



Department of Electrical and Computer Engineering
North South University

Senior Design Project

**Cardiovascular Disease Detection using Transfer
Learning Approach**

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Hafsa Tasnim Badhan **ID# 1911406642**

Faculty Advisor:
Dr. Shahnewaz Siddique
Associate Professor
ECE Department

Spring, 2024

LETTER OF TRANSMITTAL

June, 2024

To

Dr. Rajesh Palit
Chairman,
Department of Electrical and Computer Engineering
North South University, Dhaka

Subject: **Submission of Capstone Project Report on “Cardiovascular Disease Detection using Transfer Learning Approach”**

Dear Sir,

With due respect, we would like to submit our **Capstone Project Report on “Cardiovascular Disease Detection using Transfer Learning Approach”** as a part of our BSc program. The report deals with Multi Level Based Home Security System. This project was very much valuable to us as it helped us gain experience from practical field and apply in real life. We tried to the maximum competence to meet all the dimensions required from this report.

We will be highly obliged if you kindly receive this report and provide your valuable judgment. It would be our immense pleasure if you find this report useful and informative to have an apparent perspective on the issue.

Sincerely Yours,

.....
Jahangir Alam
ECE Department
North South University, Bangladesh

.....
Tashdid Alam
ECE Department
North South University, Bangladesh

.....
Hafsa Tasnim Badhan
ECE Department
North South University, Bangladesh

APPROVAL

Jahangir Alam (ID # 1921863042), Tashdid Alam (ID # 1931264042) and Hafsa Tasnim Badhan (ID # 1911406642) from Electrical and Computer Engineering Department of North South University, have worked on the Senior Design Project titled “**Cardiovascular Disease Detection using Transfer Learning Approach**” under the supervision of Dr. Shahnewaz Siddique partial fulfillment of the requirement for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

Supervisor’s Signature

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Dr. Shahnewaz Siddique

Associate Professor

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

Chairman’s Signature

.....

Dr. Rajesh Palit

Professor

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

DECLARATION

This is to declare that this project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. All project related information will remain confidential and shall not be disclosed without the formal consent of the project supervisor. Relevant previous works presented in this report have been properly acknowledged and cited. The plagiarism policy, as stated by the supervisor, has been maintained.

Students' names & Signatures

1. Jahangir Alam

2. Tashdid Alam

3. Hafsa Tasnim Badhan

ACKNOWLEDGEMENTS

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Furthermore, the authors would like to thank the Department of Electrical and Computer Engineering, North South University, Bangladesh for facilitating the research. We would also like to thank our friends for helping us in this project. The authors would also like to thank their loved ones for their countless sacrifices and continual support.

ABSTRACT

Cardiovascular Disease Detection using Transfer Learning Approach

Cardiovascular Disease (CVD) is a multidimensional worldwide health concern, covering illnesses such as myocardial infarctions, cerebrovascular accidents and excessive blood pressure. Understanding its risk factors is crucial for successful preventative actions and therapies. This research is inspired by the astounding effect of CVD, responsible for 17.9 million deaths yearly, comprising 31% of global mortality [32]. Encouragingly, the American Heart Association says up to 80% of CVD cases are avoidable by lifestyle adjustments and early therapies. Proactive management of risk factors is crucial, with the healthcare sector, equipped with significant patient data, playing a critical role. The paper presents a comprehensive investigation into the development and evaluation of deep learning models for binary classification in cardiovascular disease detection. Four distinct models like ResNet50, EfficientNetB0, CNN and VGG16 were explored, each utilizing different architectures and transfer learning techniques. The study begins with a detailed description of data loading and preprocessing procedures, highlighting the importance of standardized image preparation techniques for effective model training. Each model's architecture is thoroughly discussed, elucidating the unique characteristics and design choices that contribute to their performance. The ResNet50 model employs residual blocks to address the vanishing gradient problem, while the EfficientNetB0 leverages transfer learning with pre-trained layers from ImageNet. The CNN model features a basic yet successful architecture with convolutional and dense layers, whereas the VGG16 model adopts a deep and uniform structure with 3x3 convolutional kernels [33]. Training procedures and results are meticulously documented for each model, encompassing aspects such as epoch-based training, batch sizes and optimizer selection. Performance metrics including accuracy and loss are analyzed across epochs to assess model convergence and generalization capabilities. Notably, the EfficientNetB7 model outperforms others, achieving remarkable accuracy and minimal loss on both training and validation datasets, demonstrating its efficacy in cardiovascular disease detection. The ResNet50 model achieved a training accuracy of 86.39% and a validation accuracy of 84.72%. The

EfficientNetB0 model attained a training accuracy of 97.32% and a validation accuracy of 98.83%. The CNN model demonstrated a training accuracy of 80.55% and a validation accuracy of 87.83%. Finally, the VGG16 model achieved a training accuracy of 95.13% and a validation accuracy of 99.55%. The paper also presents the development of a user-friendly web application using Streamlit, facilitating easy access to the trained models for real-world application [34]. The application comprises instructional, classifier and about us pages, each designed with clarity and simplicity to enhance user experience. Sample images and immediate classification results contribute to the usability and trustworthiness of the application, catering to medical professionals' needs for accurate and timely diagnostics [34]. The study provides valuable insights into the application of deep learning models for cardiovascular disease detection, elucidating the significance of architecture selection, data preprocessing and training procedures. The findings underscore the efficacy of transfer learning techniques and model architectures in achieving high accuracy and reliability in medical image classification tasks. The developed web application offers a practical solution for real-world deployment, facilitating seamless integration of deep learning technologies into clinical workflows.