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Four Chamber Echocardiograms Using Deep Learning

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***Abstract* —** The most used modality for evaluating heart functioning is echocardiography. Yet the quality of the pictures affects how accurate the echocardiographic readings are. Today, evaluating picture quality involves a subjective procedure in which an expert in echocardiography examines the images visually. Therefore, the need for an automated image quality assessment system. Here, we have discussed the viability of creating such automatic quality grading systems utilizing deep learning. Certain quality features for on-axis, contrast/gain, and left ventricular (LV) foreshortening of the apical image were included in a proposed rating system. To create and test our models, we prepared datasets from echocardiographic patients. CNN Methods have been created for the suggested system.

Key words: CNN, Image Processing, Kaggle

I. INTRODUCTION

The importance of early cardiac problem detection is increased by the fact that heart failure is one of the leading causes of death in the globe. The most frequent diagnostic procedure utilized in the treatment and monitoring of patients with known or suspected heart conditions is echocardiography. It can give the clinician valuable information about the heart's size and structure, pumping ability, and degree of tissue damage. Many people have passed away from heart illness in recent years. It is a significant killer. The blood channels that provide blood to the heart itself, the coronary arteries, are the most frequent site of heart disease-related narrowing or blockage. Early heart disease symptoms will assist you in making the optimal treatment decision based on your doctor's advice. These echoes are converted into a moving image of your heart in an echocardiogram. A typical test that measures the size and shape of the heart using sound waves is the echocardiogram.

This system's emphasis has been on echocardiography, where a speedy diagnosis of a heart abnormality in the four chambers is the goal. It emphasises echocardiography. The word "echocardiography" refers to the use of pictures to study a patient's heart's interior architecture. These visuals are produced by the ultrasonic waves. Echo is used to find the anomalies in these photos.

Deep neural networks and a large number of parameters are very effective in machine learning systems. Overfitting is a severe issue for neural networks. Large neural nets are slow in test time prediction due to an overfitting issue. The development of a dropout technique is the answer to this issue. The fundamental concept of this technique is to randomly delete units in neural networks during training.

Throughout the previous ten years, a lot of study has been done on effective echocardiogram image analysis. Making the best decisions on medical treatment requires accurate knowledge about cardiac problems, which echocardiography helps to give. Clinically significant information can be found in the echocardiogram images, such as the heart's anatomy (size and shape), location, ability to pump blood, and degree of tissue damage.

II. LITERATURE SURVEY

The proposed approach in Amir H. Abdi, Christina Luong has the potential to facilitate the widespread use of echo at the point-of-care and enable early and timely diagnosis and treatment. Finally, the approach did not use any specific

assumptions about the A4C echo, so it could be generalizable to other standard echo views[1].

R.Kumar,F. Wang, D. Beymer, and T. Syeda- Mahmood proposed a system which exploits motion in echocardiogram videos as well as cues from both cardiac structures for automatic view classification. They represented set of novel feature. Every image is classified in independently in testing time. This system gives good result[2].

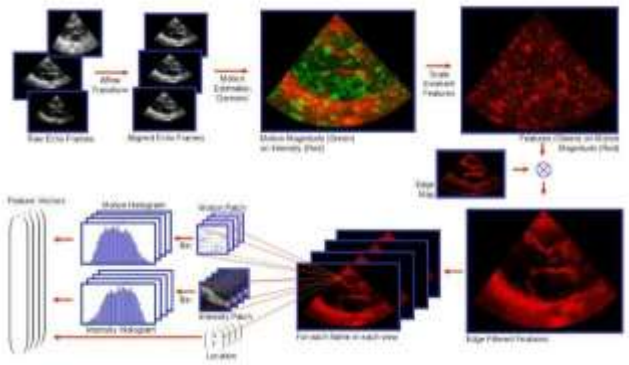


Fig 1.The proposed feature location and description algorithm.

L. Løvstakken, F. Ordernd, and H. Torp stated that the various reasons for loss of quality of echocardiogram image also contain some distractions. so the result affect in further diagnosis of patients. Because of this quality of image is degrading. To overcome this problem developed method, Real time feedback of acoustic contact along phased array transducer is helpful to obtain good image quality. K-space formulation is used for ultrasound imaging system. The proposed method cause problem is reverberations from obstructing structure close to transducer[3] .

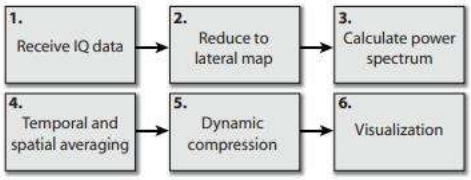


fig 2.Transducer structure.

S. R. Snare, H. Torp, F. Orderud, and B. O. Haugen, states that the regional model goodness-of-fit is used to calculate a score, which is provided to the user during acquisition, together with an icon (emoticon) indicating whether the current view is acceptable or not. The SA was implemented on a commercially available scanner. A feasibility test was performed using two healthy volunteers as models and 10 medical students acting as nonexpert users. The students examined the models on two occasions, separated more than four days in time. Half of the students used the SA during the first exam and no SA at the second exam. The other half used the opposite order. The recordings were later rated by a cardiologist. A Wilcoxon signed pair rank test revealed a statistically significant improvement when using SA. Nine cases were rated as poor without using the SA. In eight (89\%) of these cases, view quality improved to acceptable when the SA was used[4].

P. Coup e, P. Hellier, C. Kervrann, and C. Barillot the author described nonlocal (NL)-means useful for speckle reduction in ultrasound (US) images. Bayesian framework is proposed. As compared to other state of art method has given better performance. It has obtained accurate information of edge and structure details of image and preserves its image data. This method is needed for image registration or image segmentation for Optimized Bayesian Nonlocal Means (OBNLM) filter [5].

N.Srivastava, G.Hinton,A Krizhevsky,I.SSutskever,and R.salakhutdinov The proposed system very simple approximate averaging method works well in practice. The idea is to use a single neural net at test time without dropout. The weights of this network are scaled-down versions of the trained weights. If a unit is retained with probability p during training, the outgoing weights of that unit are multiplied by p at test time[6].

They proposed a fully automatic system for cardiac view classification of echocardiogram . The echo study has given different pre-defined standard views. Development of this system used machine learning technique. They extract knowledge from annotated database. They classify four standard cardiac views. This method is helpful to achieve accuracy of train and test dataset[7].

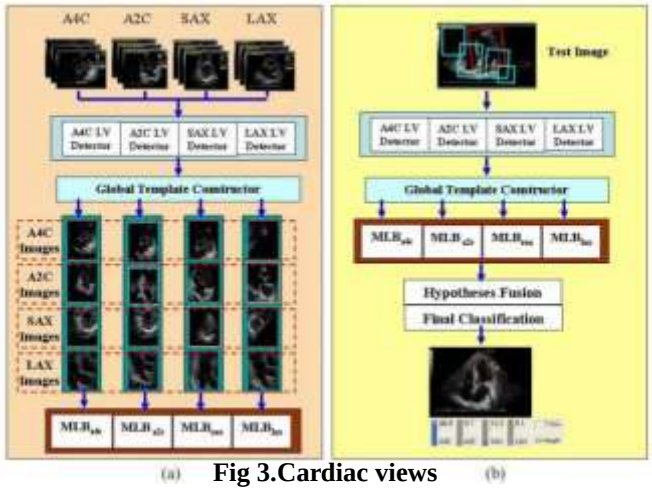


Fig 3.Cardiac views

Q.Ciampi and B.villari In machine Learning System deep neural nets and large number of parameter are very powerful. Neural network is facing serious problem with over fitting. In prediction of test time large neural nets are slow due to over fitting problem. The solution of this problem is to develop a technique of Dropout. In Neural network during training randomly drop unit is basic idea of this technique[8] .

In proposed technique update normal values for cardiac chambers .It may assume that lot of parameter in convolutional layer is missing. Over fitting is not a problem and therefore dropout would not have much effect.

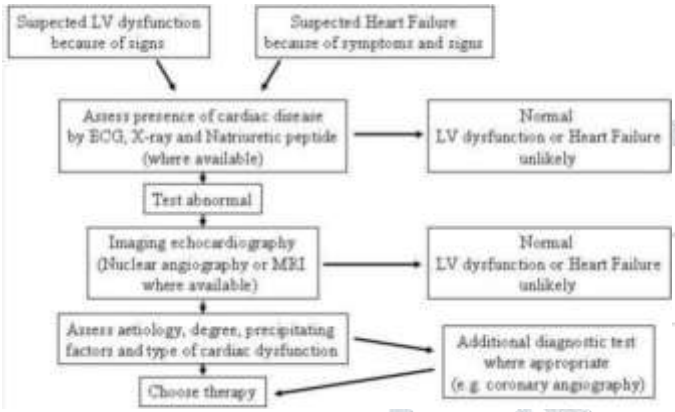


Fig 4 flow structure

III. PROPOSED SYSTEM

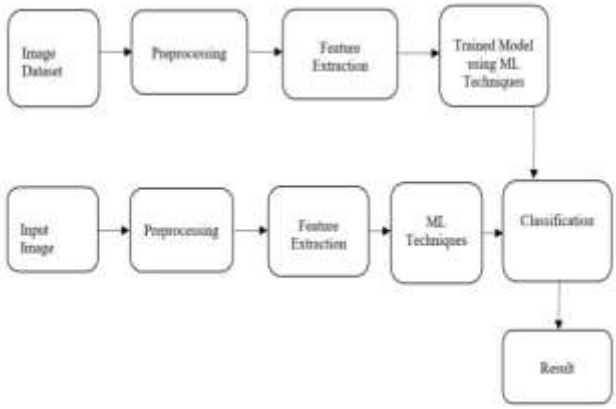


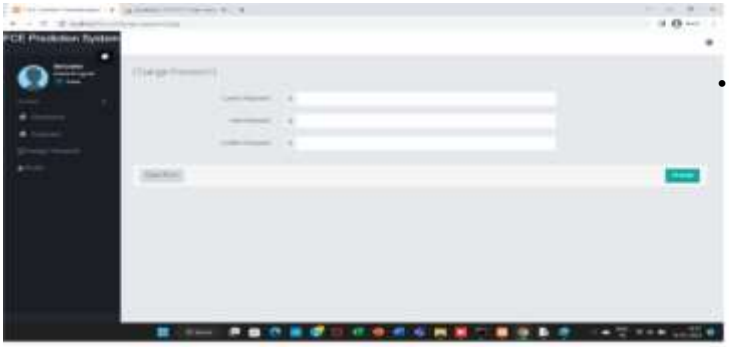
Fig 5 System Architecture

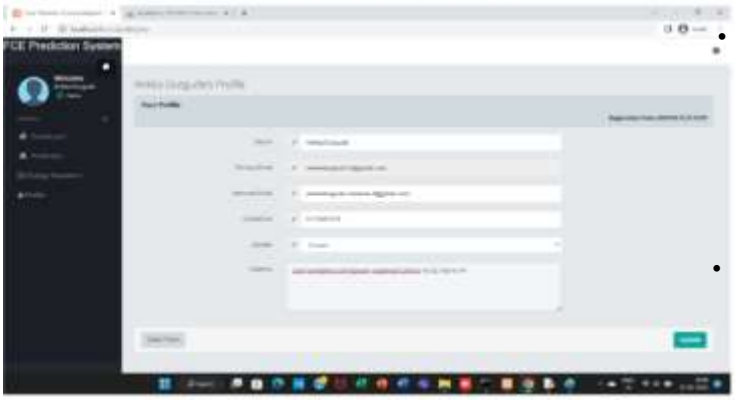
A dataset is being assembled, and it is being run through an algorithm (CNN: - Convolutional Neural Networks) Make a trained file to compare to other people's data. Convolutional Neural Networks are a well-known deep learning method for modern visual identification tasks. There are four layered ideas in convolutional neural networks:

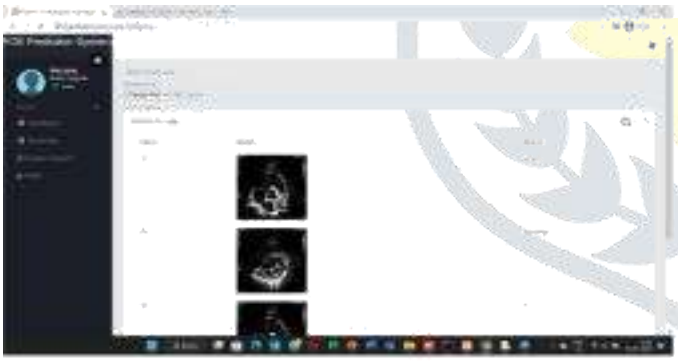
- Convolution,
- ReLu,
- Pooling and
- Full Connectedness (Fully Connected Layer).

Convolutional neural network techniques were used to train and test the gathered dataset. Just 20% of the data is used for testing; the great rest is used for training. The two main parts of a convolutional neural network are feature extraction and classification. When the picture input is given, the features of the input image are obtained and converted into pixel values. The Convolutional Neural Network goes through a number of phases, including ReLU and pooling, before reaching the final level. Kaggle was used to obtain the image data. Two pieces of the acquired data are separated. 80 percent of the cash, then, is set up for training, and 20 percent for testing. There are several methods employed, including feature extraction and preprocessing. CNN was used to categorise the data. Python was used for the backend while PHP and bootstrap were used for the frontend. The sent user-captured image is processed, and the image's features are extracted. The training model will be compared to the extracted features, and the predicted result will be chosen based on which comparison shows the closest agreement. After gathering the databases, we undertake binary classification to determine whether an image is of good or poor quality. 70 percent of the database was used for training and 30 percent for testing. It is then subjected to further processing using CNN techniques. In essence, CNN techniques consist of several layers of neural networks: - Pre-processing, during which all noise and pictures are removed; followed by Convolutional filters, a pooling layer, and a fully connected layer. The trained model, which is built using CNN techniques and saved, is utilised in the testing step to compare the outcomes of the features discovered following the input image. The system forecasts the outcome of the proposed system based on the matching features.

IV. RESULT







V. CONCLUSION

We outline the clinical importance and viability of creating an automated system for evaluating the quality of echocardiographic images in order to aid in automated echocardiology diagnosis and quantification. A system that may shorten the learning curve for individuals studying echocardiography and an automated quality control procedure that is necessary for both clinical and research purposes would be significant if it included an automated image quality assessment technique. Less experienced operators would receive real-time advice in doing this, increasing their odds of getting the best possible images and improving the accuracy of diagnosing heart functions.

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