An Effective Deep Learning Approach Based On CNN To Predict COVID-19 Rapidly Using Chest Images.

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April, 2021

An Effective Deep Learning Approach Based On CNN To Predict COVID-19 Rapidly Using Chest Images.

By

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The thesis submitted to the Department of Computer Science and Engineering, Bangladesh University of Business & Technology (BUBT). In partial fulfillment of the requirements for the degree of

BACHELOR OF SCIENCE

IN

COMPUTER SCIENCE AND ENGINEERING

April, 2021

ABSTRACT

Abstract— In December 2019 the novel coronavirus which first appeared in Wuhan City of China spread rapidly around the world and became a pandemic. It has caused a devastating effect on daily lives, public health, and the global economy. As soon as possible we have to detect the affected patient and quickly treat them. There are no accurate automated toolkits available so the need for auxiliary diagnostic tools has increased. Modern outcomes attained using radiology imaging systems recommend that such images have salient evidence about the COVID-19 virus. Real-time reverse transcription-polymerase chain reaction (RT-PCR) is the most common test technique currently used for COVID-19 diagnosis that is too much time-consuming. Using artificial intelligence (AI) techniques associated with radiological imaging can be helpful for the accurate detection of this disease and can also be assistive to overcome the problem of an absence of specialized doctors in remote communities. In this paper, a new model based on Convolutional Neural Network (CNN) that automatically detects COVID-19 using chest images is presented. The proposed model is designed to provide accurate diagnostics for binary classification. A computer vision is rapidly relieved day by day. During our study, we observed that most of the affected people have no common symptoms before checkup COVID-19. If the detection results are incorrect, the patient will not be able to understand that he or she has Covid-19. The proposed model is evaluated by Python libraries namely TensorFlow and Keras. In the proposed model, we got 95% accuracy as well as the detection of COVID-19 is fast.

Keywords— CNN, Covid-19 affected dataset, Chest Images, Python, TensorFlow.

DECLARATION

We hereby declare that the thesis work presented in the thesis titled, "**An Effective Deep Learning Approach Based On CNN To Predict COVID-19 Rapidly Using Chest Images**.", in partial fulfillment of the requirements for the degree of bachelor of science in Computer Science and Engineering submitted to the department of Computer Science and Engineering of Bangladesh University of business & Technology (BUBT), is an authentic record of our own work. The matter presented in this thesis has not been submitted for the award of any other degree of this or any other university.

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CERTIFICATE

This is to certify that Ranjit Kumar Shing, Md. Sazzad Hossain, Md. Rakibul Basher, Md. Hasibul Hasnat, Faisal Ahahmmad students of B.Sc in Computer Science and Engineering have completed their thesis work titled "An Effective Deep Learning Approach Based On CNN To Predict COVID-19 Rapidly Using Chest Images" satisfactorily in partial fulfillment for the requirement of B.Sc in CSE in Bangladesh Univrsity of Business and Technology (BUBT) in the year 2021.

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ACKNOWLEDGMENTS

First and foremost, all praises and thanks due to ALLAH, the Almighty, for His showers of blessings throughout our research work to complete the thesis successfully.

We would like to express our deepest and sincere gratitude and regards to our thesis supervisor, **Sohel Rana**, Lecturer, Department of Computer Science and Engineering, Bangladesh University of Business and Technology, for his precious guidance throughout the whole journey of our endeavor. His dynamism, vision, sincerity and motivation have deeply inspired us all. He has taught us methodology to carry out the research in collaborative manner and to present the thesis work as clearly as possible. We are extremely grateful for what he has offered and it was a great privilege and honor to work and study under his guidance. We also express our sincere regards to the Head of the department, **Dr. Muhammad Firoz Mridha**, Professor, Department of Computer Science and Engineering. We also take this opportunity to express appreciation to all faculty members of the department for their assistance and providing us with much information to facilitate our thesis work.

We are extremely grateful to our parents and family members for their love, prayers, caring and sacrifices for educating and preparing us for our future. And last but not the least special thanks to our classmates and friends in the department of Computer Science and Engineering who help us through discussions.

DEDICATION

Dedicated to our parents for all their love and inspiration

APPROVAL

This Capston project "An Effective Deep Learning Approach Based on CNN to Predict COVID-19 Rapidly Using Chest Images" submitted by that Ranjit Kumar Shing, Md. Sazzad Hossain, Md. Rakibul Basher, Md. Hasibul Hasnat, Faisal Ahahmmad, Department of Computer Science and Engineering (CSE), Bangladesh University of Business and Technology (BUBT) under the supervision of Sohel Rana, Lecturer, Department of Computer Science and Engineering has been accepted as satisfactory for the partial fulfillment of the requirement of the degree of Bachelor of Science (B.Sc. Engg) in Computer Science and Engineering and approved as to its style and contents.

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Table of Contents

List of Figures

1 INTRODUCTION

1.1 Problem Statement

At present Covid-19 is the most dangerous name. Covid-19 is a large family of viruses that start to cause illness beginning from the common cold to more severe diseases such as the Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). The major problem of Covid-19 is identification because it is a new strain that has not been previously identified in the human body or animals. A new model for Convolution Neural Network (CNN) that automatically detects COVID-19 using raw chest images is presented. The proposed model is designed to provide accurate diagnostics for binary classification. Computer vision is expressing rapidly day-by-day. Our main target to identify Covid-19 easily.

1.2 Problem Statement

We know at present Covid-19 is the main issue the entire world. Many researchers work hard to find out the strain of Covid-19. We use CNN in chest x-ray images to find easily a covid-19 person. Many researchers work on new technique algorithms. CNN is among them. It is challenging for us to get better results in this dataset. We know Covid-19 change his action day by day so this is difficult for us to the identification. If we find out Covid-19 action then we overcome this disease.

1.3 Problem Background

We face some problem to identify Covid-19 these are,

- Lack of awareness
- Difficult to find out strain
- Geographic separation

1.4 Research Objective

The main objective of our research is.

- To identify Covid-19.
- To classify the early stage of Covid-19.
- Easily find out Covid-19 peoples using chest x-ray images.

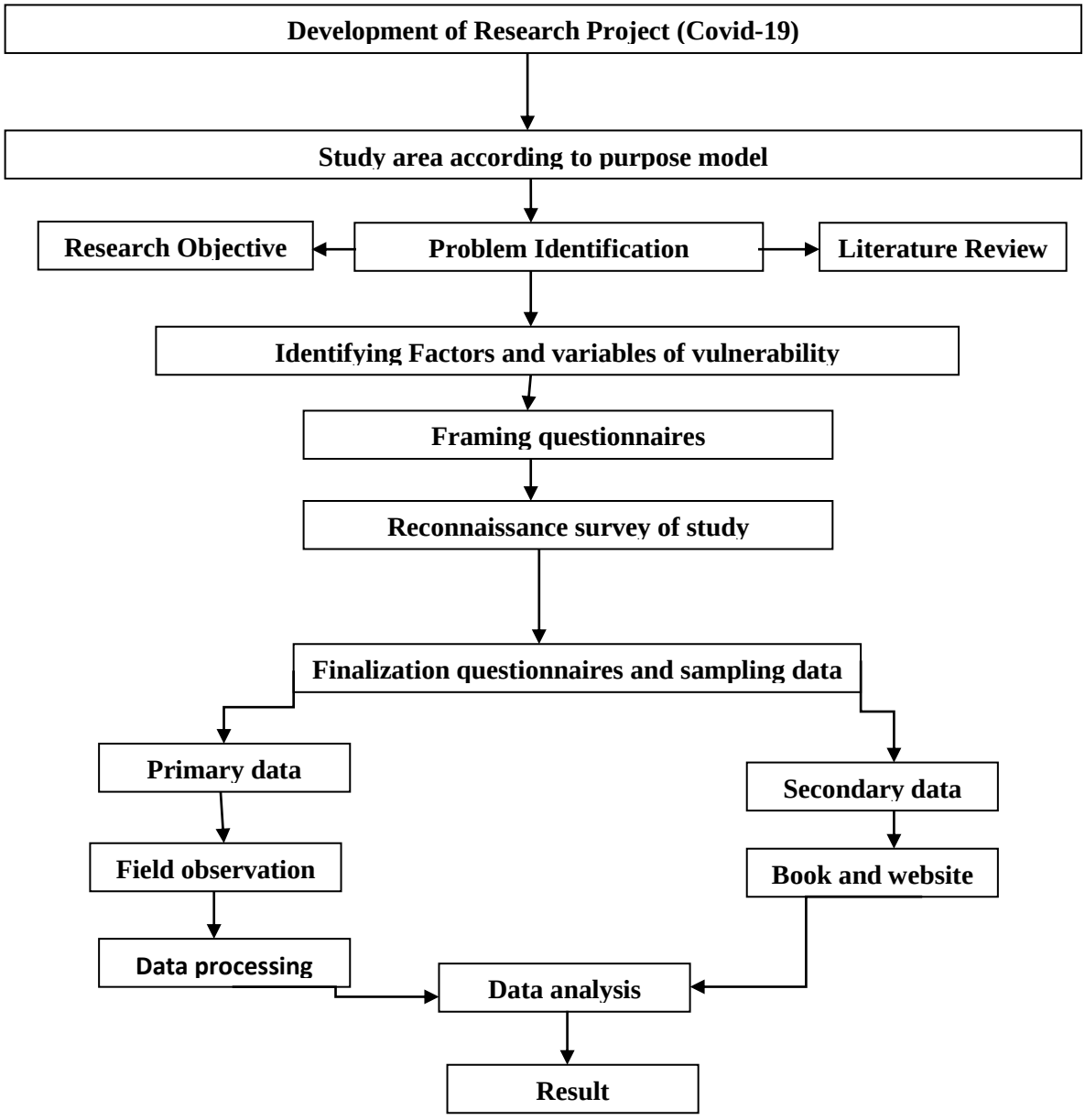
1.5 Motivation

Now the whole world is facing the most dangerous situation. Many people die early Covid-19 because we cannot identify this in the early stage. So we think we research Covid-19 and trying to identify it in the early stage. We know many researchers already work in this field. We are

motivated by them and want to research this field. We add some features and try to hard solve this problem.

1.6 Flow of the study

When we were started our topic first we are gathering some knowledge about Covid-19.We studied the basic theory of Covid-19 and image classification from researcher papers. After studied papers, we find out some lack of papers, and we start to find out Covid-19 implementation by new algorithm and method. Here is our flow of study.



1.7 Significance of the research

We focus on chest image because Clinical setups and population surveillance employ serology for the detection of antibodies. The limited availability of the test kits makes it challenging to detect every individual affected by the virus. Our research can help the medical site by deciding and give treatment to patients. A doctor can easily find out a Covid-19 person by using chest X-ray images.

1.8 Research Contribution

The contributions of our research are

- We focus on early detection of Covid-19 which is a good solution for peoples.
- We will enhance an existing method to raise the ability of this system.
- We use the mathematical techniques that increase performs of the CNN model.
- We will apply a new method to this research to provide better performance.

1.9 Thesis Organization

The thesis organizes follows

Chapter 2 highlights the background and literature review on the field of the speaker recognition system.

Chapter 3 contains the proposed architecture of the speaker recognition system, along with a detailed walkthrough of the overall procedures.

Chapter 4 includes the details of the tests and evaluations that were performed to evaluate our proposed architecture.

Chapter 5 explains Discussion and analysis of proposed model.

Chapter 6 explains the standards, ethical policy, and the challenges of the proposed architecture and the overall field of our study.

Chapter 7 comprises the overall design and implementation constraints of our conducted thesis work.

Chapter 8 illustrates the time schedules that we managed while conducting the thesis.

Finally, chapter 9 contains the overall conclusion of our thesis work.

1.10 Summery

This chapter includes a comprehensive overview of the problem that we specially target of the objective of thesis work and the motivation of the thesis works output. This section also illustrates the overall step that we are carried out our thesis work.

2 BACKGROUND

2.1 Introduction

There is a lot of algorithms like K-nearest, Native bays, CNN, KNN,BP, XGBoost, BPNN, LR, etc. Also, there have many datasets for the research purpose. By using deep learning manner, researchers acquire more exactness and most of them focus on CNN. They got a better outcome by using CNN manner. Most researchers used chest images for their experiment.

2.2 Literature Review

Most of the review paper introduces some common idea such as XGBOOST algorithm, CNN, SVM, CAD System, KNN, DCNN etc.

Zhao et al. [1] not only found ground-glass opacities (GGO) or mixed GGO in most of the patients, but they also observed a consolidation, and vascular dilation in the lesion.

Li and Xia [2] reported GGO and consolidation, interlobular septal thickening and air bronchogram sign, with or without vascular expansion, as common CT features of COVID-19 patients. Peripheral focal or multifocal GGO affecting both lungs in 50%–75% of patients is another observation.

Zu et al. [3] and Chung et al. [4] discovered that 33% of chest CTs can have rounded lung opacities..

Narin et al. [6] achieved a 98% COVID-19 detection accuracy using chest X-ray imagescoupled with the ResNet50 model.

Sun et al.[7] concluded that the CNN represented higher performance than deep belief network (DBN) and stacked denoising autoencoder (SDAE) in diagnosing malignant lung nodules with an area under the curve (AUC) of 0.899

Barbosa et al.[8] compared the quantitative CT (qCT), pulmonary function testing (PFT), and semi-quantitative image scores (SQS) metrics and found that pul - monary function testing and qCT metrics demonstrated the highest ac - curacy for monitoring bi- and unilateral lung transplantation with an AUC of 0.771 and 0.817

M. Alhanahnah [9] They focused on two model, Back Propagation Neural Network (BPNN) model and the Logistic Regression (LR) model. LR model give a result with the value between zero to one which indicate the risk factor of this disease. They get higher accuracy in LR algorithm.

Bolei at el[10] Worked with histopathological image. Worked with deep learning algorithms, they used DeNet and SaNet approach where DeNet is used to find out the most useful patches from images and it is use for classification. Using BreakHis dataset and they get 98%accuracy.

Wang at el[11] worked with mammography images. Used CNN in detection phase and US_ELM for feature extraction and clustering. In diagnosis phase they use deep feature set of each mammogram as a input of ELM for classification. The output indicates benign or a breast tumor.

TingSim[12] worked with self-regulated multilayer perceptron neural network (ML-NN). This algorithm can help medical experts in diagnosis of breast cancer. This algorithm can classified the input medical images as benign, malignant or normal patient with accuracy, specificity, sensitivity and AUC of 90.59%, 90.67%, 90.53%, and 0.906 ± 0.0227 respectively.

XiaofeErik at el[13] worked with the 2D mammograms and 3D tomosynthesis images. Used CNN for classification. They get better result in 3D tomosynthesis images.

PinarSelma at el[14] worked with mammogram images. Used CNN for classification. Worked with MIAS and BCDR database. Get 87% accuracy with MIAS database and 88% accuracy with BCDR database.

Burak Akbugday [15] analyzes different machine classifiers like k-Nearest Neighbors (k-NN), Naïve Bayes(NB) and Support Vector Machine (SVM) with Weka software. The dataset contains 699

Xiaofei Zhamg'[16] el at developing and evaluated a number of CNN models for whole image classification mammogram. He showed that CNN model he had built and optimized via data augmentation and transfer learning have a great potential for automatic breast cancer detection.

Erwin Halim [17] applied on the different models for early detection of breast cancer like DWT-based multi-resolution MRF (MMRF) segmentation for mammography, MLP for histologic examination, and k-– SVMRFE method for gene identification.he expected to increase the accuracy in early detection of breast cancer.

Hanij et al [18] work with thermal image. Use LSVM and CNN for processing the images. Implement random walks algorithm. Dataset contain 200 images. Get 90.5% accuracy.

khanAroma[19] work with thermal image. Use SVM classifier. Work with 50 image. Get 84.5% accuracy.

NanKrzysztof at el[20] In this paper they worked with Breast density classification which is an essential part of breast cancer screening. They apply CNN. Get 88% accuracy.

TasleemWang at el[21] Worked with histology images. Apply CNN for classification. Worked with ICIAR 2018 breast histology dataset. Get 94.3% accuracy on 4-class and 97.5% 2-class histology image.

2.3 Problem Analysis

Finding CNN, SVM, ML, XGBOOST algorithm out of the research paper where they did Covid-19 classification. The researcher obtains better accomplishment with the use of Convolution Neural Network which is flourished on deep learning. Deep learning is very in high favor of classification. The deep learning approach is more compatible than other approaches.

2.4 Summery

This chapter explains the latest implementations of the COVID-19 classification. The target of the thesis work is to implement better results for COVID-19.

3 PROPOSED MODEL

3.1 Introduction

In this chapter, we talk about the action-ability of the Covid-19 system and the acceptance of demand for this model. Ultimately this chapter clarifies the models of all-inclusive architecture, which is elaborated by the given work.

3.2 Feasibility Analysis

The thesis work required five researchers with one supervisor and took one year to be executed. The research work required technical support including, hardware and software. The research work also required a dataset generation and evaluation process that is also performed by the researchers. The comprehensive data collection of the thesis work is executed, considering the legal feasibility of the dataset. Also, the thesis work did not require any financial support from the institution and supervisor.

3.3 Requirements Analysis

To conduct the proposed architecture of the overall necessity include

• High-performance computing Device.

• Google Colab.

• Open source software libraries for scientific computations.

• Open source software libraries for machine learning models.

3.4 Research Methodology

In this part, the methodology of the proposed model is exhibited. This part is sub-sectioned into four chunks. The sub-sections are arranged from input to output period of the model back-to-back explanations comprehensively.

3.4.1 Architecture the model

In the proposed approach, we used the CNN features to achieve better accuracy.The proposed model consists of four CNN layers namely Convo 2D, Max_pooling2D, Flatten, and Dense layer). We used four Convo2D and two Dense layers. These covo2D are (8,16,32,64) and Dense are (512,1).The size of Maxpooling2D used in the model is 2x2 with same padding . A flatten layer is used to create a single long feature vector size of 4096. The aactivation functions used in the dense layers are ReLu and Sigmoid. The activation function ReLu is applied to the final dense layer (512x1) to classify the Covid -19 in binary manner (positive or negative). For fully connected 4096x512 neural network, we used sigmoid function as the activation function.

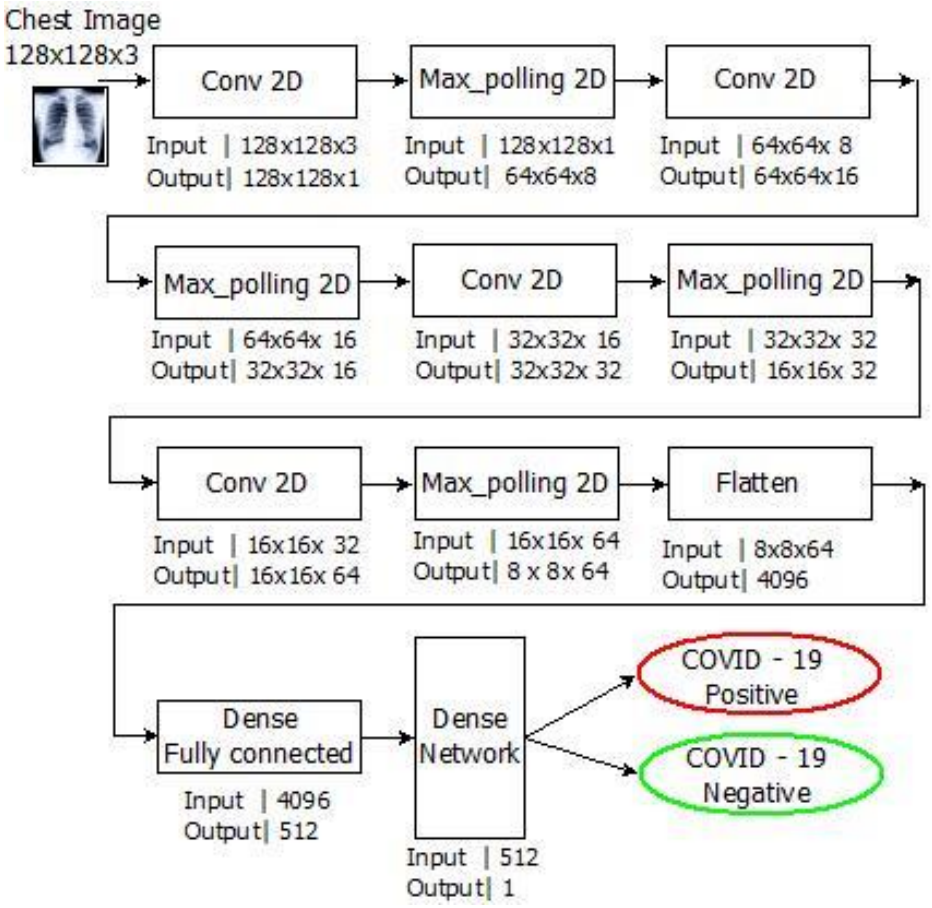


Figure 3.1 Internal architecture of Proposed Model

The fully connected layer is passed to the ReLU layer so as to normalize the binary classification vector. After the output of the classification vector, two categories i.e. Covid-19 positive or Negative for evaluation. All the hidden layers use sigmoid as their activation function. The sigmoid function is more computationally efficient because it leads to faster learning and it also decreases the likelihood of vanishing

3.4.2 DFD in our model

This section illustrates the Data Flow Diagram of the proposed models' working process. After collecting dataset, proposed model is trained to predict the Covid-19 virus from images. We used MINI-MIAS dataset to train the model. There is a performance evaluation process before making the final decision.

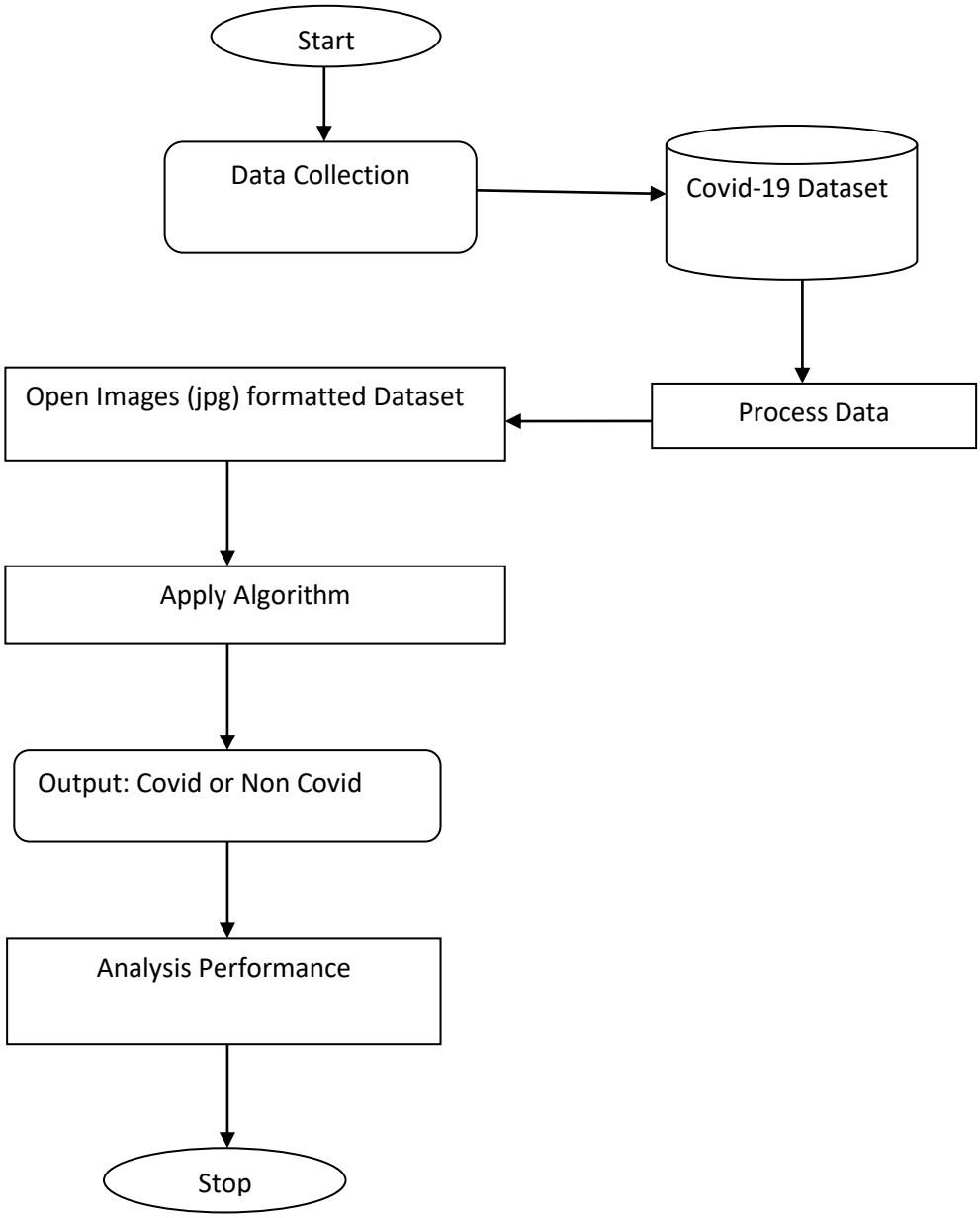


Figure 3.2 DFD in our model

3.4.3UML design in our model

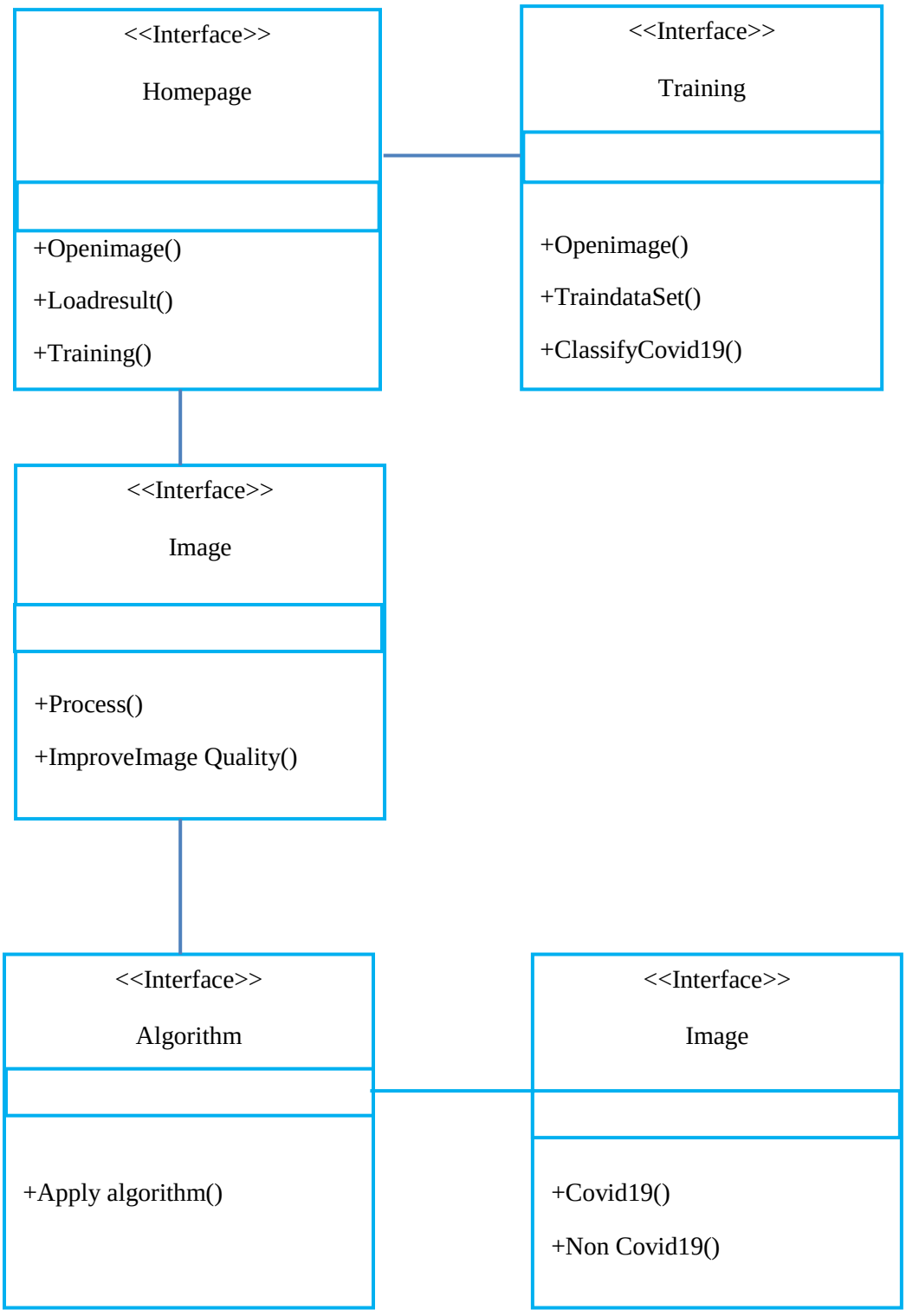


Figure: 3.3 UML Architecture

3.5 Design, Implementation and Simulation

The total work action of the raised architecture makes clear in Figure [3.1]. All the allude to the stride of the prototype are implemented by using Python language and Google collaborator platform. The Convolutional neural network models are implemented using python. Also, for additional calculation, implementation, and backing by used NumPy and pandas. The visual evolution reports were produced using Matplotlib in python.

3.6 Summary

This section explains the architecture of the proposed Covid-19 classification using the deep learning method. The overall architecture uses the CNN of the features as well.

4 EXPERIMENTAL SETUP AND RESULT

4.1 Introduction

In this chapter, the proposed architecture has been examined and analyzed. This section contains the system setup that was completed. At the same time, this section explains the evaluation metrics used to measure the accuracy of the results and the detailed analysis of the results.

4.2 System Setup

4.2.1 Data Pre-processing

Data pre-processing in any machine learning process is the step where data is converted or encoded, bringing it to the point where the machine can now easily parse. In other words, the data properties can be easily explained by algorithms. For training and evaluation, we use the MINI-MIAS dataset. We use two class trains and validation.

4.2.2 Data visualization after Pre-processing

After Pre-processing augmentation picture, given the picture below:

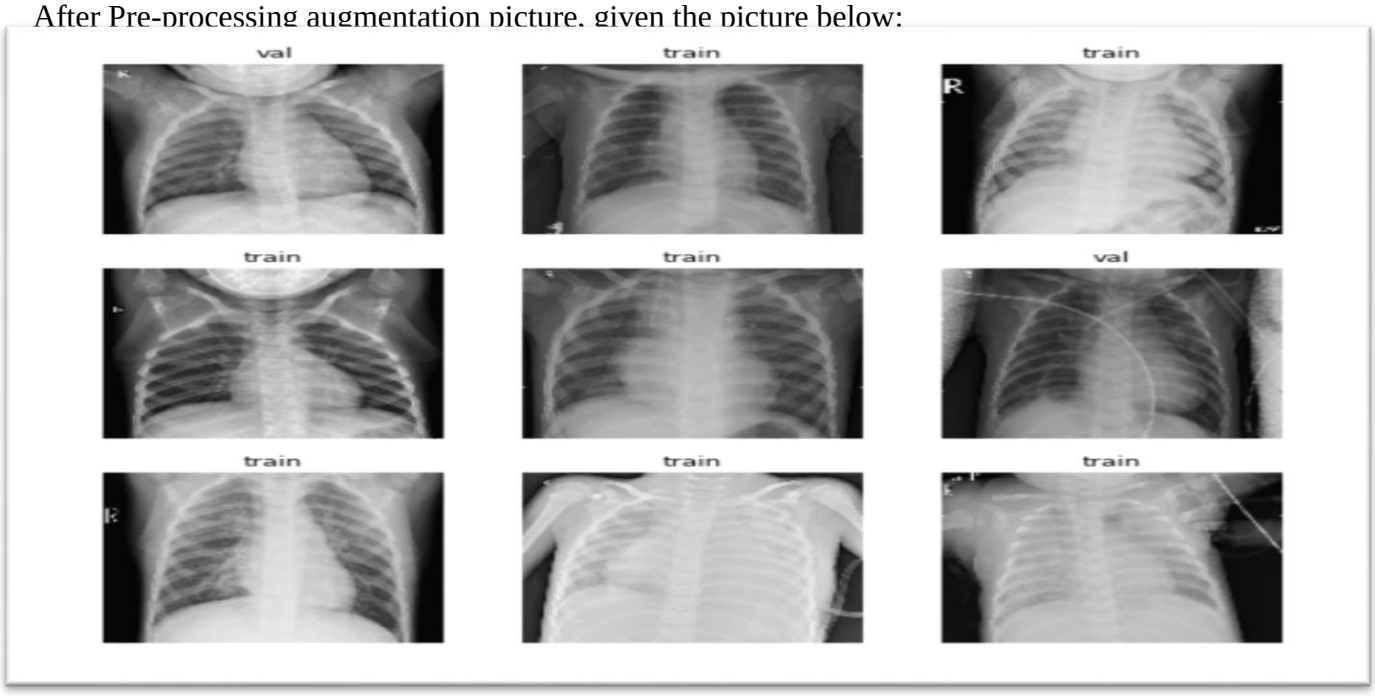


Figure 4.1 Data visualization

4.2.3 Dataset retrieves and batch size

We use the batch size of this dataset as 64. Images height and width is 128. The image batch of our dataset is (“64”, “128”, “128”, and “3”).

4.2.4 Configuration dataset for performance

There are two important methods are cache, prefetch. When we're loading data use this dataset.

i) Dataset. Cache (): These objects are required for use with the software in this package.

ii) Dataset. Prefetch (): These objects using when model training.

4.2.5Data augmentation

Data augmentation creates new training data from existing training data. Cropping, padding, and horizontal flipping are commonly used to train large neural networks for data augmentation techniques. Using this augmentation model gets better performance to finding accuracy

4.2.6Visualize data augmentation Picture

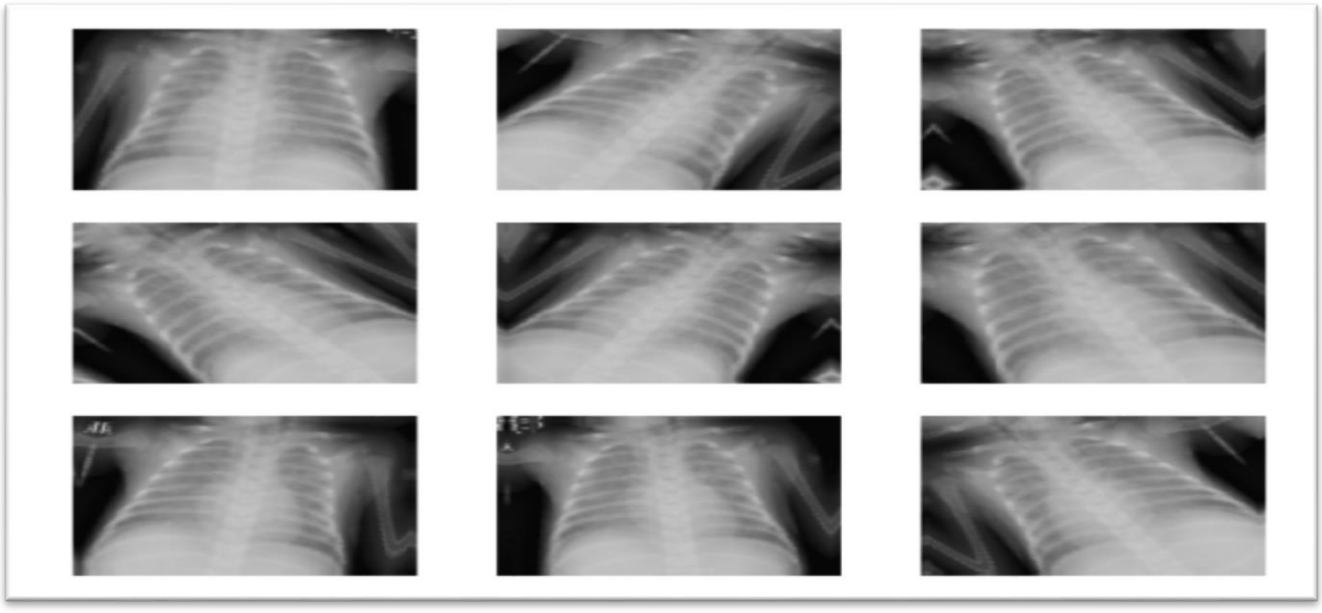


Figure: 4.2 Augmentation pictures of the data

4.3 Implement of Proposed CNN model

In this project, we were using the CNN model. Also, we are using four CNN layers (Convo 2D, Maxpooling2D, Flatten, Dense). We used four Convo2D and two Dense. Those covo2D are(8,16,32,64) and Dense are (512,1).The Maxpooling2D size of our model (2,2). Activation is ReLU and sigmoid.

Our layer works given below the figure:

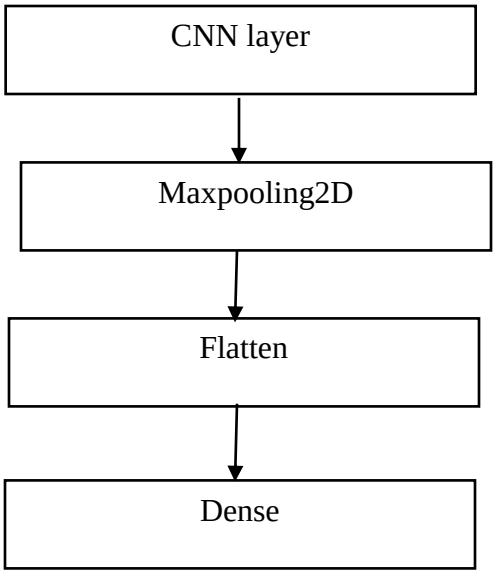


Figure 4.3: Layers of proposed model

4.4 Picture of our CNN Model

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 128, 128, 8)       224
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 64, 64, 8)         0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 64, 64, 16)        1168
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 32, 32, 16)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 32, 32, 32)        4640
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 16, 16, 32)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 16, 16, 64)        18496
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 8, 8, 64)          0
_________________________________________________________________
flatten (Flatten)            (None, 4096)              0
_________________________________________________________________
dense (Dense)                (None, 512)               2097664
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 513
=================================================================
Total params: 2,122,705
Trainable params: 2,122,705
Non-trainable params: 0
```

Figure 4.4 Picture of CNN Model

4.5 Epochs Result

```
Epoch 90/100
78/78 [==============================] - 97s 1s/step - loss: 0.1087 - accuracy: 0.9564 - precision_1: 0.9733 - recall_1: 0.9708
Epoch 91/100
78/78 [==============================] - 98s 1s/step - loss: 0.1107 - accuracy: 0.9550 - precision_1: 0.9740 - recall_1: 0.9685
Epoch 92/100
78/78 [==============================] - 99s 1s/step - loss: 0.1035 - accuracy: 0.9562 - precision_1: 0.9761 - recall_1: 0.9678
Epoch 93/100
78/78 [==============================] - 98s 1s/step - loss: 0.1085 - accuracy: 0.9568 - precision_1: 0.9763 - recall_1: 0.9688
Epoch 94/100
78/78 [==============================] - 98s 1s/step - loss: 0.1449 - accuracy: 0.9407 - precision_1: 0.9627 - recall_1: 0.9620
Epoch 95/100
78/78 [==============================] - 97s 1s/step - loss: 0.1129 - accuracy: 0.9555 - precision_1: 0.9750 - recall_1: 0.9679
Epoch 96/100
78/78 [==============================] - 96s 1s/step - loss: 0.1097 - accuracy: 0.9583 - precision_1: 0.9749 - recall_1: 0.9725
Epoch 97/100
78/78 [==============================] - 96s 1s/step - loss: 0.1124 - accuracy: 0.9569 - precision_1: 0.9722 - recall_1: 0.9727
Epoch 98/100
78/78 [==============================] - 96s 1s/step - loss: 0.1135 - accuracy: 0.9510 - precision_1: 0.9686 - recall_1: 0.9679
Epoch 99/100
78/78 [==============================] - 97s 1s/step - loss: 0.1153 - accuracy: 0.9546 - precision_1: 0.9714 - recall_1: 0.9704
Epoch 100/100
78/78 [==============================] - 96s 1s/step - loss: 0.1350 - accuracy: 0.9459 - precision_1: 0.9689 - recall_1: 0.9612
```

```
true_positives_1: 1957.5696 - true_negatives_1: 495.2911 - false_positives_1: 43.3797 - false_negatives_1: 52.8354
true_positives_1: 1926.3924 - true_negatives_1: 500.8228 - false_positives_1: 49.6835 - false_negatives_1: 57.8987
true_positives_1: 1926.2785 - true_negatives_1: 491.6962 - false_positives_1: 56.1013 - false_negatives_1: 64.8861
true_positives_1: 1917.1646 - true_negatives_1: 506.0000 - false_positives_1: 47.2785 - false_negatives_1: 64.3544
true_positives_1: 1925.0506 - true_negatives_1: 494.1266 - false_positives_1: 51.5570 - false_negatives_1: 62.8734
true_positives_1: 1929.9241 - true_negatives_1: 481.8861 - false_positives_1: 64.1772 - false_negatives_1: 72.4937
true_positives_1: 1905.0380 - true_negatives_1: 502.4557 - false_positives_1: 49.9494 - false_negatives_1: 61.8861
true_positives_1: 1951.1899 - true_negatives_1: 483.7595 - false_positives_1: 50.9241 - false_negatives_1: 55.4684
true_positives_1: 1923.0633 - true_negatives_1: 496.5696 - false_positives_1: 54.9367 - false_negatives_1: 57.8481
true_positives_1: 1923.9367 - true_negatives_1: 501.4304 - false_positives_1: 55.7848 - false_negatives_1: 63.1646
true_positives_1: 1918.6582 - true_negatives_1: 494.5443 - false_positives_1: 51.9367 - false_negatives_1: 60.7342
true_positives_1: 1910.7975 - true_negatives_1: 502.0253 - false_positives_1: 60.0759 - false_negatives_1: 74.9873
```

Figure 4.5 Epoch result from CNN Model

5 PERFORMANCE ANALYSIS AND DISCUSSION

Accuracy, Recall and Precision are the core metrics for evaluating a classification model. Informally, accuracy is a fraction of what our model accurately estimates. In general, accuracy has the following definitions.

$$\text{Accuracy} = \frac{\text{Numberofcorrectpredictions}}{\text{Totalnumberofpredictions}}$$

For binary classification, accuracy can also be calculated in terms of positives and negatives as follows:

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

$$\text{Recall} = \frac{TP}{FN+TP} \quad (2)$$

And

$$\text{Precision} = \frac{TP}{FP+TP} \quad (3)$$

where TP = True Positives, TN = True Negatives, FP = False Positives, and FN = False Negatives.

Now Accuracy for proposed model $= \frac{TP+TN}{TP+TN+FP+FN}$

$= \frac{1910.7975+502.0253}{1910.7975+502.0253+60.0759+74.9873}$

=0.95*100

=95%

Matrix of the Recall for proposed model $= \frac{TP}{FN+TP}$

$= \frac{1910.7975}{74.9873+1910.7975}$

= 0.96*100

=96%

Matrix of the precession $= \frac{TP}{FP+TP}$

$= \frac{1910.7975}{60.0759+1910.7975}$

= 0.97*100

=97%

Matrix of the F1 Score $= \frac{2*(0.97*0.96)}{0.97+0.96}$

= 0.96*100

= 96%

TABLE1 PERFORMANCE METRICS

Accuracy (%)	Recall (%)	Precision (%)	FI Score (%)
95	96	97	96

From the evaluation reports, it is evident that this CNN architecture performs the most satisfying accuracy on Covid-19 detection tasks.

5.1 Summary

From the evaluation reports, it is evident that this CNN architecture performs the most satisfying accuracy on Covid-19 detection tasks.

6 STANDARDS IMPACTS ETHICS AND CHALLENGES

6.1 Impacts on Society

The impact of this project will be is a milestone on society to find out the COVID-19 using chest images based on Convolution Neural Network. This classification is essential for promptly diagnoses. It will be subsidiary for doctors that doctors can find the COVID-19 using chest images. A well-established and flawless diagnosis system that can track out COVID-19 in the primary stage. CNN model can classify and fatal COVID-19 for this work.

In this project there have chest images of the peoples, some of the peoples have pneumonia, some have COVID-19 and some have normal in the dataset which we use in this project. Using the CNN model for the project brings better performance to find out the COVID-19 using chest images. This is necessary for a society that can alert peoples and helps to take needful steps.

6.2 Ethics

By using this classification doctor can comprehend that the circumstance of the patient. After knowing the circumstance, the patient can take proper health care and treatment. Using this classification also helps that the biopsies are benign or malignant.

The systems also maintain individuals' privacy concerns and not be used for any ambition that elevates a national or social security threat.

6.3 Challenges

Though it is difficult to diagnose promptly detection of COVID-19. It may have happened on the influence of bogus classification. It is challenging to classify to detect COVIS-19 accuracy. Using a CNN model with chest images delivers better accuracy. CNN focuses on the best performance that improving accuracy. Extensively, chest images with CNN which used for decreasing the fatality rate.

Computer-aided diagnosis has many restrictions but using chest image in CNN model, it gives better performance. This work gives us 94% accuracy with better classification. This classification will be so helpful for doctors and patients because this accuracy is much better than before.

Although technologies are evolving rapidly, the companies developing such technologies still face information security challenges. This thesis work has clearly shown that the actual user of chest images with CNN to detect COVID-19 systems is close to real-world implementation.

6.4 Summary

Nowadays COVID-19 classification with chest images using CNN is going to rapidly popular. This work is helpful because this work's performance is much better than the others. Our work has 95% accuracy.

Hope that this work will be efficient in diagnosis in medical. It could identify COVID-19, that helps peoples to take proper steps and treatment.

7 CONSTRAINTS AND ALTERNATIVES

7.1 Design Constraints

The overall structure of the proposed architecture can be implemented based on CNN models. The model requires devices with high processing capability to perform simultaneous leaf detection. The model does not require any GPU support.

7.2 Component Constraints

The component requirements of the proposed architecture include,

- Minimum Processor Requirement: Intel i3 (7th Gen, 3GHz)
- Minimum Memory Requirement: 4 GB (DDR3, 1600 buses)

7.3 Budget Constraints

The estimated budget is to be calculated by the current market price of the component requirements.

7.4 Summary

The avoidance of deep learning in the proposed Convolutional neural network (CNN) architecture can be implemented in medical images.

8 SCHEDULES, TASKS AND MILESTONES

8.1 Timeline

The overall timeline of the project work can be segmented into three divisions based on the three semesters of our supervisor's work execution procedure. The first-semester work process contains the planning and reviewing of the related works of the thesis work. The second-semester work process includes collaborative work of prototype designing and analysis of the prototype. In the third semester, we implemented and tested the overall architecture and reported the overall workflow.

8.2 Gantt chart

Figure 7.1 contains the Gantt chart describing the work execution process of the thesis work. The thesis work's overall execution is three semesters long, where each semester is twelve weeks long.

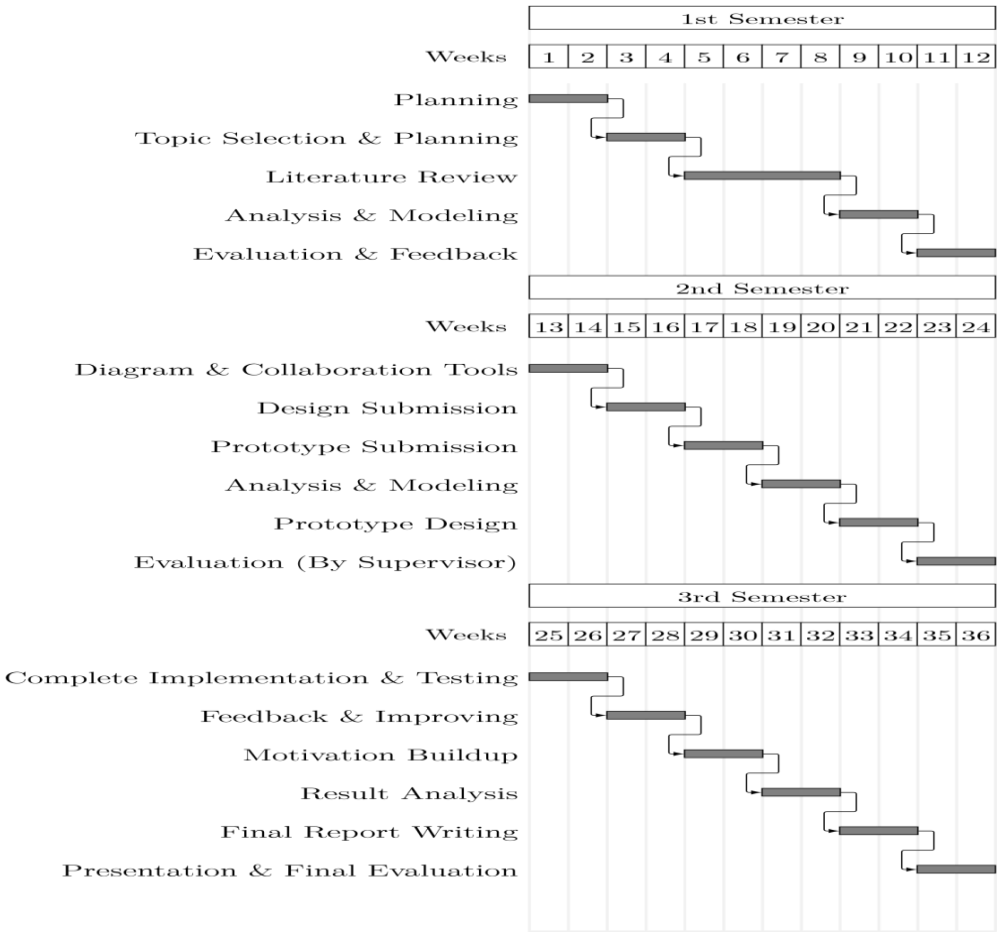


Figure 7.1 Gantt chart of the work execution process

9 CONCLUSION

9.1 Introduction

In the present situation, Covid-19 is one of the most dangerous names. It changes strains day by day so difficult for us to easily detect Covid-19. If the doctors detect early-stage in Covid-19 it is helpful and life-saving for us. We use a Convolutional neural network with chest images and get a satisfactory accuracy of 95% of our model.

9.2 Future work

In future work, we intend to increase the layer in convolutional neural networks (CNN) using the most powerful hardware to improve the accuracy of model.

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