

A Survey of Image Mining Techniques for Diagnosing Heart Disease

^[1] M.Umamaheswari, ^[2] K.Krishnaveni
^[1] Research Scholar, ^[2] Head & Associate Professor

Abstract: - Image mining refers to a data mining technique which is used to extract the knowledge directly from the images. It supports a large field of applications such as medical diagnosis, agriculture, industrial work, space research and the educational field. Heart disease is one of the popular causes of death in the world. Heart disease diagnosis is a most important challenge faced by medical fields and hospitals. The goal of this paper is to present a study of various image mining techniques and different algorithms used to diagnose the heart diseases.

Keywords: Image Mining, Heart Disease, Image Segmentation, Classification, ANN, Back Propagation.

I. INTRODUCTION

Image mining is a technique that explores information images data dependence and unambiguous patterns stored in the images. It handles the mining of information, image data association or additional patterns not unambiguously stored in the images. It utilizes methods from computer view, image processing, image retrieval, data mining, machine learning, database, and artificial intelligence. There are two basic techniques in image mining field,

- The exploration in an extensive range of independent pictures.
- Explores a series of integrated and linked images.

Image mining focuses on the extraction of patterns from large collections of images while the significance of image processing and machine view on the understanding of certain characteristics of a particular image. A high volume of images, such as medical images, satellite images and digital photos are created on a daily basis. In case of the analysis of these images, a lot of valuable information can be gained. The pixels shown in a raw image in order to detect objects and the relationship among them is the most fundamental challenge in the mining picture [7]. Image mining generally deals with the growth of new technologies. Image mining is not only the simple fact of improving significant images. The aim is the innovation of image patterns that are important in a given collection of images. First, the images are preprocessed from an image database to improve their quality. These images then undergo various transformations and feature extraction to create the important features from the images. With the generated features, mining can be carried out to discover significant patterns [9]. The figure 1 represents the image mining process.

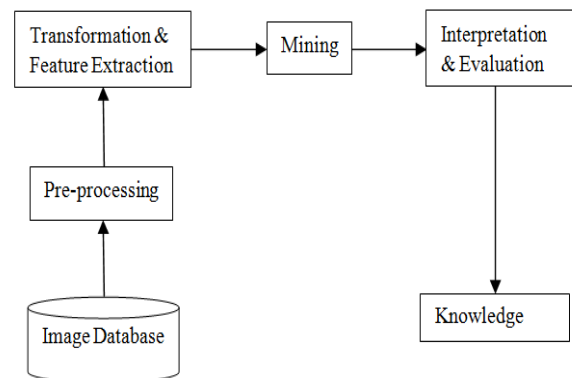


Figure 1: Image Mining Process

II. LITERATURE REVIEW

Vijayavanan M, Rathikarani V, Dhanalakshmi P in the year 2014 proposed “Automatic Classification of ECG Signal for Heart Disease Diagnosis using morphological features”. In this work, an efficient techniques to automatically classify the ECG signals into normal and arrhythmia affected category are used. From these categories morphological features are extracted to illustrate the ECG signal. Probabilistic neural network is the modeling technique engaged to occupy the distribution of the feature vectors for classification. ECG time series signals in this work are composed from MIT-BIH arrhythmia database. The proposed system has shown an accuracy of 96.5% classification rate [1]. Pouya Derakshsan Barjoei, Mojdeh Bahadorzadeh, Elham Foroozandeh, discusses the diagnostic methods using cuckoo algorithm and an optimal bio inspired diagnostic

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model. The Coronary angiography using X-ray imaging systems has long been the preferred modality for diagnosis and treatment of Coronary Artery Disease (CAD). Using bio-inspired algorithm as cuckoo optimization in order to edge detection as well as noise reduction has been done. The bio-inspired technique showed the speed and accuracy of the algorithm better than related to other methods. It is very effective in detecting and demonstrating the effect of vascular or artery congestion in surgery. In this method, the patient's pictures were taken immediately and then, with the optimal processing methods have proposed; the results of estimation and diagnosis were carried out by portable devices [2]. Chavan Krushna D, Kale Abhijeet A, Kulkarni Swapnil P, Sayyed Ajmeer D, uses the algorithms like Decision Tree, Neural Network and the Naive Bayes in the data mining and in the image Processing Local Binary Pattern technology is used. The result shows the accuracy of 99%. Data mining permits the health sector to predict patterns in the datasets. Here we use image processing for comparing the ECG, CT scan, Angiography, etc, reports and finding the more accurate results. In this paper, finally hidden patterns for making decision in healthcare organization were found [3].

Ye Naing Oo, Aung Soe Khaing, proposed ECHO images are used in calculation of cardiac tissue displacement at any arbitrary point and to derive useful heart parameters like size, shape, cardiac output and ejection fraction. In this research, an algorithm for Left Ventricle (LV) segmentation of heart in ECHO images is presented. The left ventricle transfers the necessity of blood to all the parts of body and so it is important to consider the condition of left ventricle. It is based on the level set method, which is used to get the Region of Interest (ROI), using velocity term F , speed term D , gradient value of ϕ , first order derivative, mean curvature K and second order derivative. Then, the segmentation of the Left Ventricle is obtained. In all the experiments, parameters of the algorithm are set in $\epsilon=35$, $T=45$, $\alpha=0.03$. The maximum number of iteration is 1000, and the iteration is reinitialized every 50 iteration. The running time for one image is about 20 minutes. This algorithm was implemented in MATLAB language [4].

Sana S. Zadawale, Savita Bakare, discusses Electrocardiogram (ECG) signal which is used to identify the human heartbeat. In this work, the human heart activities for identifying any abnormalities and also are used to measure the heart rate and regularity of heartbeat. Wavelet functions db8 and sym8 are used to predict the heart diseases such as bradycardia, tachycardia, first degree heart block and healthy person. In this context, the cycle P-QRS-T in the ECG signal which determine the amplitude and location of each peak using QRS complex to identify the cardiac disorder. Based on P-QRS-T peak

values it is easy to predict the heart diseases. For feature extraction DWT (Discrete Wavelet Transform) is used and SVM (Support Vector Machine) is used for classification. The results are found to be encouraging in terms of detection heart disorder [5].

Jasminder Kaur, J.P.S. Raina, focused on computer based automated system in the analysis of the ECG signals in which the images are fed into the system and the software extracts the ECG signal from the image and feed it to the Artificial Neural Network classifier. ANN has its own database of diseased ECG recordings which will match the inputted ECG to the existing one so that they must be diagnosed and interpreted accurately irrespective of the physicians. Furthermore, it shall display the normality or abnormality of the signal so as to start the early treatment for the problems and many lives could be saved. Modifying the ECG records into a computer based digitized image reduces the storage space and the retrieval of the required information can be made accurate and quickly [6].

Atta Elalfi, Mohamed Eisa, Hosnia Ahmed, presented an image processing-based artificial neural network for the diagnosis of heart valve diseases. In this work, extracting texture features from medical echocardiography images, integrating intensity histogram features and Gray Level Co-occurrence Matrix (GLCM) features, then developing an artificial neural network for automatic classification based on back-propagation (BP) algorithm to classify heart valve diseases more accurately. The performance was evaluated in terms of precision, recall and accuracy. The preprocessing techniques applied to the images are the Gaussian filter and the Gabor filter, the proposed method of feature extraction is the combination of intensity histogram features and GLCM features. All the features are input to the B-P ANN which used to identify the various heart valve diseases. The experimental results validate the efficiency of the proposed method that provides good classification efficiency [7].

Hussain K. Khleaf, Kamarul H. Bin Gazali, Ahmed N Abdalla, Mithaq Na'ma Raheema, developed for an ECG feature extraction. In this study, extract the 12-lead ECG from the thermal paper and converting it to digital images. Feature extraction and the digital images were tested on 30 of 12-lead ECG paper records from the MIT-BIH arrhythmia database. The accuracy was between 96.31% and 98.25%. Evaluation of this method for ECG feature extraction was done by comparing the obtained values with manual data and this method offered an accuracy of 98.06% [8].

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Vipulsangram Kadam, Amol A. Shirsath, detects the congenital heart disease with 3D imaging techniques such as MRI image which is then pre-processed, after that some features are extracted with the help of feature extraction tools and finally disease type is identified. Early detection of congenital heart disease will definitely helpful to treatment. With the help of these methods severity can also be define, for immediate medication or surgery. Also it can be used as a great assistance to doctors in understanding accurate and unfailling detecting heart problems at the beginning stages and prevent patients going to proficient cardiologists [10].

K. Rajalakshmi, K. Nirmala, focuses Support Vector Machine (SVM) and Sobel Edge Detection [SED] has been proposed. It takes the number of medical tests such as Heart MRI, ECG, stress Test etc. This proposed technique provides better output for heart disease detection. The pre-processing step improves the image quality of heart disease using MRI image. Increasing of

image quality makes the process easy to find out the affected region. The region of interest techniques sharps the edges in scanned image. Region classification is being applied for isolating the abnormal and normal regions in the heart cells with SVM for identification of various types of abnormalities. The training process classifies the features and recognizes the affected region. The Sobel Edge Detection technique is used to process the MRI images and changed into a binary image. SVM and SED are employed to detect the heart disease and provide a better prediction for separating the abnormal and normal regions in Heart cell. The accuracy of this system is 98.61% and 87% [11].

III. COMPARISON OF METHODS

The following Table 1 shows the PROS and CONS of the image mining techniques.

TABLE 1: ADVANTAGES AND DISADVANTAGES OF IMAGE MINING METHODS

AUTHORS	TECHNIQUES	PROS	CONS
Vijayavanan M, Rathikarani V, Dhanalakshmi P,	Probability Neural Network (PNN)	Effective and reliable classification method for analyzing the ECG signals. Provides a computation less method for evaluating the ECG signals.	Requires more memory space to store the model. PNN are slower than multilayer perceptron (MLP) networks.
Pouya Derakhshan Barjoei, Mojdeh Bahadorzadeh, Elham Foroozandeh	Cuckoo Algorithm	The edges of the angiogram blood vessel so detected. More efficient when compared to the canny edge detection algorithm.	Computational cost is expensive.
Ye Naing Oo, Aung Soe Khaing	Image Segmentation	To solve the problem of corner point producing, curve breaking and combination.	Computational complexity is high.
Chavan Krushna D, Kale Abhijeet A, Kulkarni Swapnil P, Sayyed Ajmeer D,	Decision tree	It gives more Accuracy. As compare to existing system it is faster.	It is over sensitivity to the training set and to noise.

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Sana S. Zadawale, Savita Bakare	Support Vector Machine (SVM)	The optimality problem is convex as compared to NN	Non parametric technique. It runs slowly.
Jasminder Kaur, J.P.S. Raina	Artificial Neural Network (ANN)	Very efficient for large dataset.	High computational cost.
Hussain K. Khleaf, Kamarul H. Bin Gazali, Ahmed N Abdalla, Mithaq Na'ma Raheema	Image Segmentation	To Self-extract information from an ECG image and convert them into real information that can be used for diagnosis of heart disease.	It is not suitable for very noisy images.
Atta Elalfi, Mohamed Eisa, Hosnia Ahmed	Back Propagation Neural Network (BPNN)	Simple and More efficient. Provide high accuracy.	Time to train NN is probably identified as the biggest disadvantage.
Vipulsangram Kadam, Amol A. Shirsath	Multilayer Perceptron Neural Network (MLP)	More stable than back propagation. Execution time is reduced.	Convergence can be slow. Hard to scale.

IV. CONCLUSION

Heart disease Diagnosis is the most complicated task in the field of medical science. The main intent of the image mining is to remove the data loss and obtain the useful information which is expected to the need of human. In this paper most of image mining techniques have been discussed. These all techniques have their own advantages and disadvantages.

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