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Detection of coronary block in angiogram images using Neural Networks

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Abstract: One of the major health issues nowadays is heart attack (CAD) which is caused due to several reasons, cardiac block is one of the kind. Detecting the presence of cardiac block at early stage plays a vital role. Various methods are used for detecting such block. Angiography is widely used and the image obtained during the angiographic procedure is called as angiogram. Our project mainly concentrates in the area of detecting the blocks using CNN algorithm in the X ray angiograms.

Keywords: Angiogram, CNN, Cardiac block, Fuzzy logic

I. INTRODUCTION

Coronary artery disease (CAD) is the most common type of heart disease. It is the leading cause of death in the United States in both men and women. CAD happens when the arteries that supply blood to heart muscle become hardened and narrowed. This is due to the buildup of cholesterol and other material, called plaque, on their inner walls. This buildup is called atherosclerosis. As it grows, less blood can flow through the arteries. As a result, the heart muscle can't get the blood or oxygen it needs. This can lead to chest pain (angina) or a heart attack. Most heart attacks happen when a blood clot suddenly cuts off the hearts' blood supply, causing permanent heart damage. Over time, CAD can also weaken the heart muscle and contribute to heart failure and arrhythmias. Heart failure means the heart can't pump blood well to the rest of the body. Arrhythmias are changes in the normal beating rhythm of the heart.

A coronary angiogram is a procedure that uses X-ray imaging to see your heart's blood vessels. The test is generally done to see if there's a restriction in blood flow going to the heart.

During a coronary angiogram, a type of dye that's visible by an X-ray machine is injected into the blood vessels of your heart. The X-ray machine rapidly takes a series of images (angiograms), offering a look at your blood vessels. If necessary, your doctor can open clogged heart arteries (angioplasty) during your coronary angiogram.

The angiographic images are found to be noisy. The noise present in the image must be removed so that we are using the image processing techniques. The step by step process techniques are image pre- processing, image segmentation, image enhancement and image classification using CNN

Image pre-processing takes care of the noise removal part which includes the filters to remove the noise present. In image segmentation we use fuzzy logic and we are using the canny edge detector finally the classification algorithm is implemented and results are obtained.

II. LITERATURE SURVEY

This paper [1] discusses the use of combined uncertainty methods in the diagnosis of coronary artery disease using ECG stress signals. Combined uncertainty computes a composite of two types of uncertainties, fuzzy and probabilistic. First, we introduce basic definitions for fuzzy and probabilistic uncertainty types. Next, the ECG analysis problem is discussed in the context of classifying ECG signals using traditional methods. Three examples of models that compute fuzzy, probabilistic, and combined uncertainty models are introduced in the next section. Our experimental results show that models developed by combined uncertainty produce better results, in terms of ECG signals correct classification percentage, compared to those computed using only fuzzy or probabilistic uncertainty

This paper [2] is evident that usage of data mining methods in disease diagnosis has been increasing gradually. In this paper, diagnosis of Coronary Artery Disease, which is one of the most well-known diseases that cause heart failure, was conducted with such a data mining system. Many researchers have attempted to develop a medical expert system to increase the ability of physicians in detecting this disease. This paper proposes a new ensemble PSO-based approach to extract a set of rules for diagnosis of coronary artery disease. The new presented boosting mechanism considers the cooperation between generated fuzzy if-then rules using the PSO meta-heuristic. We have evaluated our new classification approach using the well-known Cleveland data set. Results indicate that the proposed learning method can

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detect the coronary artery disease with an acceptable accuracy. In addition, the extracted fuzzy rules have significant interpretability either.

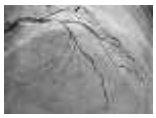
III. PROPOSED WORK

Our work consists of the following stages such as image pre-processing, image segmentation and image classification.

The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. For that we are using the median filter. The median filter is a non-linear digital filtering technique, often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise also having applications in signal processing.

The next stage is the image segmentation which includes the fuzzy logic and canny edge detection. Fuzzy clustering (also referred to as soft clustering or soft k-means) is a form of clustering in which each data point can belong to more than one cluster. Clustering or cluster analysis involves assigning data points to clusters such that items in the same cluster are as similar as possible, while items belonging to different clusters are as dissimilar as possible. Clusters are identified via similarity measures. These similarity measures include distance, connectivity, and intensity. Different similarity measures may be chosen based on the data or the application. Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirements for the application of edge detection on diverse vision systems are relatively similar. Thus, an edge detection solution to address these requirements can be implemented in a wide range of situations.

The final stage is classification using CNN algorithm. The convolutional neural network (CNN) is a class of deep learning neural networks. CNNs represent a huge breakthrough in image recognition. They're most commonly used to analyze visual imagery and are frequently working behind the scenes in image classification. They can be found at the core of everything from Facebook's photo tagging to self-driving cars. They're working hard behind the scenes in everything from healthcare to security.



IV. RESULTS

The experiment is carried out in the MATLAB platform. The accuracy obtained is found to be 81%.The sensitivity and specificity values are also found.

Figure 2: Overall output

V. CONCLUSION

We proposed a system which uses a CNN algorithm. The accuracy obtained is 81%, future work may progress such that accuracy can be improved.

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