# MEDINFORM

## AI-POWERED MULTIPURPOSE WEB PLATFORM FOR MEDICAL IMAGE ANALYSIS

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UNDER THE SUPERVISION OF
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# PROBLEM STATEMENT

The problem at hand is to build an automated system in the form of a web application that would use deep learning models, in particular Convolution Neural Networks as its back end to detect the presence of diseases such as Tuberculosis, Skin Cancer, Malaria, Covid-19, Pneumonia and Diabetic Retinopathy by using medical images and thereby providing a more accurate, efficient and faster method to diagnose the diseases.

# MOTIVATION AND NEED OF SUCH A SYSTEM

01 Efficient and widespread testing is needed in cases of diseases that spread exponentially, such as Malaria and Covid-19. In that case presence of online system can greatly increase number of tests being performed and decrease the duration of test.

02 In case of highly infectious diseases, an online system would greatly decrease the number of people that come in contact with samples. Hence reducing the front line workers in case of highly infectious disease which would help reducing their spread.

03 Since this approach just uses image in order to predict the result, in some cases this would reduce the amount of equipment required to get results which would make it easier to setup remote camps for those diseases and will be boost for telemedicine sector.

04 Online testing can easily be standardized which means that no matter where the test would be done the results would be same, that removes the need for people to travel to far away places just to get tests done.

# NOVELTY OF THE IDEA

01 In this product, we intent to build a full fledged system in the form of a web application that would run the ML model at the backend. The web application have a user friendly UI that would allow evan a naive person to use it.

02 We have intended to improve upon the results of the previous models using a Deep Learning based approach to build our model along with techniques such as transfer learning and data augmentation.

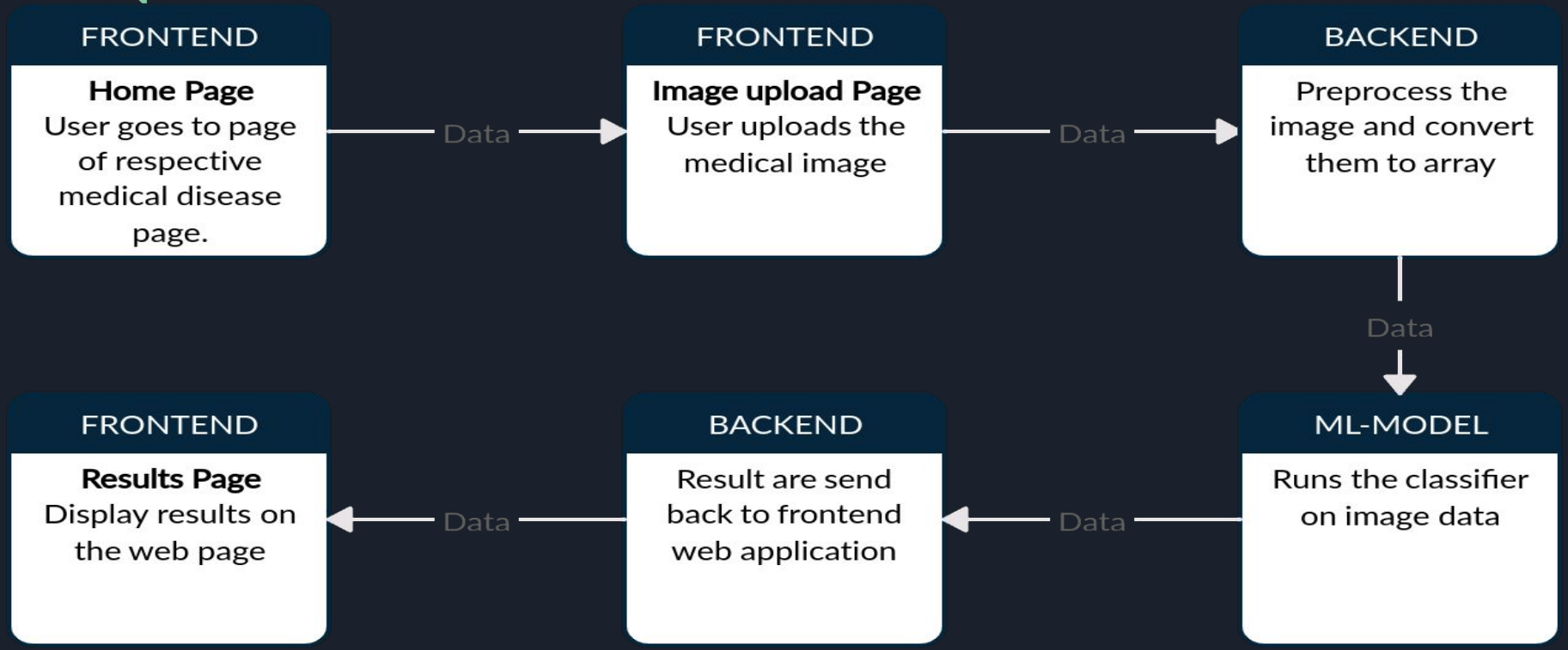
03 The earlier research in this regard was solely machine learning and deep learning based. The models that were made were not deployed in any proper manner to web or any mobile device. This limited their use amongst medical practitioners and common people

04 Currently diagnosis of these disease heavily depends on human expertise or models in which features are extracted by hand for making decisions such methods can be impacted by the variability on observation and the biases of the expert.

# OBJECTIVES

- Developing a CNN based Deep Learning Model that would classify the medical images into their respective classes based on the disease.
- Deploying our model using a web based application in which users will be able to upload medical image and the app will display the results to the user
- This would provide assistance to medical practitioners and a reliable second opinion to people without medical background about diseases that can be detected from medical images or scans taken by medical professionals or people themselves.
- This app will classify various diseases such as Tuberculosis, Skin Cancer, Malaria, Covid-19, Pneumonia and Diabetic Retinopathy.

# SYSTEM DESIGN

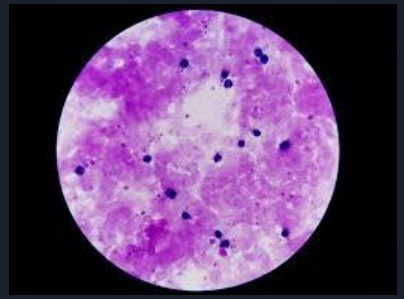


# SAMPLE DATA OF ALL MODELS

TUBERCULOSIS
CHEST X-RAY

SKIN CANCER IMAGE

PNEUMONIA CHEST X-RAY



MALARIA BLOOD SAMPLE

COVID CHEST X-RAY

DIABETIC RETINOPATHY

# BASIC CNN ARCHITECTURE

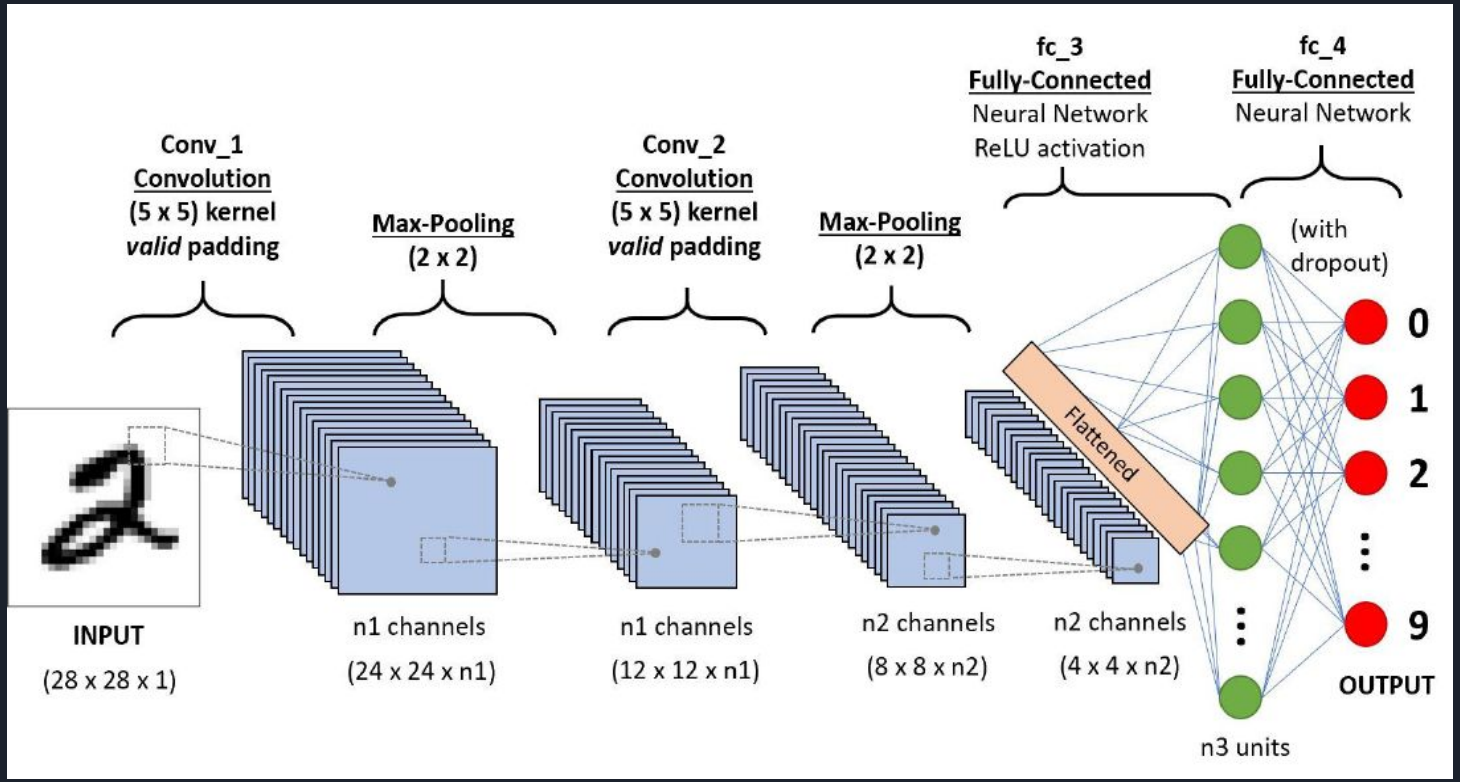
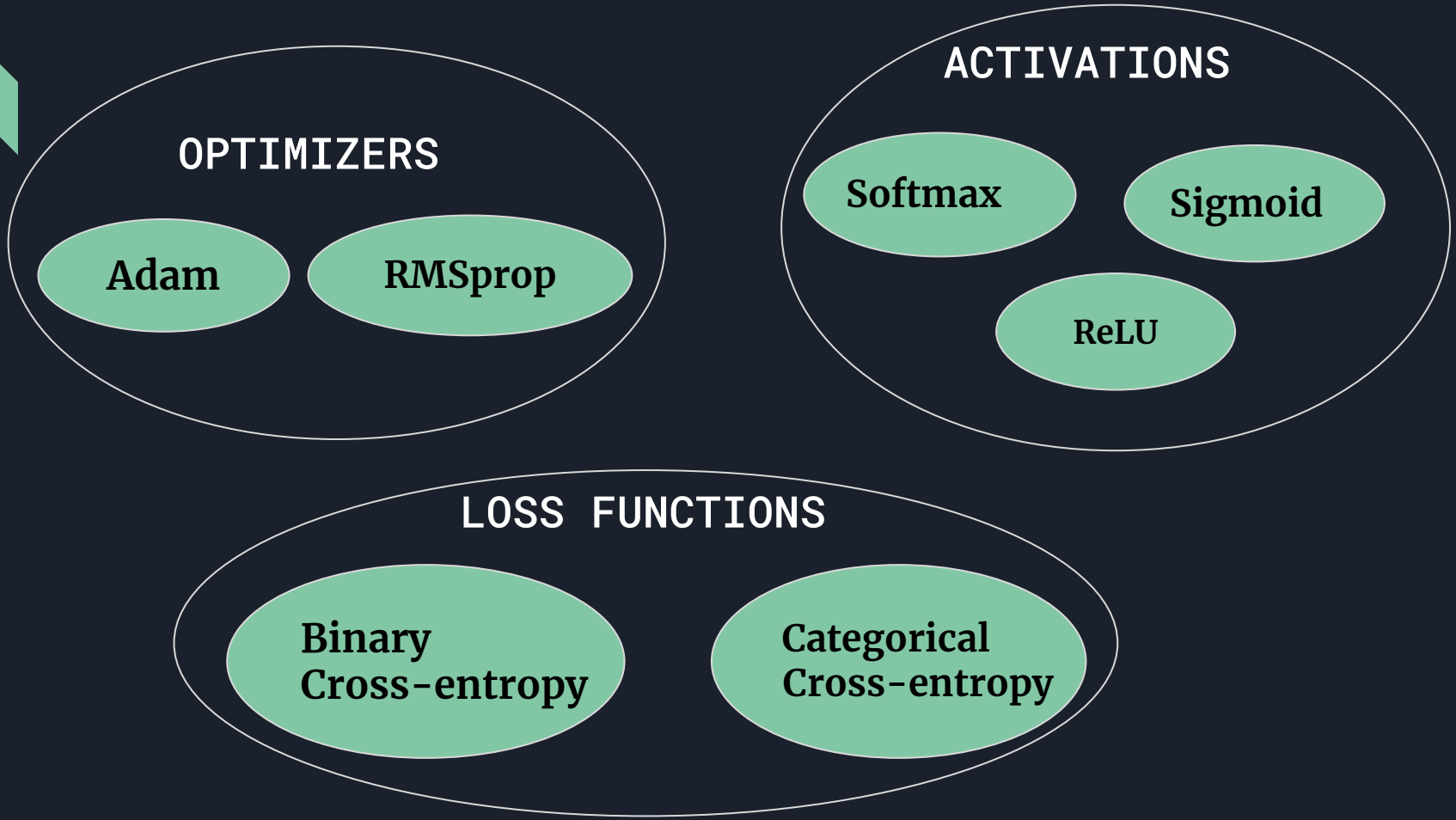



Figure : A basic convolutional neural network

# DEEP LEARNING TERMINOLOGIES



# TRANSFER LEARNING

Transfer learning is a machine learning method where a model developed for a task is reused as the starting point for a model on a second task. It is a popular approach in deep learning where pre-trained models are used as the starting point on computer vision and natural language processing tasks given the vast compute and time resources required to develop neural network models on these problems and from the huge jumps in skill that they provide on related problems.

# RESNET-50 MODEL

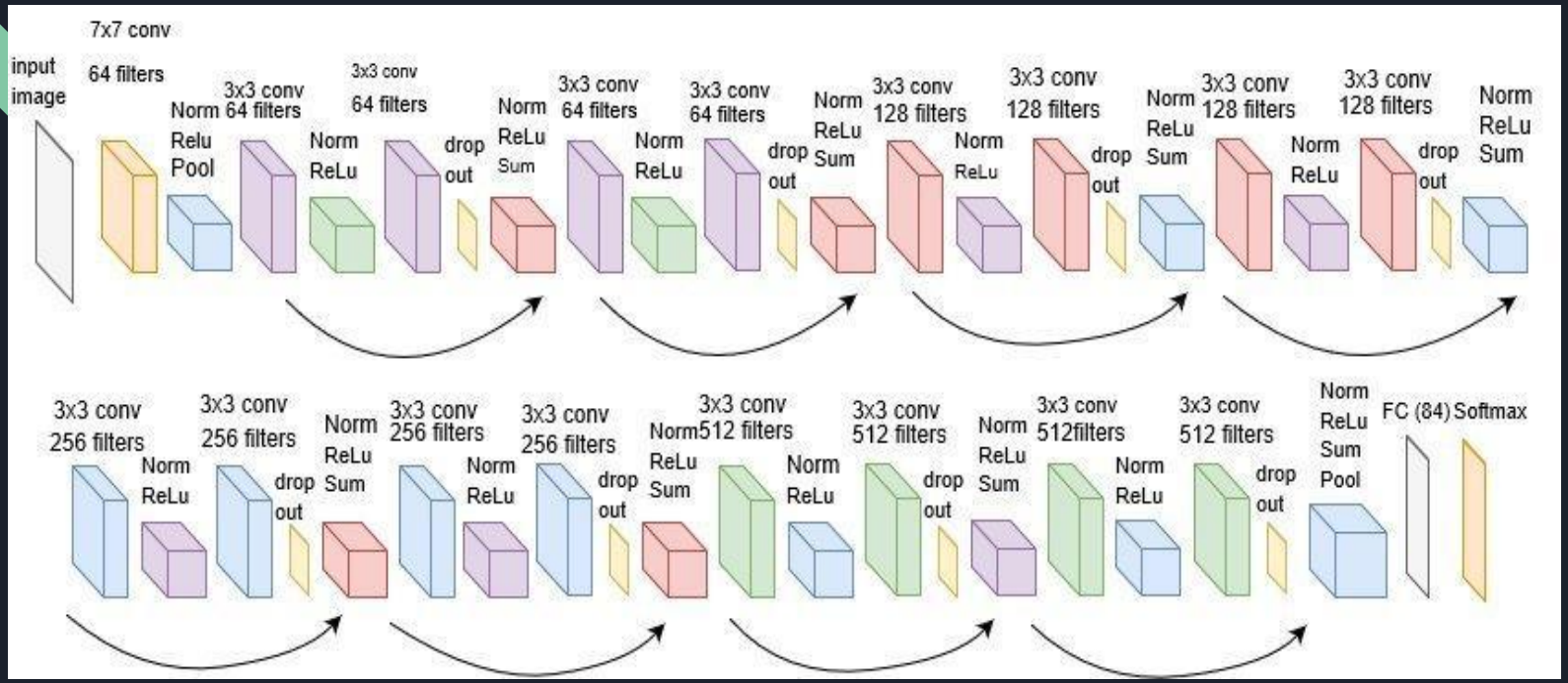



Figure : Resnet-50 Architecture also know as Residual Network or Skip-Net Connection.

# INCEPTION V3 MODEL

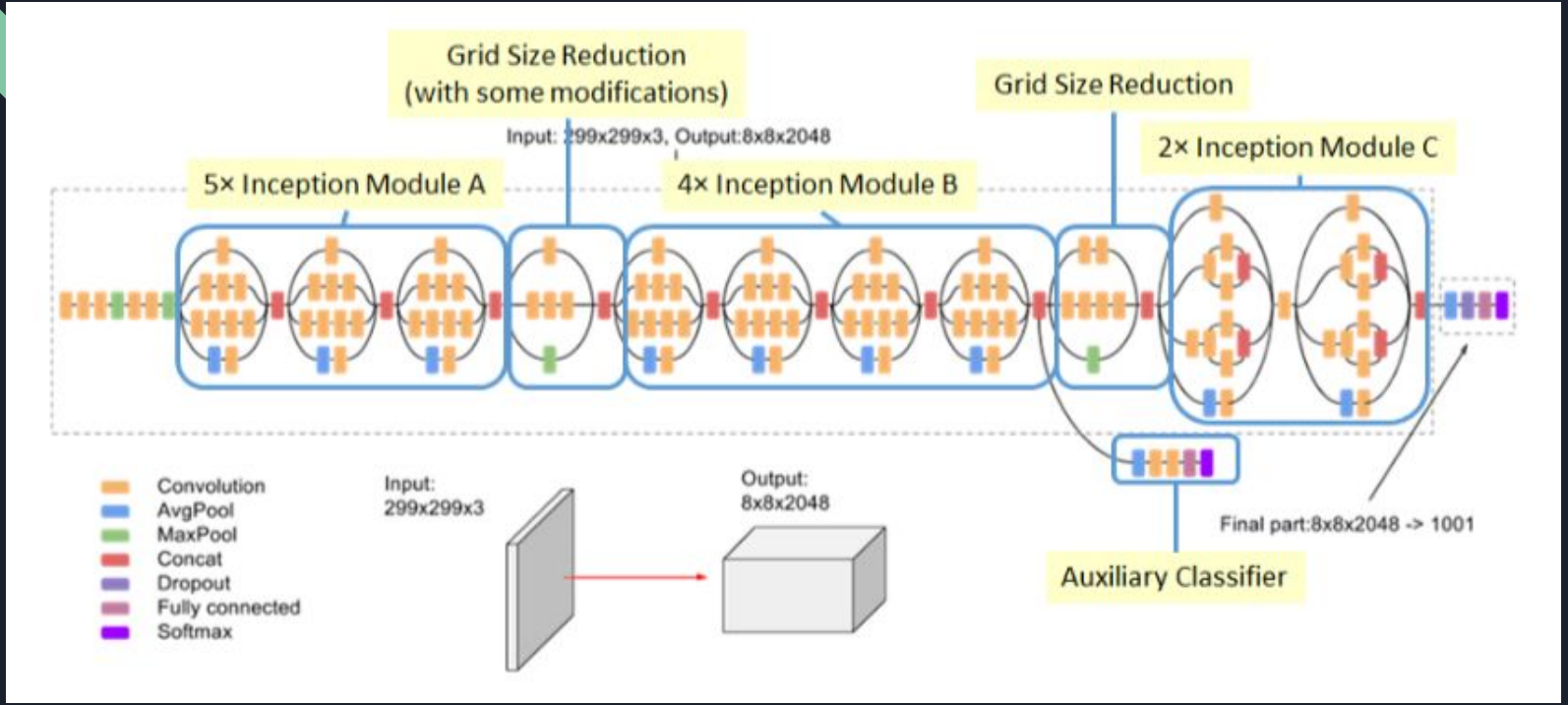



Figure : Inception v3 Architecture it is the third version of GoogleNet Model.

# VGG-16 MODEL

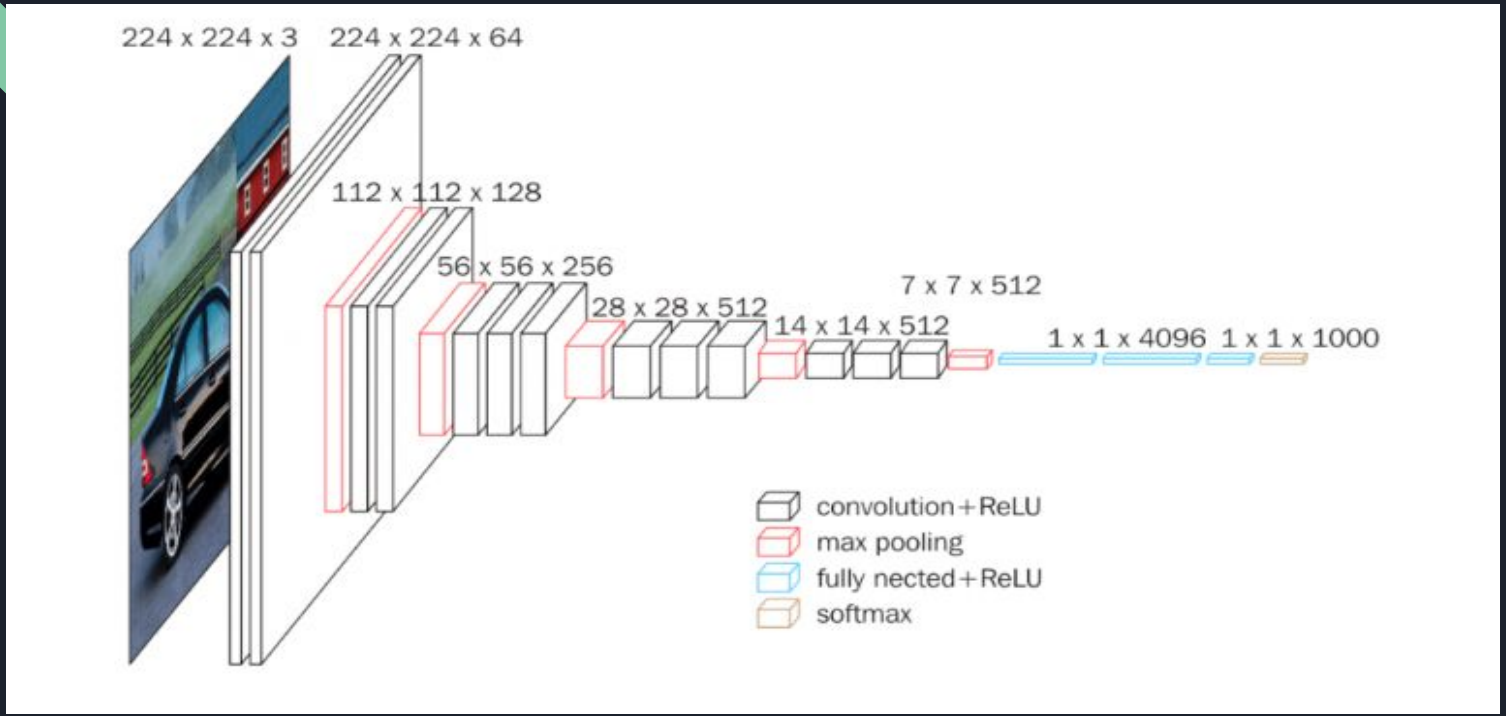



Figure : VGG-16 Model Architecture

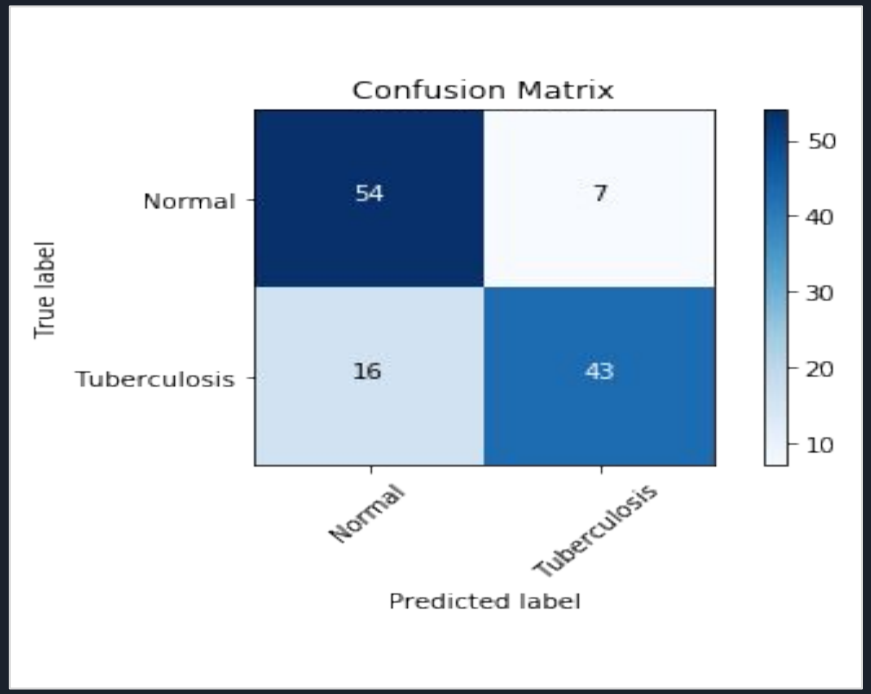
# TUBERCULOSIS DETECTION MODEL

Half a million children become ill with TB each year. There are 10 million children worldwide who had been orphaned because a parent died of TB. Tuberculosis is a leading cause of death from infectious disease worldwide, and is an epidemic in many developing nations. Countries where the disease is common tend to have poor access to medical care and diagnostics test.Basic diagnosis of TB has not changed for more than a century. New genetic tests for TB make it possible to rapidly identify people who need TB treatment. But a simple quick test of the sort already available for diseases like HIV and malaria is needed urgently.
So the aim here is to make a model that can look at a chest x-ray and predict accurately and swiftly whether a person has TB or not. The model being used in this case has custom architecture created and trained specifically for TB detection.

Input :
Chest X-Ray Image of Person

Output:
TB or not with percentage probability

# TUBERCULOSIS DETECTION MODEL




Accuracy Score = 84.56%

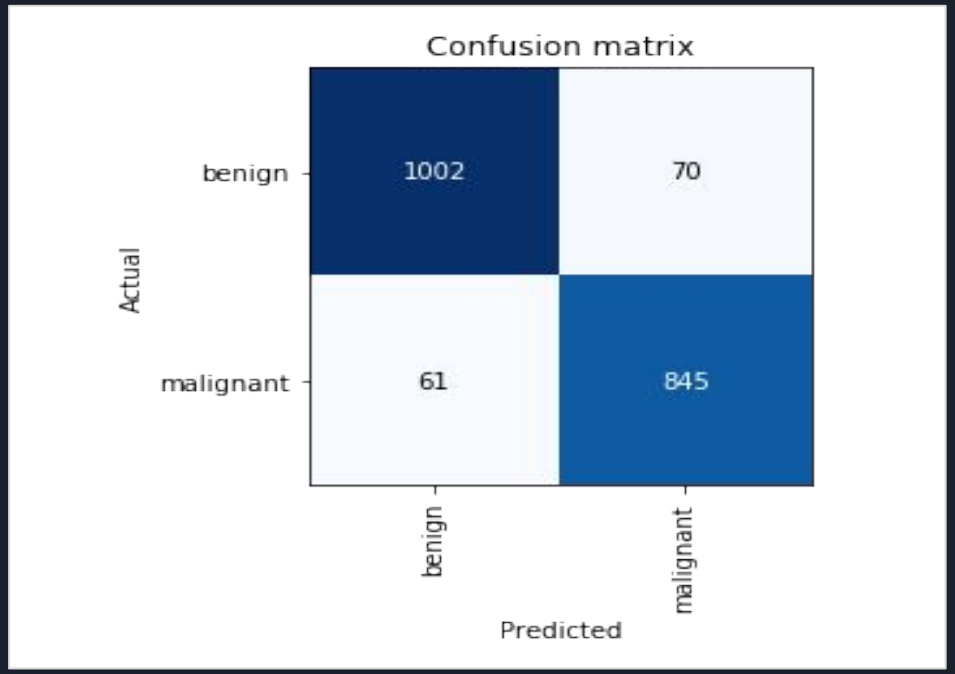
# SKIN CANCER RECOGNITION MODEL

According to recent stats,  more people are diagnosed with skin cancer each year than all the other cancers combined and it is estimated to increase exponentially in the future. In the US, more than 10k people are diagnosed with skin cancer everyday. Skin cancer is common, yet the number of dermatologists is fairly low. AI can reduce dermatologist workloads by eliminate repetitive and routine task..
So, aim of the model is classify skin images into benign and Malignant skin moles using resnet-50 model architecture fine tuned on the skin images dataset.

Input: Skin Images

Output: Benign Skin moles or Malignant Skin moles with percentage probabilities

# SKIN CANCER RECOGNITION MODEL




Accuracy Score: 91.87%

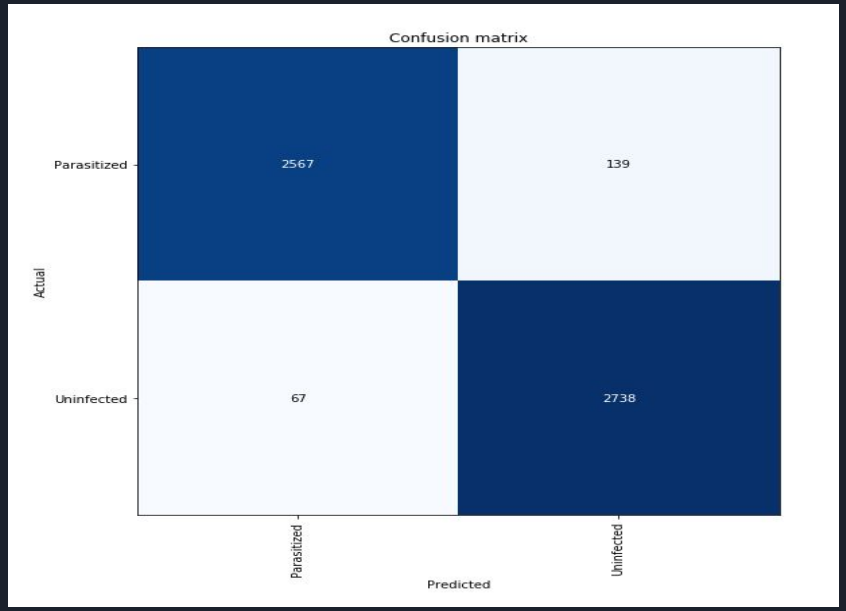
# MALARIA DETECTION MODEL

According to World Health Organization(WHO), there are over 200 million malaria cases and approx 400,000 deaths due to malaria every year. Since people and professionals are not equipped with adequate resources in many countries so many cases concerning these may go undetected and possibly endanger lives or chronic ailments.
So, aim of the model is to reduce such cases by predicting accurately and swiftly if the person has malaria just by looking at microscopic image of the blood smear slide. The model being used in this case has custom architecture created and trained specifically for malaria detection

Input
Microscopic image of blood smear slide

Output
Parasitic or Normal with the percentage probability

# MALARIA DETECTION MODEL




Accuracy Score = 96.26%

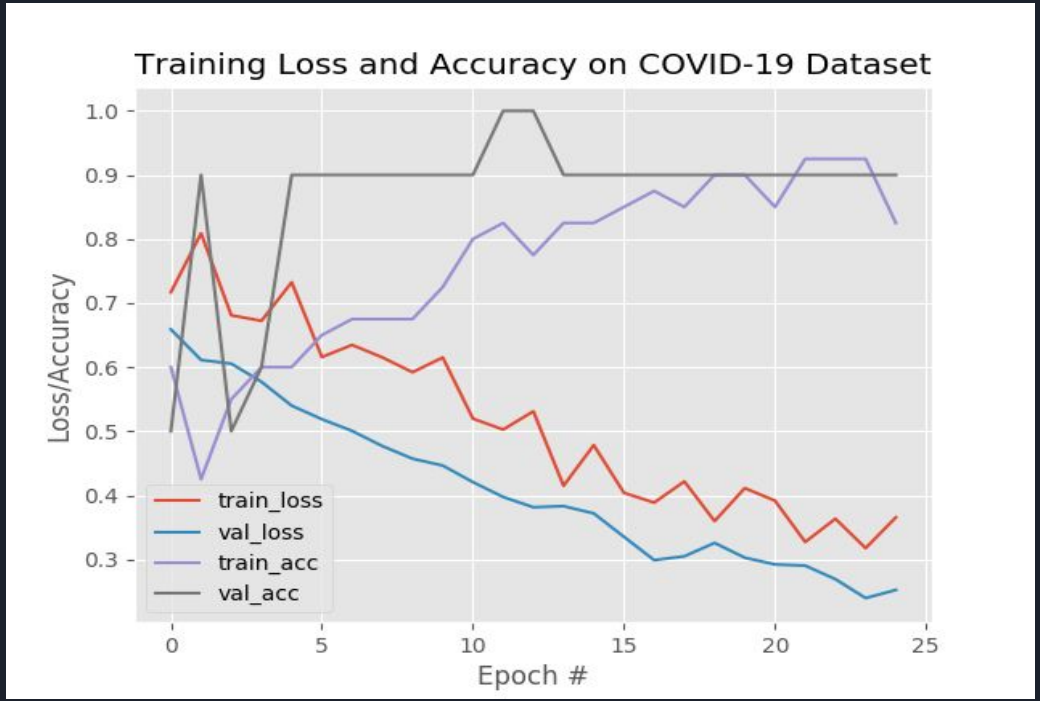
# COVID-19 DETECTION MODEL

The Covid-19 pandemic continuous to have a devastating effect on the global health. Covid-19 has widely spread all over the world since the first case was detected at the end of 2019. Early diagnosis of the disease is important for treatment and the isolation of the patients to prevent the virus spread. Currently, there are 6.93 million cases recorded worldwide. A critical step in the fight against this virus is effective screening of patients, with one of the key approaches being radiology examination.
The purpose of developing this model is to fully automate the work to detect Covid-19 using chest X-Ray Scans and evaluate its performance. VGG-16 model architecture is used with fine tuning on our dataset.

Input: Chest X-Rays Scans

Output: Normal or Covid with percentage probabilities

# COVID-19 DETECTION MODEL




Accuracy Score: 91.87%

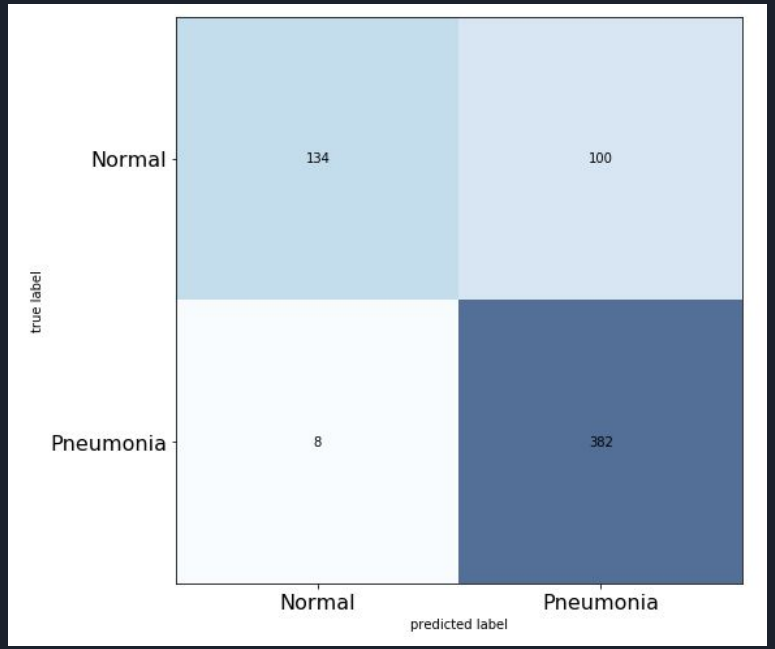
# PNEUMONIA DETECTION

Pneumonia is a breathing condition in which there is an infection of lungs. It is extremely common illness that affects millions of people in each country every year. According to one of the stat, pneumonia accounts for 15% of all deaths of children under 5 years old. Usually it is treatable and is not a very dangerous disease but the main problem arises when it goes undetected in which case it can become very dangerous, even life threatening.
Aim of the model here is to look at chest X-Ray images and predict whether the person has pneumonia or not.

Input
Chest X-Ray image of the person.

Output
Pneumonia or not with percentage probability

# PNEUMONIA DETECTION MODEL




Accuracy Score = 86.69%

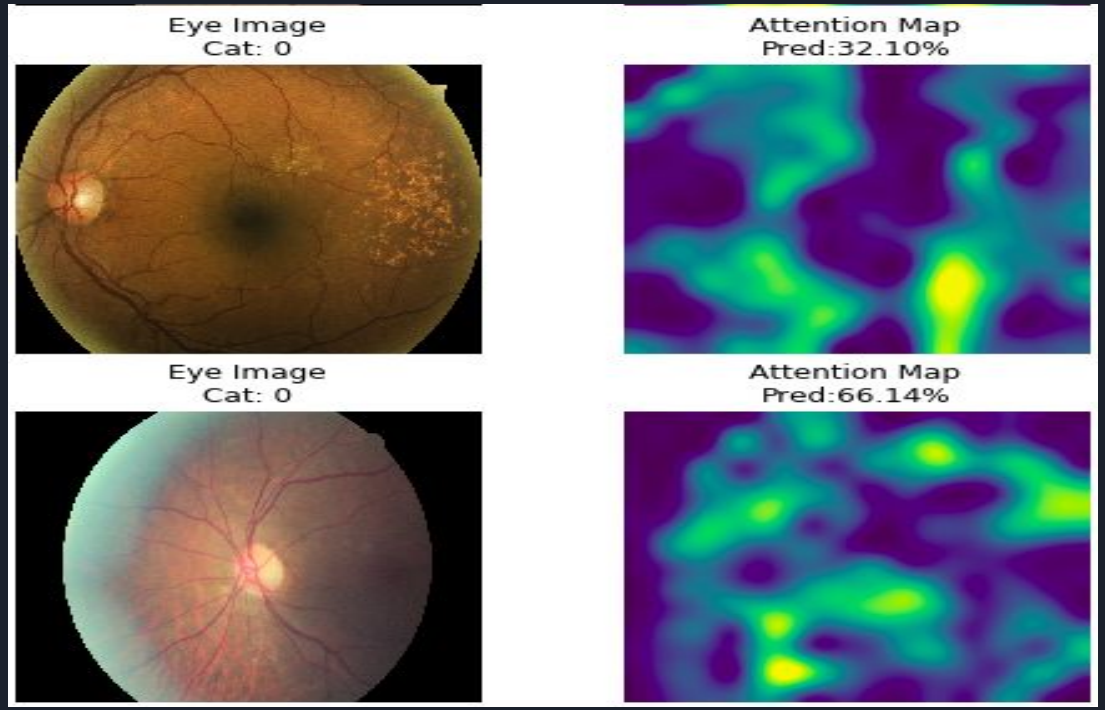
# DIABETIC RETINOPATHY(DR) DETECTION MODEL

Diabetic retinopathy is the leading cause of blindness in the working age population. Globally, 600 million people will have diabetes by 2040, with one  third having DR. A pooled analysis  of 22,896 people with diabetes from 35 population-based studies in the USA, Australia, Europe and Asia showed that the overall prevalence of any DR was 34.6%, with 7% vision-threatening diabetic retinopathy. Screening for DR, coupled with timely referral and treatment, is a universally accepted strategy for blindness prevention.
Aim of this model is to speed up disease detection by accurately classifying retina images into various categories of Diabetic retinopathy using inception V3 model architecture which is fine tuned for our dataset..

Input: Retina images taken using Fundus photography

Output: No DR, Mild, Moderate, Severe or Proliferative DR with percentage probabilities

# DIABETIC RETINOPATHY DETECTION




Accuray Score: 88.34%

# TECHNOLOGY STACK

## CLIENT SIDE

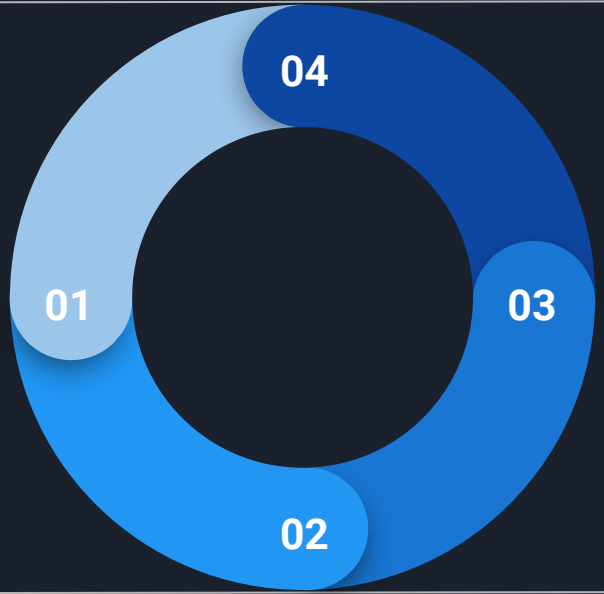
Web Application: REACTJS

Language: JAVASCRIPT

## SERVER SIDE

API : STARTLETTE + UNICORN, KERAS

Version Control: GITHUB




## THE OPS

Environment: DOCKER

Cloud Service: GOOGLE CLOUD SERVICE(GCP) +CLOUD RUN AND BUILD API (CI/CD)

## ML MODELS

Language: PYTHON

Libraries: TENSORFLOW KERAS & OPENCV

# CONCEPT AND DEMO OF THE APPLICATION

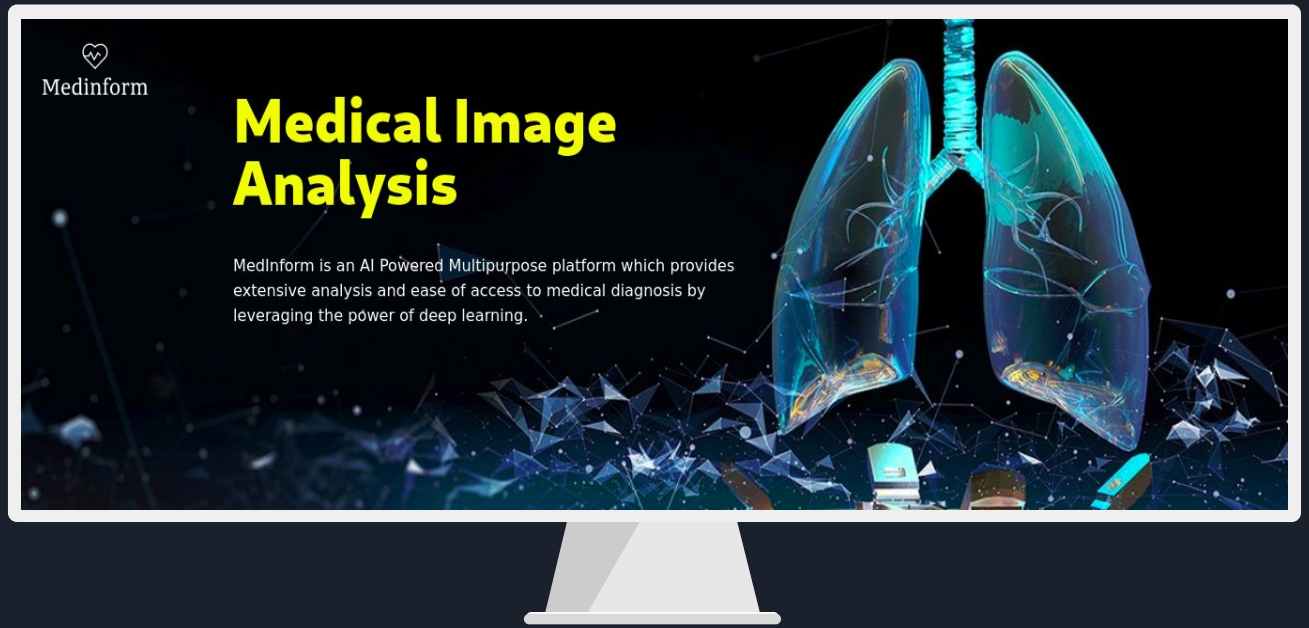



Figure : Home page of the Application

# CONCEPT AND DEMO OF THE APPLICATION


Figure :Home Page:  Services of the application

# CONCEPT AND DEMO OF THE APPLICATION

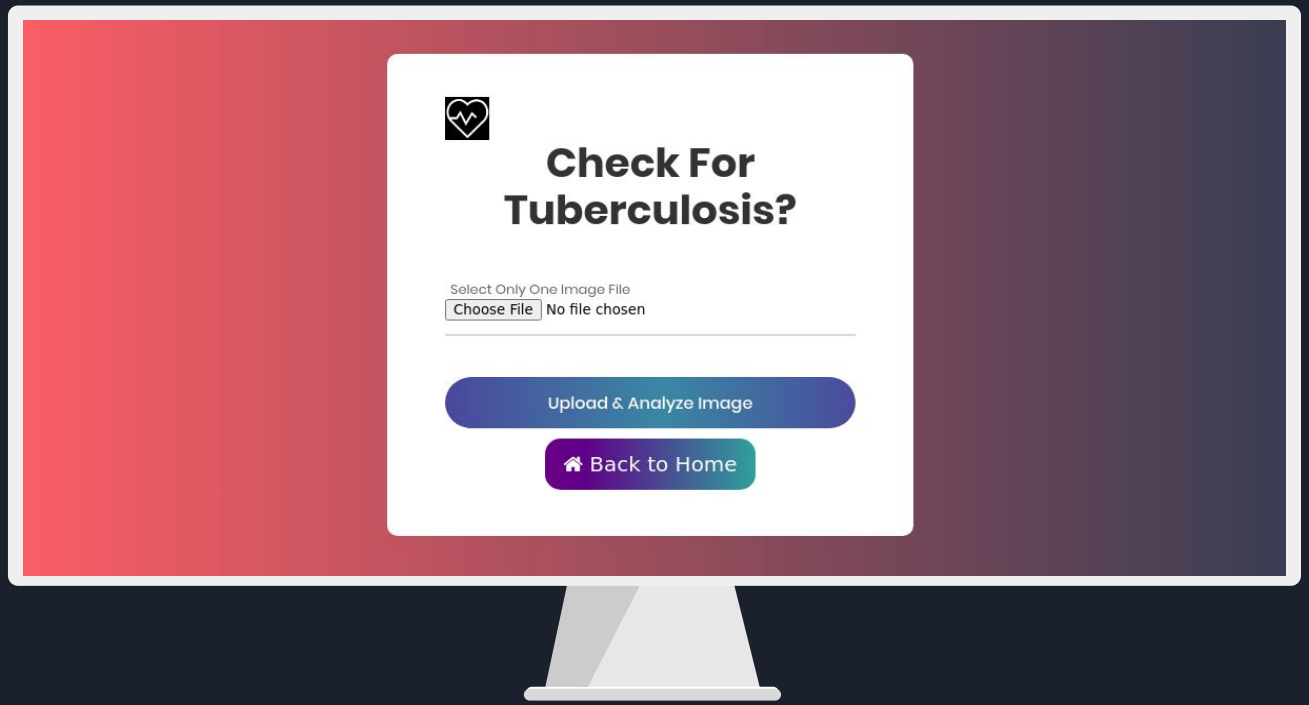



Figure : Image Upload Page

# CONCEPT AND DEMO OF THE APPLICATION

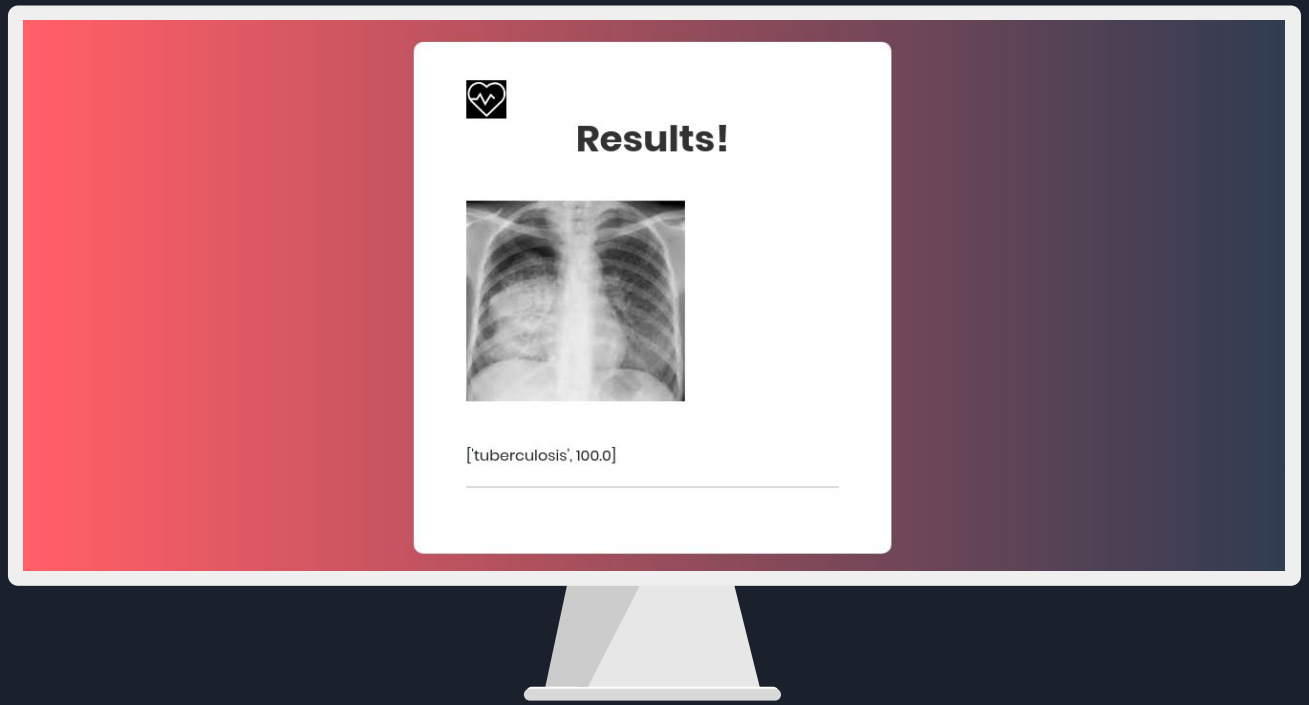



Figure : Result Page

# Thank you!

VISIT MEDINFORM TO CHECK LIVE DEMO OF OUR APPLICATION!