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Construction of predictive modelling for cardiac patient using probabilistic neural network

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ABSTRACT

Coronary Artery Disease (CAD) is a major disorder in heart rhythm invoices the reduction or blockage of blood flow due to the narrow artery which results in coronary artery disease Our project is to investigate and detect the occurrence of coronary artery disease (cardiac block) using a probabilistic neural network. We would apply the probabilistic neural network to CT Images and, Feature extraction by using the Gray Level Co-Occurrence Matrix (GLCM). Image recognition and image compression are done by using the Gaussian bilateral filter method and also large dimensionality of the data is reduced. Automatic cardiac block classification is done by using a Probabilistic Neural Network (PNN). The segmentation process is done by using the K-means clustering algorithm and also detects the cardiac block spread region. PNN is the fastest technique and also provide good classification accuracy.

Keywords— *Cardiac detection, PNN, GLCM, Feature extraction, K-means cluster, Machine learning*

1. INTRODUCTION

A heart is a strong muscular pump that is responsible for moving about 3000 gallons of blood through your body every day like other muscles your heart requires a continuous supply of blood to work properly, heart muscle gets the blood from coronary arteries. coronary artery disease occurs when the coronary arteries which deliver oxygen to the heart muscle become narrowed or blocked because of the build up of fat / cholestrol within artery wall[8] The Global Buruden of disease study estimate of age standardized CAD death rate of 272 per 100000 population in India. Automatic Block detection intends to infer data from various test result from CT Scan images using probabilistic neural network and provide the result as the block is detected or not.[9]

2. LITERATURE SURVEY

There are many methods has been used for the prediction system using different machine learning and neural network Algorithm.

Kipp W. Jonnson proposed "Artifical Intelligence in Cardilogy". This method explains about predictive modelling concepts in cardiology used in both supervised and unsupervised learning.[6]

Aleocandar Selvikvag Lunder Vovel proposed "An Overview of deep learning in medical Imaging foccusing on MRI" explains about the convolution neural network algorithm focused on medical Imaging for prediction and detection.[7]

Meherwar Pathima proposed "Survey of Machine Learning Algorithms for Disease Diagnostic" explains about various machine learning algorithm for detection of different diseases such as heart disease/diabetes/liver disease etc and tools used for analysis of diseases.[1]

Sukrit Narula proposed "Machine Learning Algorithms to Automate Morphological and Funcional Assessments in 20 Echocardiagraphy", it provides a smart system for cardiac diagnosis using machine learning algorithms.[1]

Shadman Nashif proposed "Heart disease detection by using SVM algorithm" and explains about the SVM technique it can transform the training data into the high dimension.

Chavan Krushna proposed "Hidden Pattern analysis for heart disease classification" such as Naive Bayes, Decision tree and neural network.

AKhil Jabbar. M proposed "Classification of Heart disease using Artificial Neural Network and Feature Subset Selection" and the algorithm used here is Artificial Neural Network and also explains about feature selection for classification of heart disease.[2]

Lewanya devi. R proposed "Brain Tumour Classification and segmentation in MRI Images using PNN" it explains about PNN classification and segmentation.[5]

3. PROPOSED METHOD

The proposed method of Coronary artery disease classification and segmentation is shown

Proposed method takes CT Images as input Image and consists of four steps in the approach.

- The first step is the Image preprocessed and it consists of Gaussian Blurring/Bilateral filter/RGB to Gray.
- The Second step explains about Gray Level Co–Occurence Matrix feature extraction.
- The third step explains about PNN classification.
- The fourth step explains about segmentation using a K-means clustering algorithm.

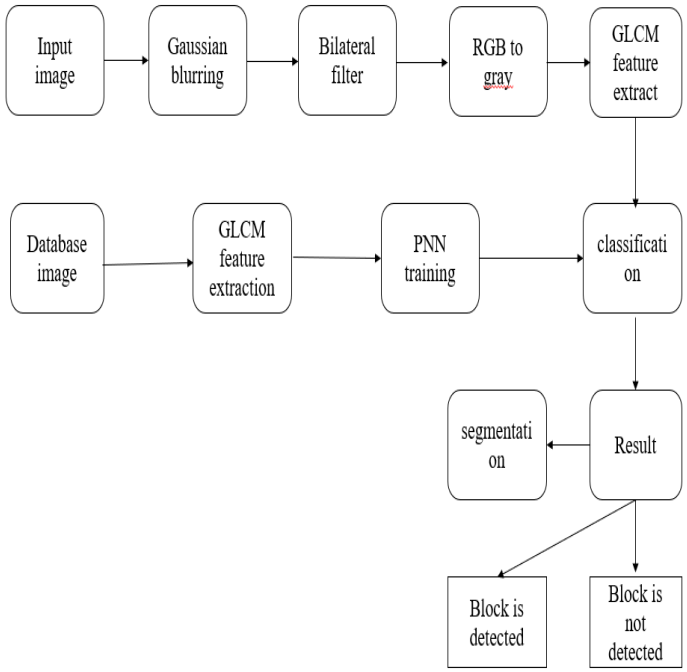

Fig. 1: Proposed system block diagram

3.1 Image Acquisition

All CT Images are composed of Internet, Hospital, Radiologist CT Image Scans are saved in the database in JPEG Image format and represented in gray scale Image.

3.2 Image Pre-Processing Stage

Pre – Processing consists of three stage as follows. Gaussian Blurring, Bilateral filter and RGB to Gray.

3.3 Gaussian Blurring

In Gaussian Blur operation the Image is convolved with Gaussion filter instead of the box filter. It is a low Pass filter that removes the high frequency components are reduced. Blurring is the commonly used Image processing for reducing the Image noise. The process removes high frequency content like edges from the Image and makes it smoth.

3.4 Bilateral filter

Bilateral filter is a simple, non-iterative scheme for edge-preserving smoothing has been filtered away and over all shading and edges are preserved.

3.5 RGB to Gray

When converting an RGB image to gray scale, we have to take the RKB values for each pixel and makes as output a single value reflecting the brightness of that pixel. One such approach is to take the average of the contribution from each channel such as R+G+B/3. In gary scale images, we do not differentiate how much we emit the same amount in each channel. We can differentiate is the total amout of emitted light of each pixel. Little light gives dark pixel and much light is proeceived as bright pixels.

3.6 GLCM Feature extract

GLCM is a statistical method of examining texture that considers the spatial relationship of pixels. They are also known as gray level spatial dependence matrix. Its function is to characterize the texture of an Image by calculating how often pairs of the pixel with specified values and in specified spatial relationship Occur in Image, Creating GLCM and then extracting Statistical measures from the matrix. The Statistical measures and Contrast, Correlation, Energy, Homogeneity.

3.7 PNN Classification

Probabilistic Neural Network is a feedforward Neural technique used for pattern recognition and classification problems. In this step examine the CT image is analyzed with the training CT image and provides a result as test image which is related to training CT images. It consists of four layers such as Input Layer, a Pattern layer, Submission layer and an Output layer.

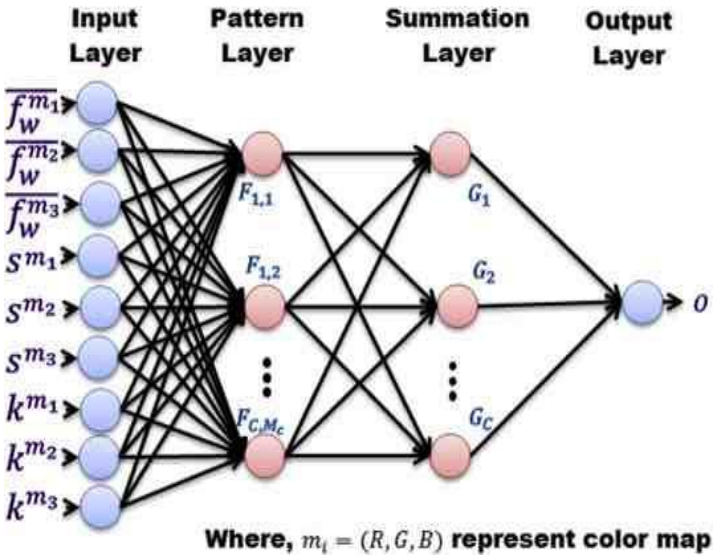

Fig. 2: PNN Classification

- **Input Layer:** The input CT image is given in the input layer. The nodes of the input layer connected to the noded of the output layer.
- **Pattern Layer:** The number of pattern nodes is determined by the number of samples in the training set. Each pattern node computes the distance measure between the input and training sample represented by the node.
- **Summation Layer:** Summation Layer has a node for each class and the sum of all the pattern layers output.
- **Output Layer:** Output Layer determines the final result of the input image by comparing all the probability density functions from the summation layer and choosing the highest value of probability density function.

3.8 Segmentation using K-means clustering

Segmentation is done by dividing an image into different groups. There are various methods and one of the most popular methods is K-means clustering. In this method, a cluster is a set of a similar object into one group and set of dissimilar object into another group and compare each other to measure based on the attribute values to describe the objects and also the distance between then is measured.

4. EXPERIMENTAL RESULTS

The proposed method used to classify the images based on the procedure as mentioned above. This method provides excellence performance.

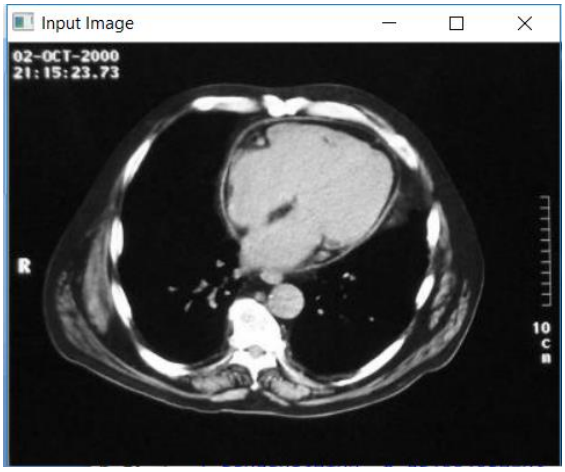

Fig. 1: Input of the cardiac CT image

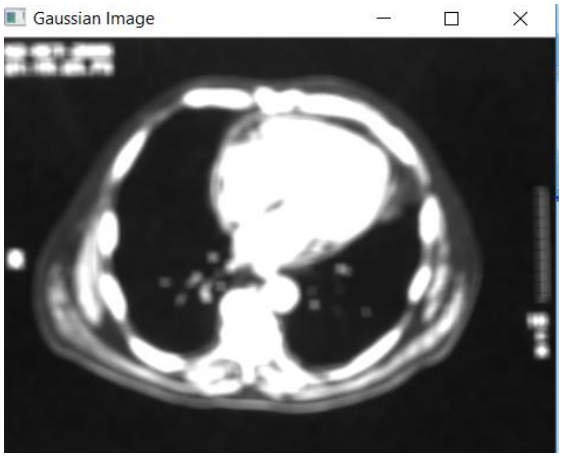

Fig. 2: Provides the Gaussian image

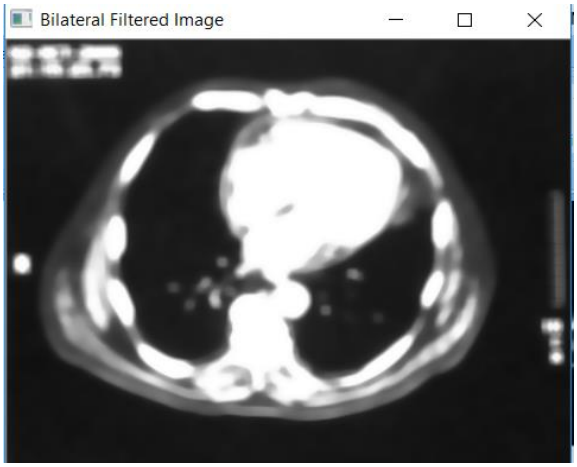

Fig. 3: Provides the bilateral filter to CT image

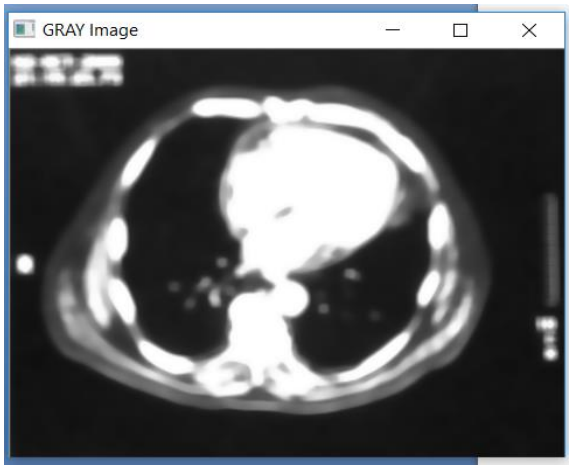

Fig. 4: Converts color image to gray

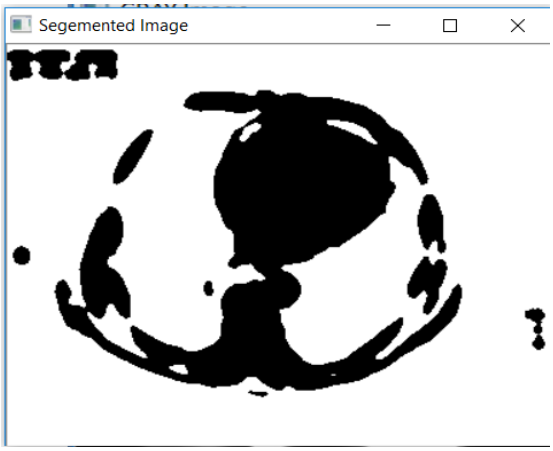

Fig. 5: Provides the segmented image

Fig. 6: Extracted region

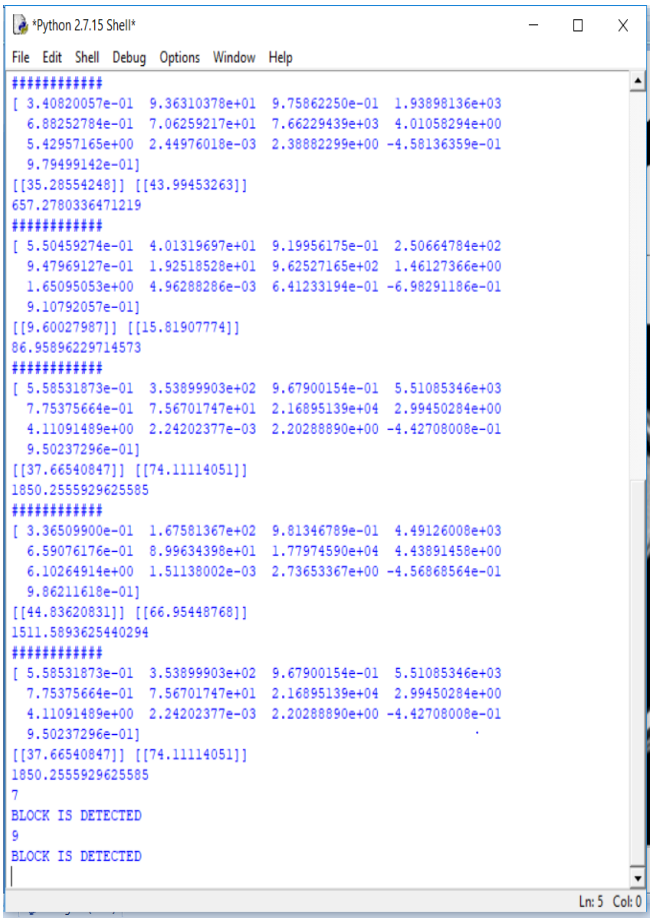

Fig. 7: provides PNN classification result

5. CONCLUSIONS

The detection of the cardiac block has been proposed. Various efficient methodologies have been used to accurately classify the cardiac block. The bilateral filter and the grey level co-occurrence matrix has been combined and used to detect the area of cardiac block present.. From the evaluation results, the proposed method has high accuracy in classification and also provides a result with less time consuming and accurate results without false positive and false negative classification.

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