e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 5, May 2024

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705127 |

Exploring Automatic Cardiovascular Disease Assessment with Convolutional Neural Networks

Shirsath Nikita Rajendra[1], Shaikh Mohammad Arsh Navid[2], Musale Harshada Sajerao[3], Prof. G.T. Avhad[4]

Students, Department of Computer Engineering, Vishwabharti Academy's College of Engineering, Ahmednagar, Maharashtra, India[1,2,3]

Assistant Professor, Department of Computer Engineering, Vishwabharti Academy's College of Engineering, Ahmednagar, Maharashtra, India[4]

ABSTRACT: This paper has focused on echocardiography where the decision is to detect the defect in the four chambers of heart quick. This work proposes to study Convolutional Neural Networks in medical science. It focuses on echocardiography. The term echocardiography means that the internal structure of a patient's heart is studied through the images. The ultrasound waves create these images. The abnormalities in these images are found through echo. This work proposes to study Convolutional Neural Networks in medical science. It focuses on echocardiography. 2D echocardiogram is the test in which pictures of heart and various parts of heart are taken with the help of probe. The motive of this work is to decrease the overhead of the cardiologist.

KEYWORDS: Convolutional neural network, Deep learning, Quality assessment, Echocardiography, Apical four-chamber, Machine Learning, Artificial Intelligence and Image Processing, etc.Introduction

This work proposes to study Convolutional Neural Networks in medical science. It focuses on echocardiography. 2D echocardiogram is the test in which pictures of heart and various parts of heart are taken with the help of probe. The motive of this work is to decrease the overhead of the cardiologist. This approach will result in pointing the abnormality in the heart. Since, cardiologist and less experienced surgeons may take a while to figure out the defect or may miss the defect in the heart, this is a powerful approach which can detect even a little defect in heart which human eye tends to ignore. Paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the step of the algorithm. After detection of text, how text region is filled using an Inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

I. INTRODUCTION

Heart failure is one of the primary causes of death worldwide, giving more value to the early detection of cardiac problems. Echocardiography is the most common diagnostic test used in management and follow-up of patients with suspected or known heart problems. It can provide the doctor with helpful information, including the size and shape of the heart, pumping capacity, and extent of tissue damages.1, 2 Echocardiograms are obtained from various planes or acoustic windows, called echo views, which visualize different heart structures. The standard echo views are categorized into four groups, parasternal, apical, suprasternal notch, and subcostal.3 To acquire a good quality echo of a certain view, the transducer should be positioned so that its beam sections through certain cardiac structures. Echo acquisition is relatively a manual procedure and it is the sonographer's job to find the correct acoustic window. An echo with suboptimal quality may affect the accuracy of measurements and even result in the misdiagnosis and misclassification of the patient in terms of the final treatment. There has been some efforts in helping the sonographer during image acquisition. Some studies have tried to alert the operator on presence of shadows and aperture obstructions in the echo window via analyzing the power spectrum of the signal. However, these methods are blind to the anatomical structures on the echo image and cannot go beyond obstruction detection to determine the quality of a given echo. Other methods aimed for the expected anatomical structures and evaluated the quality based on the goodnessof-fit of a predetermined template on the image.6, 7 Due to the intrinsic nature of the echocardiography imaging, records from different patients may not follow a defined template. However, the mentioned methods rely solely on the low-level intensitybased features. Meaning, they do not capture the large range of variations present inside

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705127 |

each echo view. Moreover, they are sensitive to the speckle noise, which is naturally present on echo images. Consequently, these template matching methods do not perform well in this domain. In this research, a deep generative model is proposed to learn the appropriate features from a fairly large dataset of echo images. The trained model will then automatically evaluate the quality of a given echo frame, in real time. The experiments in this study only focus on the apical four-chamber view; but our approach is general and can be extended towards other views.

II. PROBLEM STATEMENT

In this proposed system, a deep generative model is proposed to learn the appropriate features from a fairly large dataset of echo images. The trained model will then automatically evaluate the quality of a given echo frame, in real time. The experiments in this study only focus on the apical four-chamber view; but our approach is general and can be extended towards other views. To implement Computational Neural Network for analyzing the abnormality in a heart showed in echocardiogram in Apical Four Chambers (A4C) Cardiovascular Disease Analysis.

The algorithm automatically generates mask image without user interaction that contains only text regions to be inpainted.

III. EXPERIMENTAL RESULTS

The quality of echo data depends highly on the scanning technique and configurations. Because most of echo artifacts occur as a result of improper configurations and acquisition, echo images of a specific cardiac tissue acquired by different operators/vendors or under different configurations can have different visual appearances. These variations can confuse cardiologists and make the image interpretation task challenging. In our previous work [23], we investigated the feasibility of using convolutional neural networks to assess the quality of echo data. Here, we expand on that work and propose a framework for optimizing the deep learning architecture to generate an automatic echo score (AES) in real time. Our framework incorporates a regression model, based on hierarchical features extracted automatically from echo images, which relates images to a quality score determined by an expert cardiologist. We demonstrate the feasibility of our approach on the A4C echo view. In this study, data acquired from 6,916 patient studies were used to design, optimize, train and test the model. Using GPU-computing, the ultimate trained network is able to assess the quality of an echo image in real time. Since the design of the proposed DCNN architecture does not include any a priori assumptions on the A4C view, this approach could be extensible to other standard echo views.

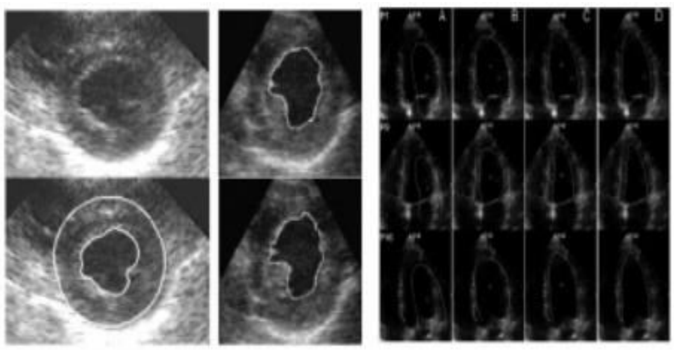

Fig. 1: Examples of echocardiographic image segmentation.

Short axis images from (a) and from (b) (c) Long axis images

A. SYSTEM ARCHITECTURE

The dataset was examined by an expert cardiologist and an integer quality score of 0 (not acceptable) to 5 (excellent) was assigned to each image based on the following:

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705127 |

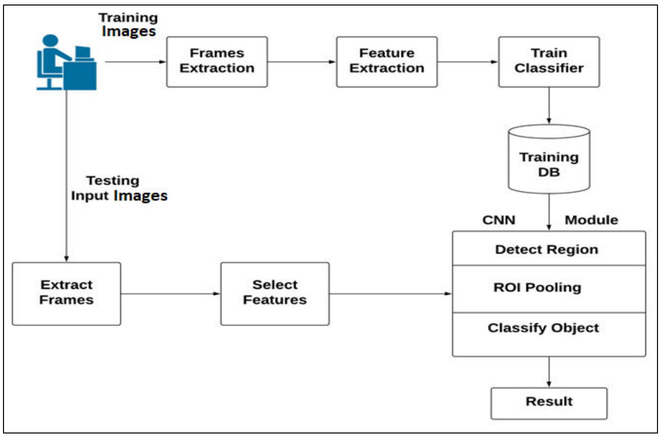

Fig.2: System Architecture

IV. OUTCOME

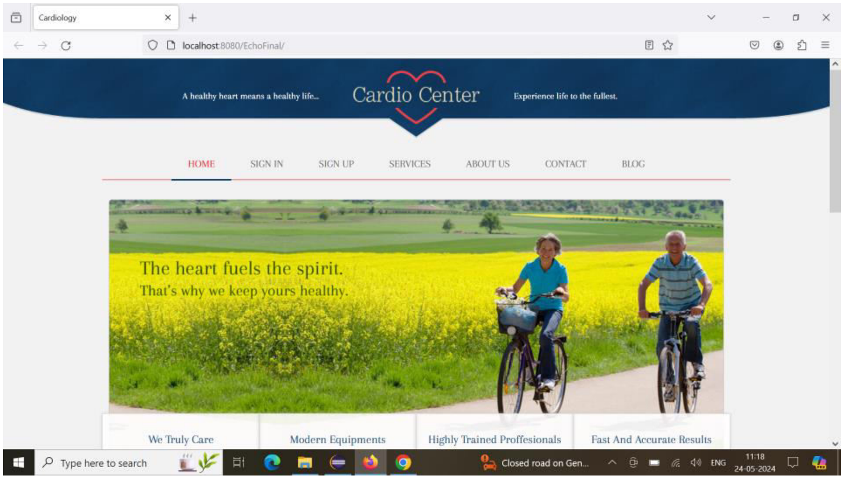

Fig.3:HOME PAGE

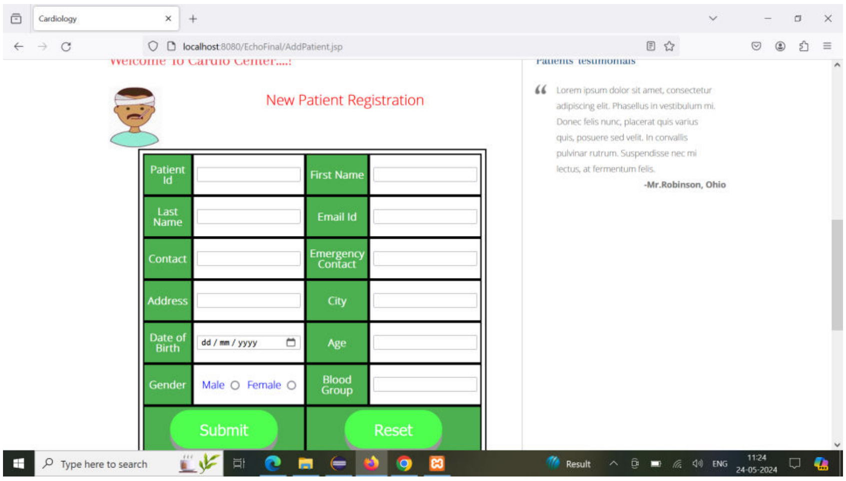

Fig.4:PATIENT REGISTRATION

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 5, May 2024 |

| DOI:10.15680/IJMRSET.2024.0705127 |

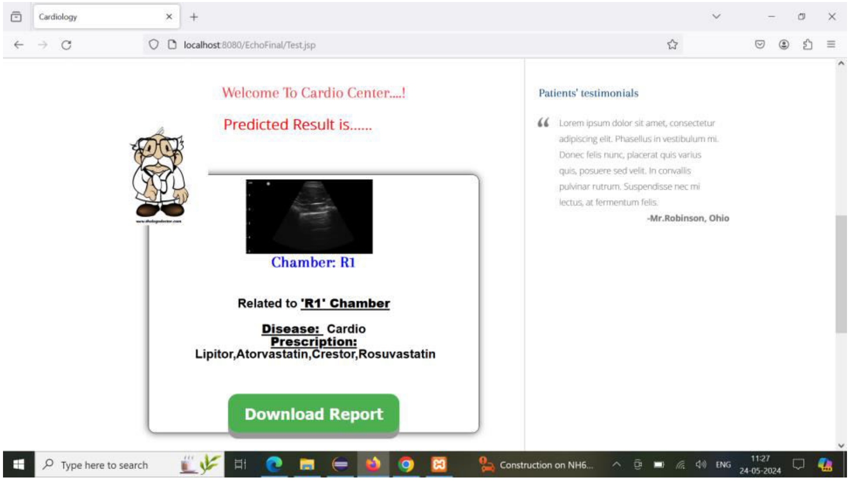

Fig.5: PREDICT RESULT

V. CONCLUSION

In this project, we have presented the concept of the project ”Exploring Automatic Cardiovascular Disease Assessment with Convolutional Neural Networks” marks a significant stride towards leveraging machine learning techniques for early detection and assessment of cardiovascular diseases (CVDs). Through the implementation of Convolutional Neural Networks (CNNs), the project demonstrates the potential of deep learning models in analyzing medical images, particularly those derived from cardiovascular imaging modalities such as echocardiography and angiography. The findings suggest that CNN-based models can effectively extract relevant features from medical images and accurately classify them into different categories of cardiovascular health. This has profound implications for clinical practice, as it offers a non-invasive and potentially more efficient means of diagnosing and assessing CVDs. Furthermore, the project underscores the importance of robust datasets and model training protocols in achieving optimal performance and generalizability. By addressing challenges related to data quality, model architecture, and validation techniques, the project provides valuable insights into the development and deployment of CNN-based systems for cardiovascular disease assessment.

REFERENCES

[1] Amir H. Abdi, Christina Luong” Automatic Quality Assessment of Echocardiograms using Convolutional Neural Networks: Feasibility on the Apical Four-chamber View”, DOI 10.1109/TMI.2690836, IEEE Transactions on Medical Imaging, 2017.

[2] R. Kumar, F. Wang, D. Beymer, and T. Syeda- Mahmood, “Echocardiogram view classification using edge filtered scaleinvariant motion features,” in 2009 IEEE Conference on Computer Vision and Pattern Recognition, June 2009, pp. 723– 730.

[3] L. Løvstakken, F. Ordernd, and H. Torp, “Real-time indication of acoustic window for phased-array transducers in ultrasound imaging,” Proceedings of IEEE Ultrasonic Symposium, pp. 1549–1552, 2007.

[4] S. R. Snare, H. Torp, F. Orderud, and B. O. Haugen, “Realtime scan assistant for echocardiography,” IEEE Trans. Ultrasonic, Ferroelectrics, and Frequency Control, vol. 59, no. 3, pp. 583–589, 2012.

[5] P. Coup´e, P. Hellier, C. Kervrann, and C. Barillot, “Nonlocal means based speckle filtering for ultrasound images,” IEEE Transactions on Image Processing, vol. 18, no. 10, pp. 2221–2229, 2009.

[6] N. Srivastava, G. Hinton, A. Krizhevsky, I. Sutskever, and R. Salakhutdinov, “Dropout: A simple way to prevent neural networks from overfitting,” Journal of Machine Learning Research, vol. 15, pp. 1929–1958, 2014.

[7] “Automatic cardiac view classification of echocardiogram,” Proceedings of the IEEE International Conference on Computer Vision, pp. 0–7,2007

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com