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The College of Graduate Studies and the College of Information Technology Cordially Invite You to a

PhD Dissertation Defense

Entitled

A DATA-EFFICIENT APPROACH FOR EFFECTIVE DIAGNOSIS OF LEFT VENTRICULAR HYPERTROPHY FROM ECHOCARDIOGRAPHY MODALITY

by

Moomal Farhad

Faculty Advisor

Prof. Mohammad Mehedy Masud

College of Information Technology

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Abstract

Left Ventricular Hypertrophy (LVH) is a medical condition characterized by the thickening and enlargement of the left ventricle (LV) of the heart. Accurate and timely diagnosis of LVH is vital for clinical prognosis and treatment decisions. Echocardiography has emerged as the gold standard for diagnosing LVH due to its ability to independently predict long-term risks such as heart failure and stroke. Echocardiography, a non-invasive and cost-effective imaging technology, is instrumental in assessing various aspects of heart health. Among the critical diagnostic calculations made possible by echocardiography, the determination of ejection fraction and heart chamber size is paramount in assessing LVH. Despite its clinical significance, the interpretation of echocardiography for the diagnosis of LVH primarily relies on manual analysis performed by technicians or cardiologists. This approach, while effective, is time-consuming and susceptible to human error. Additionally, the healthcare industry's diverse standards, along with stringent privacy laws and legal constraints, limit the availability of medical data for advancements in computer vision applications.

To address these challenges, we present significant contributions to the field of LVH diagnosis from echocardiography images with a strong emphasis on data-efficient techniques. Our research introduces a novel convolutional neural network (CNN) architecture that classifies echocardiograms into End-Systolic (ES), End-Diastolic (ED), and Non-ES-ED phase as this is the primary step for LVH diagnosis . Additionally, we propose modified zero-shot and few-shot learning models for LVH and normal class identification using a Siamese model, supported by a meticulously annotated dataset. Our work extends to a multi-purpose Siamese-based approach with weighted Euclidean distance for classifying LVH diagnosis into grades such as mild and moderate. Our model has surpassed state-of-the-art techniques in accuracy while also outperforming inter-observer and intra-observer variability, even when compared to assessments by two echocardiographers, marking a significant advancement in the field of LVH diagnosis.

Keywords: Left Ventricular Hypertrophy (LVH), Echocardiography, Data-efficient Techniques, Zero-Shot Learning, Few-Shot Learning, Siamese Model.