Echo-Based Cardiac Function Assessment

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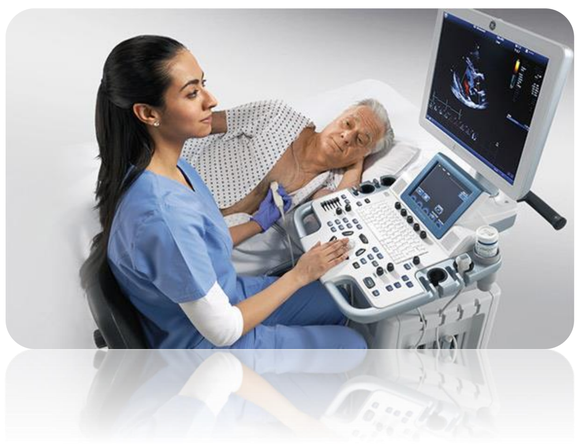
Introduction

The critical issue of accurate cardiac function assessment using echocardiography highlights its importance in diagnosing and managing heart diseases. The project aims to improve diagnostic accuracy through advanced image processing techniques and machine learning algorithms. We aim to develop a robust system that aids patients and clinicians by providing precise and reliable cardiac function evaluations.

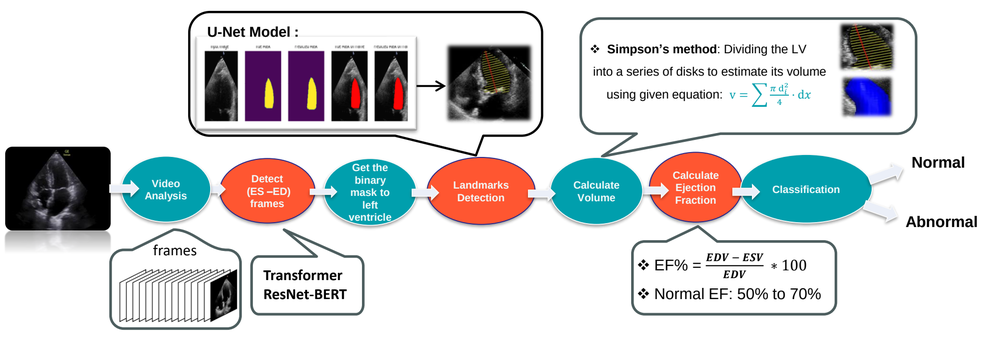


- Problem Definition
  - The heart, particularly the left ventricle, is crucial for blood circulation.
  - Conditions like cardiomyopathy impair heart function, leading to serious health issues.
  - Echocardiography, a non-invasive imaging technique, is essential for diagnosing heart conditions by measuring parameters like the Left Ventricle.
- Ejection Fraction (LVEF).
  - Newly trained cardiologists often struggle with accurate and rapid diagnoses due to the complexity of echocardiographic data.
- Motivation
  - Cardiovascular diseases are a leading cause of death globally, affecting over 500 million people and causing around 20.5 million deaths in 2021.
  - Early detection and continuous heart health monitoring can significantly reduce risks and improve outcomes.
  - Heart assessment apps can provide personalized care, enhance accessibility, and empower patients.
- Objective
  - Develop a system to accurately assess cardiac function and estimate LVEF from echocardiograms, aiding in early diagnosis and management of heart conditions.
- Proposed Solutions
  - Utilize advanced diagnostic tools like AI and machine learning for analyzing echocardiographic data.
  - Implement telemedicine for remote consultations.
  - Emphasize continuous education and training for new cardiologists Adopt a multidisciplinary approach for comprehensive patient care.

The project aims to leverage technology to enhance diagnostic accuracy, speed, and overall cardiac care.

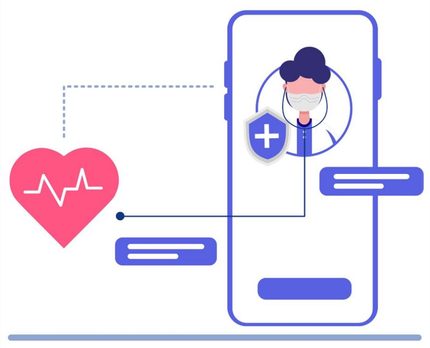
Methods

- **Hyper Model**
  - The module uses ResNetAE and BERT-based transformer encoders to capture echo video sequences and detect ES&ED Frames.
- **U-Net Network**
  - The U-Net is a supervised CNN for image segmentation to detect Left Ventricle (LV) Mask.
- **Fast API**
  - Enabling requests to the model
  - Returning response from the model
  - Hosting model to the server and deploying it to mobile application.
- **Flutter Application**
  - Send the echo video to the app and get the EF
  - Connecting with the mode

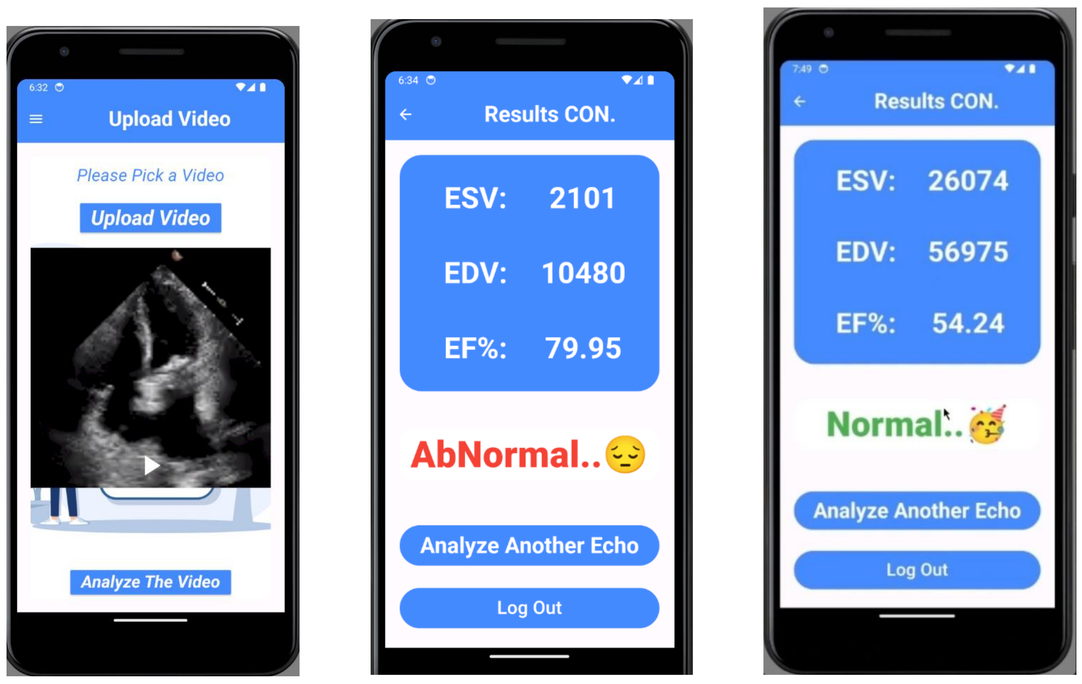


Results

The Echo-Based Cardiac Function Assessment app aims to revolutionize cardiac care by providing a powerful tool that combines advanced technology with ease of use. This app not only enhances the capabilities of healthcare providers but also empowers patients with crucial insights into their heart health.



Building a Mobile App that can hold the workflow, particularly facilitating the process for juniors or weakly experienced doctors and get the EF with classification normal or not. Along with optimizing and enhancing experience for users at all skill levels.



Conclusions

- This project addresses a critical issue facing heart failure people the objective was to develop software that gets the ejection fraction of a heartbeat from the echocardiography video and that was achieved using Deep learning models (DL).
- Throughout the development process, we have utilized a variety of programming languages, development tools, and third-party services to ensure that our app is user-friendly and reliable. We have also developed comprehensive technical and user documentation to support the development and deployment process.
- Our goal is to create a system that meets the needs of doctors everywhere and helps them to provide an accurate diagnosis of heart failure to the Patients.
- We believe that our app has the potential to make a positive impact on the diagnosis process and we are excited to see it in action and help more people to see their evolution and save their lives.

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