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Notice for the PhD Viva Voce Examination

Ms R Merjulah (Reg. No. 1650070), PhD scholar at CHRIST (Deemed to be University), will defend her PhD thesis at the public viva voce examination on Saturday, 3 October 2020 at 11.00 am on the Webex Meeting platform.

Title of the Thesis	:	**Predictive Analytics for Cardiac Arrhythmia using Machine Intelligence**
Discipline	:	**Computer Science**
External Examiner (Outside Karnataka)	:	**Dr P L Chithra** Associate Professor Department of Computer Science University of Madras Chepauk Campus Chennai - 600005
External Examiner (Within Karnataka)	:	**Dr R Suchithra** Associate Professor and Head - MSc IT Jain (Deemed to be University) #44/4, District Fund Road Behind Big Bazaar Jayanagar 9th Block Bengaluru - 560069
Supervisor	:	**Dr Chandra J** Associate Professor Department of Computer Science CHRIST (Deemed to be University) Bengaluru – 560029

Since it is an open viva, faculty members and research scholars of all branches of research are cordially invited to attend.

Registrar

Place: Bengaluru
Date: 25 September 2020

ABSTRACT

Myocardial Infarction (MI) is the primary cause of death worldwide. MI occurs when a plaque buildup in the inner surface of the coronary artery suddenly ruptures and prevents the blood flow. A heart attack is medically termed as MI. It is the irreversible damage caused by the prolonged ischemia. Ischemia is nothing but the heart organ doesn't get enough blood and oxygen which is also termed as coronary artery disease or coronary heart disease. The heart gets damaged if it has not received enough blood or oxygen. In connection to the damage of the heart, arrhythmia would occur. Arrhythmia is the problem based on the heart rhythm or rate of the heartbeat. Tachycardia, when there is a fast beat in the heart. Bradycardia, when the heart beats too slow. The common type of arrhythmia is atrial fibrillation. The great concern is that the patient who has arrhythmia has to be treated immediately. They lose consciousness in a few minutes when the heart is not pumping enough blood mainly to the brain. Death occurs when the patient is not given emergency treatment. Treatment which is included in the emergency is defibrillation and Cardiopulmonary Resuscitation (CPR). CPR is an emergency procedure which is combined with the chest compressions. It is through artificial ventilation which gives manual effort, preserves the brain functions until further treatment for the restoration of spontaneous blood circulation. The common symptoms of sudden cardiac death are chest pain, shortness of breath, severe wheezing, irregular heartbeats, fainting etc. Heart Scar tissue which is not like heart muscle. It doesn't contrast like the normal heart muscle. Heart muscles get damaged for the heart attack patient based on the time of the treatment. The damage of the heart is based on the blockage of the artery. Arrhythmia can be predicted based on the volume of the scar region in the heart. Arrhythmia patients are treated by fixing Implantable Cardioverter Defibrillator (ICD). In general, the echocardiogram is the clinically used tool to identify arrhythmia patient. To identify the arrhythmia patient an early prediction is required to avoid the sudden cardiac death.

Echocardiogram can't identify the heart damage. The medical imaging technique is used to identify the scar that resists in the heart attack the patient heart. Magnetic Resonance Imaging (MRI) is one of the effective medical imaging techniques used to visually represent the inner part of the body. The medical image processing technique is used to analyze the imaging technique which includes preprocessing, segmentation, classification and prediction to automatically identify the contour. Removal of noise, image resizing, transforming the gray scale or colored images etc., are processed in the preprocessing and segmentation stage. The image segmentation technology is widely used in the medical image processing for the partitioning of the image into various parts which identify the contour. The medical image classification is used to diagnose the patient based on various divisions of classes.

To identify the high risk arrhythmia patient an early predictor tool is required to avoid the sudden death. Clinical measurement fails to exactly identify the scar region for finding the high risk arrhythmia patient. An Intelligent Analytical Arrhythmia Predictor (IAAP) model is developed which identifies the high risk arrhythmia patient based on the scar volume in the heart attack patient. IAAP model includes 5 stages. The first stage is the preprocessing and segmentation technique which is used to identify the scar region in the heart based on median filtering, fuzzy c-means and morphological filtering technique. The second stage is the feature selection and feature extraction technique which is used to identify the scar region and to extract the scar region based on gray thresholding and region growing. The third stage is the classification model building stage which is used to classify the scar region based on 4 classes. 1% to 25% scar region comes under the category of class 1. 26% to 50% scar region comes under the category of class 2. 51% to 75% scar region is under class 3 which is based on the decision tree technique. The scar region which is > 75% is under class 4. Class 1 and class 2 doesn't require ICD. The final stage is the testing model which is used to evaluate the classification model using Levenberg Marquardt Neural Network (LVNN).

The proposed IAAP model yields good results based on the evaluation of the Mean Squared Error (MSE), Structural Similarity Index (SSI), matrix evaluation and statistical measures. Based on the result it is revealed that the proposed IAAP model is one of the best models for an early prediction of arrhythmia using heart attack patient MRI.

Keywords: Myocardial Infarction, Preprocessing, Segmentation, Feature Selection, Feature Extraction, Classification, Prediction, Medical Image Processing, Magnetic Resonance Imaging (MRI), Median Filtering, Fuzzy C-Means (FCM), Morphological Filtering, Gray Thresholding, Region Growing, Decision Tree.