exudates and soft exudates which is not possible with the proposed algorithm.

***TABLE 1**. OUTCOMES AND FUTURE WORK OF EXISTING PAPERS*

S.NO	AUTHOR	NAME OF THE ALGORITHM USED	OUTCOMES	FUTURE WORK
1.	R.Geetharamani (2017)	Kmeans , Wavelet and Reduced Error Purning tree	Automatic detection of Glaucoma through Naïve Bayes followed by ensemble classification of Reduced Error Purning tree reporting an accuracy of 96.42%	To detect various eye disease using the same algorithms.
2.	Dr.Karim Hashim (2017)	SVM Classifier & Fuzzy Algorithm	Feature extraction such as that of Microaneurysm, Hemorrhages, Hard Exudates and Soft Exudates.	System to be expanded and improves by combining other medical features, as well as data mining techniques.
3.	Ishmeet Kaur (2016)	Fuzzy c means and Neutrosophic Approach	Automatic disease detection achieves an accuracy, sensitivity and specificity of 98.74%,98.38% and 94.78%	The future insight includes applying enhanced post processing techniques to achieve better results for segmented images.
4.	Kinjan Chauhan (2016)	Decision Tree and Support Vector Machine	Decision tree and Linear Regression model performs much better than SVM for diagnosis of Glaucoma giving accuracy of 99.17%,92.56% and 70.25% respectively.	Decision tree and Linear Regression model will be applied for diseases.
5.	Neelam D.Panse (2015)	Support Vector Machine	Support vector machine gives better efficiency and accuracy of identifying disease with respect to existing systems.	Future work to improve the accuracy and efficiency level.
6.	R.Geetharamani (2015)	C4.5 and Naïve Bayes Classification	Automatic segmentation of blood vessels from retinal fundus images reported 95.05% accuracy on normal images and 94.89% on pathological images.	The insight for future directions includes studying the impact of the training images and refining the resultant segmented images.
7.	J.Alamelu Mangai (2013)	Support Vector Machine and K nearest neighbour	Naïve bayes outperforms the other two classifiers and is better suited for medical image classification	
8.	Gwenole Quellec (2013)	Mathematical Morphological and multimedia data mining	ROC analysis performed in large screening dataset. Sensitivity of 80.9% and Specificity of 68%	

9.	Mohd Hanafi Ahmad (2011)	Weighted Frequent Sub graph mining	Automated screening of Age related Macular Degeneration using spatial histograms and Image Decomposition with 100% accuracy.	
10.	Mohd Hanafi Ahmad (2009)	AMD Classification and Ten Fold Cross Validation	Classification systems are ideally suited to large scale AMD screening process.	
11.	Tae Eun Choe (2006)	Floyd-Warshalls shortest pair	Extracting Y feature using articulated model and matching them with mutual information provide accurate matching pairs.	
12.	C.I Sanchez R.hornero (2004)	PCA nd Gradient Vector Flow	Automatic detection of Hard exudates with sensitivity of 79.62%	
13	Thomas Walter (2002)	Morphological Techniques	Detection of optic disc by means of morphological filtering technique and water shed transformation. Obtain a mean sensitivity of 92.8%	

IV.OPEN CHALLENGES

During the survey of all works in respective areas, many open challenges and problems were identified. In that some of the significant problems are listed down, which are pertinent to do the future research work.

- Distinction between Hard exudates and soft exudates which is not possible with the proposed algorithm.
- Limited to retinal images and not explored on general image patches to construct a mosaic.
- Post processing technique should be enhanced to achieve the better result for the segmented images.
- Results shows that the NB outperform the other two classifiers still improvements can be made to support KNN and SVM classifiers.
- Algorithms need to be improved to detect small exudates.
- It is further hoped for the system to be expanded and improved by combining other medical features as well as other data mining techniques for large data set.

V.CONCLUSION

As the volume of medical image knowledge is exponentially increasing over time, patient diagnosing and maintaining clinical record is sort of difficult. This review clearly shows that data processing techniques are accustomed extract helpful, wealthy and hidden data from the retinal image info. This helps us to a mass data regarding however process and image processing algorithmic program employed in identification of retinal diseases. From the survey it is planned to carry out the further research to implement data processing algorithmic program in different categories of medical retinal image set.

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