A Review of Detecting Myocardial Ischemia

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Abstract— A systematic approach has been developed to detect boundaries of coronary artery. The features are further processed. New combinations of algorithms are used. The various techniques are Edge detection techniques, Dynamic programming algorithm, clustering algorithm and Back propagation algorithms are used. These algorithms outputs are helpful for practitioner to detect the boundary and to predict the plaque region of coronary artery. The research results are beneficial and vital to practitioners to detect the elasticity of Intima-Media Thickness.

Keywords— back propagation algorithm , coronary artery, intima media, myocardial ischemia

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1. Introduction

Myocardial ischemia occurs when blood flow to heart muscle is decreased by a partial or complete blockage of heart's arteries (coronary arteries) [1]. The decrease in blood flow reduces heart's oxygen supply [2].Treatment for myocardial ischemia is directed at improving blood flow to the heart muscle and may include medications, a procedure to open blocked arteries or coronary artery [3].Making heart-healthy lifestyle choices is important [4] Myocardial ischemia occurs when the blood flow through one or more of the blood vessels that lead to the heart (coronary arteries) is decreased [5]. This decrease in blood flow leads to a decrease in the amount of oxygen the heart muscle (myocardium) receives [6]. Myocardial ischemia may occur slowly as arteries become blocked over time, or it may occur quickly when an artery becomes blocked suddenly [7]. A computerized analysing system with manual tracking of echo interfaces for measurements of Intima-Media thickness and Lumen diameter in coronary and femoral arteries was previously developed by several research groups and has been used for many years in several laboratories[8]. However, manual measurements are not only time consuming, but the results from these readings are also dependent on training and subjective judgement [9]. A further problem is observed drift in measurements overtime [10]. A critical component in scientific studies of most biological variables is the variation or error in measurements in which leads to non-identical results of repeated measurements from the same subject.

Removing noise from the original image is still a challenging research in image processing. Generally, there is no common enhancement approach for noise reduction. Several approaches have been introduced and each has its own assumptions, advantages and disadvantages.

The steady increase in the number of patients with myocardial infarction or cerebral infarction, both of which are considered to be mainly caused by atherosclerosis, is becoming a serious problem. Therefore it is important to diagnose atherosclerosis in the early stage. Ultrasound diagnostic equipment are used for the diagnosis of atherosclerosis. However they provide information only on the shape of the artery such as the diameter of the lumen. Recent developments in ultrasound technology enable the non-invasive measurement of structural and functional vessel wall changes. Until now, the effect on the arterial wall has remained unclear, reports on Intima-media thickness yield conflicting results, whereas data on vessel wall stiffness are lacking.

Computerized medical image segmentation is a challenging problem, due to poor resolution and weak contrast. Moreover the task is often made more difficult by the presence of noise and artefacts, due to instrumental limitations, reconstruction algorithms and patient movement. There is yet no universal algorithm for medical image segmentation. An algorithm advantages and drawbacks often vary according to the problem under investigation.

In conclusion, these methodologies provides a reliable tool to detect the intima media thickness in ultrasound images and can be used efficiently as secondary observer in clinical decision making.

Objectives of Proposed System

- To detect the damaged heart muscle and to investigate its relationship with inner and outer heart wall.
- The purpose of this study is to investigate the interobserver variability of manual and also of computer software measurement of inner and outer heart wall.
- To develop and implement an intelligent decision system for identifying myocardial ischemia through echocardiography images with plaque area.
- To investigate whether the interobserver error's in measurement of inner and outer heart wall in coronary artery could be decreased.
- To describe a computerized and analyzing system for the measurement of wall thickness of plaque area on the coronary arteries.
- To develop a fully automated segmented system to extract the boundary of the coronary artery from echocardiography images in a real time and to partition it into different anatomical

structure thereby separating the components of interest such as blood vessels, identifying plaque regions from their background.

♣ To find out the plaque thickness using Image processing and classification with Artificial Neural Network provides diagnosis for the patients with plaques.

2. Methodology

In the present study image segmentation technique based on edge-detection algorithm are examined to extract the boundary of coronary artery. The features like area, shape, intensity, size of the internal diameter, wall thickness and length of segmented regions traced by edge detection algorithm were compared with the same parameter traced by the fuzzy logic and wavelet transform. Wall motion analysis is performed to produce displacement graphs to see if the wall segments move synchronously during contraction and relaxation. The features extracted are used as inputs to the Artificial Neural Network for the classification. The algorithm's output will be used to know the status of the coronary artery. This will provide a faster solution and effective way for classification of normal or damaged heart muscle where it can reduce the burden of the conventional way of manual observation through echocardiography images.

In the present study the coronary images of CT scan are given as input and the image had been enhanced by removing blur and noise after enhancement the image had been segmented using edge detection algorithm, the canny edge detector, the best edge detector and segmented using threshold suitable for segmenting the particular myocardial ischemia. For classification, different clustering techniques used are C-means clustering, Subtractive Clustering and fuzzy C-means clustering are used to select the best classifier suitable to detect the stages of myocardial ischemia and the same had been applied in artificial neural networks for pattern recognition to extract the features and the same had been trained and tested with back propagation algorithm to evaluate the best technique to detect the myocardial ischemia stages in order to detect it in earlier stage.
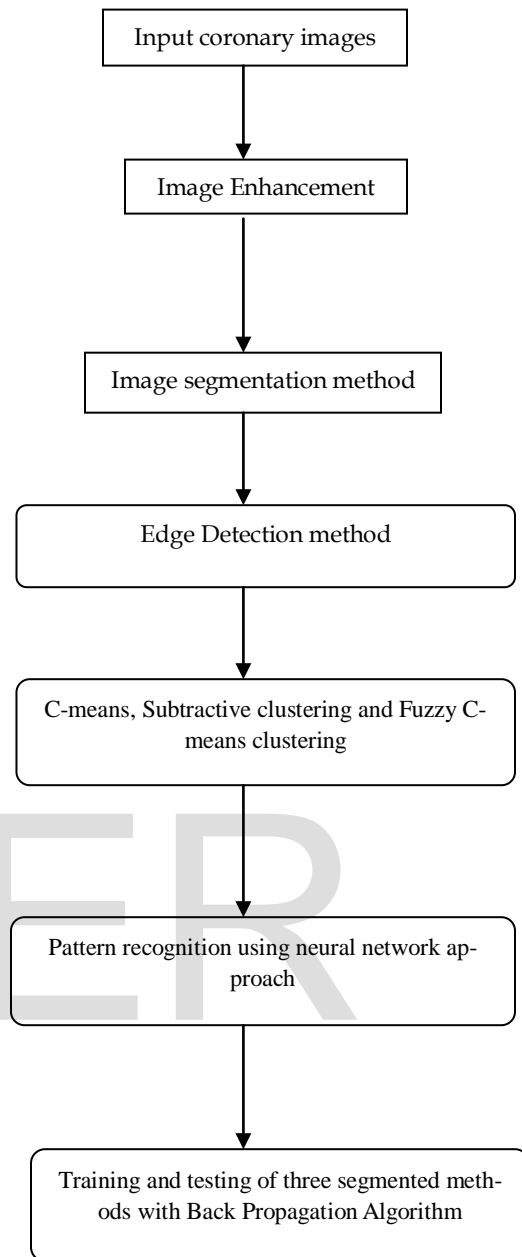

Fig.1. Overview of the proposed system.

3. Conclusion

These methodology provide a reliable tool to detect the myocardial ischemia in ultrasound images and can be used effectively as secondary observer in clinical decision making. The same can be enhanced in future to detect the vascular diseases and its stages.

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