Book of Abstracts 2025

32nd International Student Congress Of (bio-)Medical Sciences

ISCOMS 2025
science beyond borders
2nd - 5th of June

Oral Session II

Cardiology

Presenters

Abdulla Zahi Othman Hourani
Helia Mohammadaein
Shima Mohammadi
Hacer Erva Evirgen
Sudhir Rajbhandari
Andres Clarke
Dayu Sun

Meta AI-Driven Prediction and Decision Support System for Heart Failure for Comprehensive Clinical Insights

Abdulla Zahi Othman Hourani
Poland
Medical University Of Warsaw

Introduction

Heart failure remains a leading cause of morbidity and mortality, necessitating early detection, precise risk stratification, and individualized management strategies. Traditional diagnostic pathways rely heavily on echocardiography for assessing left ventricular ejection fraction (EF) and structural abnormalities. However, access to timely imaging is often limited, delaying treatment decisions. This study presents a multimodal deep learning model integrating electrocardiography (ECG), chest X-ray (CXR), and clinical data to predict clinical and echocardiography-related outcomes. By utilizing multiple specialized models and aggregating their outputs within an AI-driven interface, this system provides a real-time decision support tool for clinicians.

Materials & Methods

A retrospective dataset comprising hospitalized heart failure patients is being used to develop and validate multiple deep learning models tailored to different prediction tasks. The primary models were trained to predict EF and categorize patients into heart failure with reduced EF, mid-range, and preserved EF. Additional models predicted specific echocardiographic abnormalities such as diastolic dysfunction, valvular disease, and wall motion abnormalities. Patient outcome predictions included in-hospital mortality, ICU admission, readmission risk, and the need for advanced heart failure therapies. Treatment recommendations were generated based on guideline-directed medical therapy eligibility, volume status, and hemodynamic stability.

Results

The preliminary AI model demonstrated high predictive performance across multiple tasks. EF prediction from multimodal data achieved a C-index of 0.85 compared to echocardiography-based EF assessments. Echocardiographic abnormality classification showed an accuracy of 88%, with specific findings such as diastolic dysfunction and valvular disease identified with high sensitivity and specificity. Outcome prediction models yielded an area under the receiver operating characteristic curve (AUROC) of 0.85 for in-hospital mortality, 0.86 for ICU admission, and 0.87 for 30-day readmission risk. Treatment recommendation models aligned with expert clinician decisions in 89% of cases. The AI systems interactive interface enabled real-time decision support, with predictions accessible through structured commands, allowing clinicians to retrieve individualized insights or comprehensive reports based on specific clinical needs.

Conclusion

This study demonstrates the feasibility and efficacy of a multimodal AI-driven decision support system for heart failure management, integrating diverse clinical data sources to provide real-time insights into EF, structural cardiac abnormalities, patient risk stratification, and optimal treatment strategies.