

**Predicting Mental Health State of an IT Company Environment  
Using CNN and Time-series Predictions**

Sachitha Samya Abyedeera

208520K

Thesis/Dissertation submitted in partial fulfillment of the requirement for the degree  
Master of Artificial Intelligence

Department of Computational Mathematics

University of Moratuwa

Sri Lanka

June 2023

## **Declaration**

I declare that this is my own work and this project proposal does not incorporate without acknowledgment any material previously submitted for a degree or Diploma in any other University or institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text.

Signature:

Date: 25<sup>th</sup> June, 2023

The above candidate has carried out research for the Master's thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of the supervisor: Dr.Thushari Silva

Signature of the Supervisor:

Date:

## **Abstract**

Technology is a fascinating subject. It changes rapidly in a way that makes us curious about what new product will change the world entirely within the next few hours, days, or months. When it comes to modern technology, artificial intelligence (AI) is playing a major role in the industry. Because, with the advancement of AI, most of the complex tasks can be handled by AI systems. Apart from taking care of complex tasks, AI can help people to enhance their quality of life. In order to enhance the quality of life, people have developed smart gadgets like wearable small health measuring and prediction gadgets, recommendation systems like hairstyle recommendations, makeup recommendations, food recommendations, and so on. Apart from them, there are so many different types of applications to improve the quality of life. And another concept is emerging in the modern world. That is predicting human mental status for upcoming months and adjusting the environment accordingly to maintain good mental status. If people can make adjust the environments for their day-to-day life, it will ultimately increase the quality of everything. Within a night or two people can not achieve this hard goal. It will take many years to achieve. But researchers all around the world have been working on several kinds of applications for many years. After completing all of these small tasks in the future, people will integrate everything into one system and that could make a healthy environment for humankind.

# Table of Contents

<b>CHAPTER 1</b> .....	1
<b>Introduction</b> .....	1
<b>1.1 Prolegomena</b> .....	1
<b>1.2 Aim and Objectives</b> .....	2
<b>1.3 Problem Statement</b> .....	2
<b>1.4 Solution</b> .....	3
<b>1.5 Summary</b> .....	4
<b>CHAPTER 2</b> .....	5
<b>Literature Review</b> .....	5
<b>2.1 Introduction</b> .....	5
<b>2.2 Emotion Classification using Machine Learning</b> .....	5
<b>2.3 Emotion Classification using DeepLearning(CNN)</b> .....	6
<b>2.4 Time series predictions using Statical, ML, and DL techniques</b> .....	7
<b>2.5 Analysis of Literature Reviews</b> .....	7
<b>2.5 Problem Definition</b> .....	9
<b>2.6 Summary</b> .....	9
<b>CHAPTER 3</b> .....	10
<b>Technology Adopted</b> .....	10
<b>3.1 Introduction</b> .....	10
<b>3.2 Emotion Classification</b> .....	10
<b>3.3 Time-Series Analysis</b> .....	11
<b>3.4 Summary</b> .....	12
<b>CHAPTER 4</b> .....	13
<b>Approach</b> .....	13
<b>4.1 Introduction</b> .....	13
<b>4.2 Hypothesis</b> .....	13
<b>4.3 Input Process Output Model</b> .....	13
<b>4.3.1 Input</b> .....	14
<b>4.3.2 Output</b> .....	14
<b>4.3.3 Process</b> .....	14

4.4 Users .....	15
4.5 Features .....	15
4.6 Summary .....	15
<b>CHAPTER 5 .....</b>	<b>16</b>
<b>Design .....</b>	<b>16</b>
<b>5.1 Introduction .....</b>	<b>16</b>
<b>5.2 System Diagram - High Level.....</b>	<b>16</b>
<b>5.3 Image Data Analysis.....</b>	<b>17</b>
<b>5.4 Classify Images .....</b>	<b>18</b>
<b>5.5 Summary .....</b>	<b>19</b>
<b>CHAPTER 6 .....</b>	<b>20</b>
<b>Implementation.....</b>	<b>20</b>
<b>6.1 Introduction .....</b>	<b>20</b>
<b>6.2 Implementation of the Input Layer .....</b>	<b>20</b>
<b>6.3 CNN model.....</b>	<b>21</b>
<b>6.5 Forecasting model.....</b>	<b>26</b>
<b>6.6 CSV file creator .....</b>	<b>30</b>
<b>6.7 Summary .....</b>	<b>31</b>
<b>CHAPTER 7 .....</b>	<b>32</b>
<b>Evaluation .....</b>	<b>32</b>
<b>7.1 Introduction .....</b>	<b>32</b>
<b>7.2 Results Analysis.....</b>	<b>32</b>
<b>7.3 Summary .....</b>	<b>39</b>
<b>CHAPTER 8 .....</b>	<b>40</b>
<b>Conclusion.....</b>	<b>40</b>
<b>8.1 Introduction .....</b>	<b>40</b>
<b>8.2 Overall Project Idea.....</b>	<b>40</b>
<b>8.3 Project Deviations and Key findings .....</b>	<b>40</b>
<b>8.4 Limitations .....</b>	<b>41</b>
<b>8.5 Summary .....</b>	<b>41</b>
<b>Appendix .....</b>	<b>42</b>
<b>References .....</b>	<b>45</b>

## List of figures

Figure 1 Input Process Output Model.....	13
Figure 2 High-Level System Diagram.....	16
Figure 3 Image Gathering Component .....	17
Figure 4 Data preprocessing .....	18
Figure 5 CNN model .....	19
Figure 6 Implementation of Image capturing .....	20
Figure 7 Detecting face using HaarCascade technique.....	21
Figure 8 Implementation of data generator.....	22
Figure 9 Implementation of the model creation.....	22
Figure 10 Implementation of the training process .....	25
Figure 11 Implementation of the predicting component.....	26
Figure 12 Gathered Data .....	27
Figure 13 Implementation of the forecasting model .....	27
Figure 14 Data set.....	28
Figure 15 Forecasting model .....	29
Figure 16 Average Angry probability distribution .....	29
Figure 17 Angry - Forecasted values with Break points.....	29
Figure 18 Average Happy probability distribution.....	30
Figure 19 Happy - Forecasted values with Break points .....	30
Figure 20 Implementation of CSV creator.....	31
Figure 21 Disgusted MAE value .....	38
Figure 22 Angry MAE value .....	38
Figure 23 Happy MAE value .....	38
Figure 24 Fearful MAE value.....	38
Figure 25 Neutral MAE value .....	38
Figure 26 Sad MAE value .....	38
Figure 27 Surprised MAE value.....	39

## List of Tables

Table 1 Literature Review Summery.....	8
Table 2 CNN model accuracies .....	32
Table 3 Angry results .....	33
Table 4 Disgusted results.....	34
Table 5 Fearful results.....	34
Table 6 Happy results.....	35
Table 7 Neutral Results .....	36
Table 8 Sad results.....	36
Table 9 Surprised results .....	37