



AYESHA YOUNIS

01-235172-017

SHAHEER ARSHAD QURESHI

01-235172-073

Phonocardiogram Classification using Deep Learning

Bachelor of Science in Information Technology

Supervisor: Abrar Ahmad

Department of Computer Science
Bahria University, Islamabad

June, 2021

Abstract

According to World Health Organization 17.7 million people die because of the cardiovascular diseases. So, to be able to mitigate the risk of heart related problems early detection of condition of heart may save millions of lives worldwide. We have built a solution which would classify the heart sound into normal and abnormal. Along with that there is a mobile application so that it is easy for the Cardiologists, Doctors, and other non-technical people to check the Phonocardiogram(PCG).

Our system is intended to mitigate the risk of error of manual auscultation which is considered to be error prone. The system works as a computer-aided tool which is cost effective and time efficient. Thereby, aid the Physicians and Cardiologists. The system provides an overview of the person's heart and its condition.

Contents

Abstract	i
1 Introduction	1
1.1 Problem Description	1
1.2 Project Objective	2
1.3 Project Scope	3
1.4 Benefits	3
2 Literature Review	4
2.1 Existing Applications	4
2.2 Classification of PCGs using CNN and ANN	4
2.3 Phonocardiogram Classification using pre trained AlexNet	5
2.4 Phonocardiogram Classification using deep learning	5
2.5 Mitigating the Gaps	5
3 Requirement Specifications	7
3.1 Existing System	7
3.2 Proposed System	7
3.3 Requirement Specification	7
3.3.1 Functional Requirements	8
3.3.2 Non-Functional Requirements	8
3.4 Use Cases	9
3.5 Detailed Use Cases	10
3.5.1 Login	10
3.5.2 Sign up	11
3.5.3 View Results	12
3.5.4 Check Heart Condition with Sonograms	13
3.5.5 Check Heart Condition with PCG audio Files	14
3.5.6 View FAQs	15
3.5.7 Gather Data	17
3.5.8 Prepare Dataset	17
3.5.9 Delete Dataset	18
3.5.10 Choose Algorithm	19
3.5.11 Examine and Update Model	20
3.5.12 Prediction	21
3.6 Activity Diagram	21
3.6.1 Login	22

3.6.2	Sign Up	23
3.6.3	Upload Input (Sonogram and PCG File)	24
3.6.4	Display Result	25
3.7	Deployment Diagram	25
3.8	Package Diagram	26
4	System Design	27
4.1	System Architecture	27
4.1.1	Presentation Layer	27
4.1.2	Logical Layer	28
4.1.3	Data Layer	28
4.1.4	System Architecture Diagram	28
4.2	Design Constraints	28
4.2.1	Internet Availability	28
4.2.2	Sonogram Availability	29
4.2.3	Phonocardiogram Availability	29
4.3	Design Methodology	29
4.4	High Level Diagram	30
4.5	GUI Design	30
4.5.1	Low Level Design	30
4.5.2	High Level Designs	33
5	System Implementation	43
5.1	System Architecture	43
5.2	Phase One	44
5.2.1	Dataset Acquisition	44
5.2.2	Pre Processing	45
5.2.3	Final Dataset	48
5.2.4	Define and Train Model	49
5.2.5	Evaluate Models	53
5.3	Phase Two	53
5.3.1	Create API	53
5.3.2	Mobile Application	54
5.3.3	Pre Processing	55
5.4	Prediction/Classification	56
5.5	Tools and Technology	56
5.5.1	Jupyter Notebook	56
5.5.2	Pycharm	56
5.5.3	Android Studio	56
5.5.4	Keras	56
5.6	Communication between the components	57
5.7	Development Environment/Languages Used	57
5.7.1	Python	57
5.7.2	Java and XML	57
5.7.3	Authentication	57

6	System Testing and Evaluation	58
6.1	Test Cases	60
6.1.1	Login Test Case	60
6.1.2	Sign Up Test Case	62
6.1.3	Display Result Test Case	65
6.1.4	Heart Conodition Check with Sonogram Test Case	66
6.1.5	Heart Conodition Check with Sonogram Test Case	68
6.1.6	View FAQs Test Case	69
7	Conclusions	70
7.1	Conclusion	70
7.2	In Future	71
A	User Manual	72
	Index	81
	References	81

List of Tables

3.1	Detailed Use Case: Login	11
3.2	Detailed Use Case: Signup	12
3.3	Detailed Use Case: View Results	13
3.4	Detailed Use Case: Check Heart Condition with Sonograms	14
3.5	Detailed Use Case: Check Heart Condition with PCG audio Files	15
3.6	Detailed Use Case: View FAQs	16
3.7	Detailed Use Case: Gather Data	17
3.8	Detailed Use Case: Prepare Dataset	18
3.9	Detailed Use Case: Delete Dataset	19
3.10	Detailed Use Case: Choose Algorithm	20
3.11	Detailed Use Case: Examine and Update Model	20
3.12	Detailed Use Case: Prediction	21
5.1	Dataset	49
5.2	Models Evaluation	53
6.1	Test Case: Login	60
6.2	Test Case: Sign Up	62
6.3	Test Case: Display Result	65
6.4	Test Case: Check Heart Condition with Sonogram(Image)	66
6.5	Test Case: Check Heart Condition with PCG File(Audio)	68
6.6	Test Case: Display FAQs	69