A

Mini Project

On

BREAST CANCER CLASSIFICATION USING CNN

(Submitted in partial fulfillment of the requirements for the award of Degree)

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

By

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CMR TECHNICAL CAMPUS

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2019-2023

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project entitled **"BREAST CANCER CLASSIFICATION USING CNN"** being submitted by **P.SAI PREETHI (197R1A05N9), N.PREETHI (197R1A05N6) & A.CHANDRIKA (197R1A05J3)** in partial fulfillment of the requirements for the award of the degree of B.Tech in Computer Science and Engineering to the Jawaharlal Nehru Technological University Hyderabad, is a record of bonafide work carried out by them under our guidance and supervision during the year 2022-23.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

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HOD

EXTERNAL EXAMINER

Submitted for viva voice Examination held on _____

ACKNOWLEDGEMENT

Apart from the efforts of us, the success of any project depends largely on the encouragement and guidelines of many others. We take this opportunity to express our gratitude to the people who have been instrumental in the successful completion of this project.

We take this opportunity to express my profound gratitude and deep regard to my guide **Rakshitha Okali,** Assistant Professor for her exemplary guidance, monitoring and constant encouragement throughout the project work. The blessing, help and guidance given by her shall carry us a long way in the journey of life on which we are about to embark.

We also take this opportunity to express a deep sense of gratitude to the Project Review Committee (PRC) **Dr. Punyaban Patel, Ms. Shilpa, Dr. M . Subha Mastan Rao & J. Narasimharao** for their cordial support, valuable information and guidance, which helped us in completing this task through various stages.

We are also thankful to **Dr. K. Srujan Raju,** Head, Department of Computer Science and Engineering for providing encouragement and support for completing this project successfully.

We are obliged to **Dr. A. Raji Reddy,** Director for being cooperative throughout the course of this project. We also express our sincere gratitude to Sri. **Ch. Gopal Reddy,** Chairman for providing excellent infrastructure and a nice atmosphere throughout the course of this project.

The guidance and support received from all the members of **CMR Technical Campus** who contributed to the completion of the project. We are grateful for their constant support and help.

Finally, we would like to take this opportunity to thank our family for their constant encouragement, without which this assignment would not be completed. We sincerely acknowledge and thank all those who gave support directly and indirectly in the completion ofthis project.

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ABSTRACT

Breast cancer is diagnosed in about 12% of women during their lifetime and it is the second leading reason for women's death. Since early diagnosis could improve treatment outcomes and longer survival times for breast cancer patients, it is significant to develop breast cancer detection techniques. The Convolutional Neural Network (CNN) can extract features from images automatically and then perform classification. To train the CNN from scratch, however, requires a large number of labeled images, which is infeasible for some kinds of medical image data such as mammographic tumor images. A promising solution is to apply transfer learning in CNN. we firstly tested three training methods on the MIAS:

1) trained a CNN from scratch.

2) applied the pre-trained VGG-16/Inception/Exception/Resnet model to extract features from input mammograms and used these features to train a Neural Network (NN)-classifier.

3) updated the weights in several final layers of the pre-trained VGG-16 Inception/Exception/Resnet model by back-propagation (finetuning) to detect abnormal regions. We found that method 2 is ideal for study because the classification accuracy of fine-tuning model was just 0.008 higher than that of feature extraction model but time cost of feature extraction model was only about 5% of that of the fine-tuning model. Then, we used method 2 to classify regions: benign vs. normal, malignant vs. normal and abnormal vs. normal from the DDSM database with 10-fold cross validation. The average validation accuracy converged at about 0.905 for abnormal vs. normal cases, and there was no obvious overfitting. This study shows that applying transfer learning in CNN can detect breast cancer from mammograms and training a NN-classifier by feature extraction is a faster method in transfer learning.

Keywords—breast mass classification, transfer learning, deep learning, convolutional neural networks, mammogram, computer aided diagnosis, fine-tuning.

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1. INTRODUCTION

1.1 PROJECT SCOPE

This project has been developed to identify Deep learning based methods thatcan extract more accurate cancer results. Deep learning is making crucial advances in solving problems that have restricted the best attempts of the artificial intelligence community for many years. It has proven to be excellent at revealing complex structures in high-dimensional data and is therefore applicable to lots of domains of science, business and government.

1.2 PROJECT PURPOSE

This project has been developed to identify Deep learning based methods that can extract more complicated face features. Deep learning is making crucial advances in solving problems that have restricted the best attempts of the artificial intelligence community for many years. It has proven to be excellent at revealing complex structures in high-dimensional data and is therefore applicable to lots of domains of science, business and government.

1.3 PROJECT FEATURES

In this project we used the CNN (Convolutional neural network) which is in deep learning that classifies the cancer image accurately at the earlier stage. Here, we are using some models to detect and classify the image given by user and the classification is benign (normal) and malignant (abnormal).We get to know that women is suffering from breast cancer or not from the homographic images by using the VGG-16, Resnet and Inception.

2. SYSTEM ANALYSIS

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System Analysis is the important phase in the system development process. The System is studied to the minute details and analyzed. The system analyst plays an important role of an interrogator and dwells deep into the working of the present system. In analysis, a detailed study of these operations performed by the system and their relationships within and outside the system is done. A key question considered here is, “what must be done to solve the problem?” The system is viewed as a whole and the inputs to the system are identified. Once analysis is completed the analyst has a firm understanding of what is to be done.

2.1 PROBLEM DEFINITION

A general statement of breast cancer classification can be formulated as the given images of a scene, identify the image and classifies the image as benign and malignant using CNN transfer learning techniques.

2.2 EXISTING SYSTEM

Early mammographic detection based on computer-aided detection (CAD) methods can improve treatment outcomes for breast cancer and longer survival times for the patients. Traditional CAD tools rely on manually extracted features, but they have a variety of drawbacks; for example, hand-crafted features tend to be domain specific, and the process of feature design can be tedious, difficult, and non-generalizable.

2.2.1 DISADVANTAGES OF EXISTING SYSTEM

- The radiation risk is irrelevant compared to the advantage of early detection.
- Since screening radiation is applied to the healthy population, screening mammography must be subject to strict quality assurance.
- Some women are afraid that compression might cause breast cancer.
- These women can be assured that no cancer can be caused by compression.

2.3 PROPOSED SYSTEM

In this project, we used mammographic images from MIAS and DDSM. Firstly, we tested three training methods on MIAS:

1) Trained a CNN from scratch.

2) Applied the pre-trained VGG-16/Inception/Xecption/Resnet model to extract features from input images and used these features to train a Neural Network (NN)-classifier.

3) Updated the weights in several last layers of VGG-16 model by backpropagation (fine-tuning) to detect abnormal regions. By comparison, we found that the method 2 is ideal for study. Secondly, we used method 2 to classify regions: benign vs. normal, malignant vs. normal and abnormal vs. normal from DDSM.

This study shows that applying transfer learning in CNN can detect breast cancer from mammograms and training a NN-classifier by feature extraction is a faster method in transfer learning.

2.3.1 ADVANTAGES OF PROPOSED SYSTEM

- Conventional methods take up a large amount of time in examination of one data at a time, ANN examines a large amount of data after a short training period.
- ANNs predict outputs with a high accuracy and are easy to code.
- ANNs can be developed in order to diagnose breast cancer, which broadens the horizons for earlier and easier breast cancer detection.

2.4 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

- Economic Feasibility
- Technical Feasibility

- Social Feasibility

2.4.1 ECONOMIC FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

2.4.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.4.3 SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

2.5 HARDWARE & SOFTWARE REQUIREMENTS

2.5.1 HARDWARE REQUIREMENTS:

Hardware interfaces specify the logical characteristics of each interface between the software product and the hardware components of the system. The following are some hardware requirements.

System	**:**	Intel core i3 (Minimum)
Hard Disk	**:**	1 TB.
Monitor	**:**	14’ Colour Monitor.
Mouse	**:**	Optical Mouse.
Ram	**:**	8 GB

2.5.2 SOFTWARE REQUIREMENTS:

Software Requirements specifies the logical characteristics of each interface and software components of the system.
The following are some software requirements:

Operating system	**:**	Windows 10 Ultimate
Coding Language	**:**	Python.
Front-End	**:**	Python console, jupyter notebook, HTML.
Data-Base	**:**	SQLite-3

3. ARCHITECTURE

3. ARCHITECTURE

3.1 PROJECT ARCHITECTURE

This project architecture shows the procedure followed for classification, starting from input to final prediction.

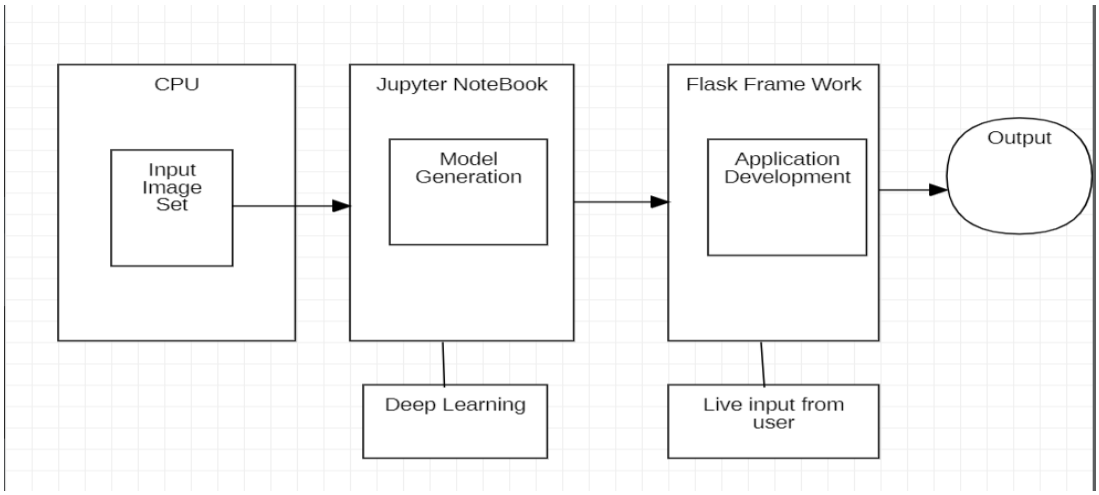


Figure 3.1 Project Architecture of Breast Cancer Classification using CNN

3.2 DESCRIPTION

This project is totally based upon detection of breast cancer. In this we use the mammographic images to detect the cancer. User will give the mammographic image then it will check in the pretrained models after that it will gives the output that the women are affected from the breast cancer or not.

3.3 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use case in which the user is involved. A use case diagram is used to structure of the behavior thing in a model. The use cases are represented by either circles or ellipses.

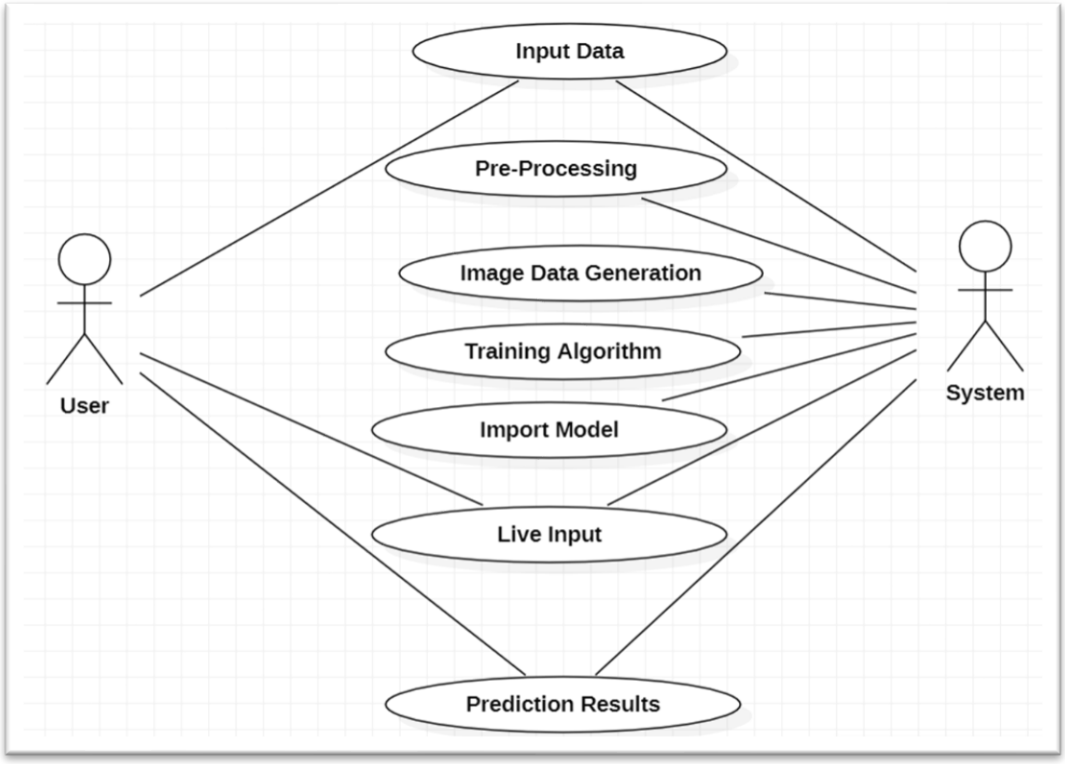


Figure 3.2 Use Case Diagram for Breast Cancer Classification Using CNN

3.4 CLASS DIAGRAM

In software engineering, a class diagram in the Unified Modelling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

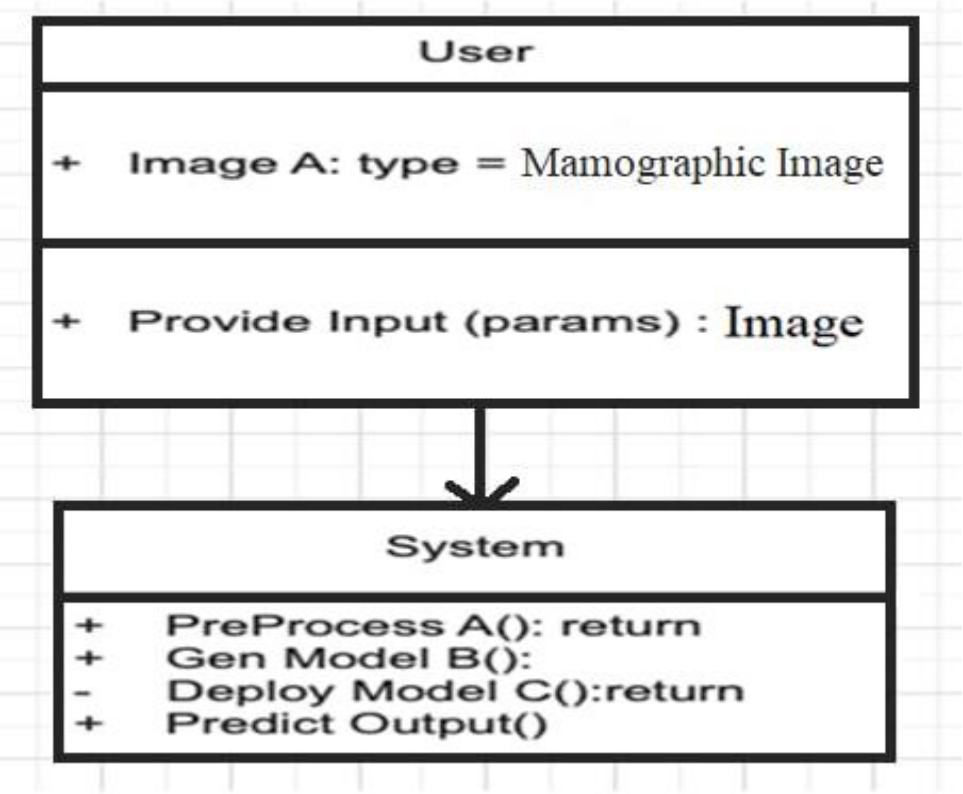


Figure 3.3 Class Diagram for Breast Cancer Classification Using CNN

3.5 SEQUENCE DIAGRAM

A sequence diagram simply depicts interaction between objects in a sequential order i.e., the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

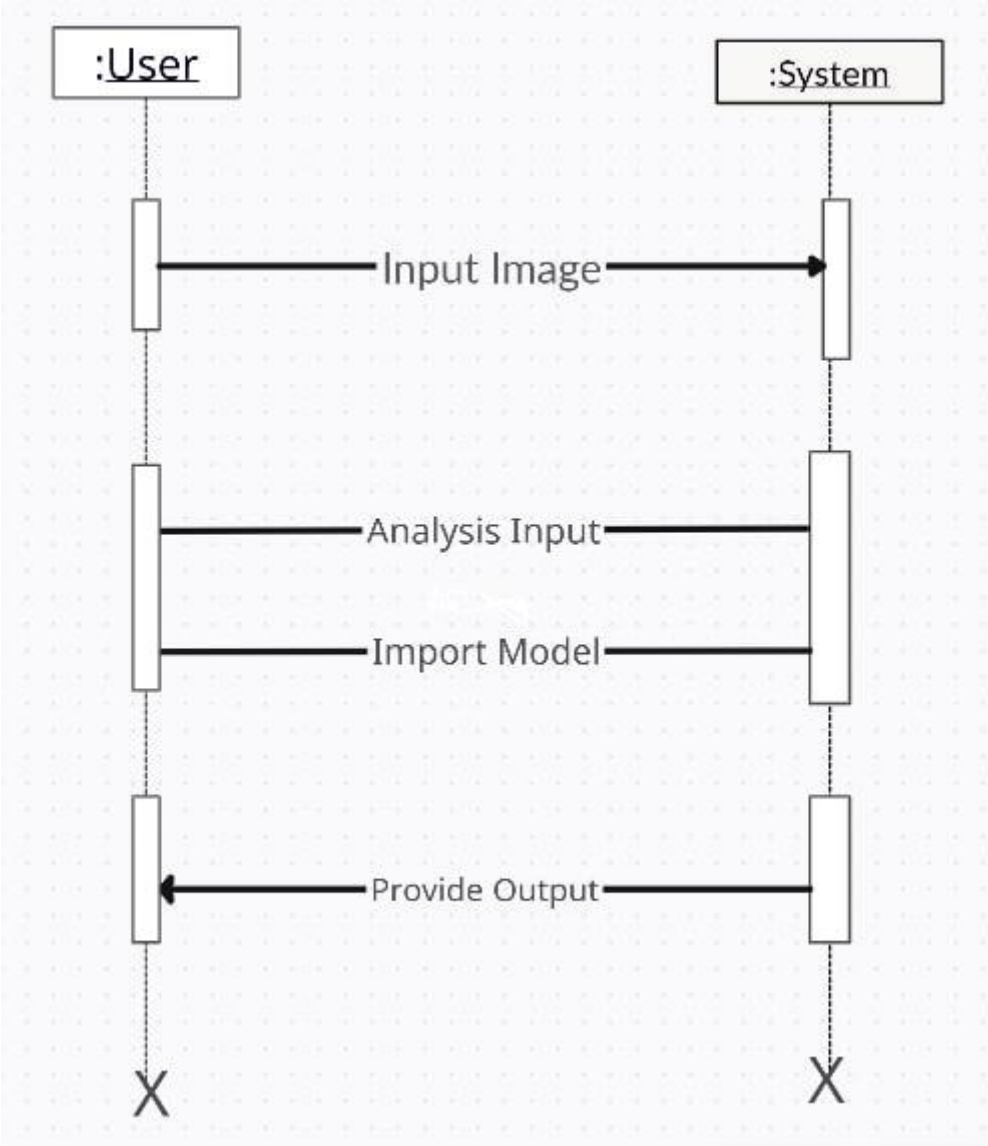


Figure 3.4 Sequence Diagram for Breast Cancer Classification Using CNN

3.6 ACTIVITY DIAGRAM

A sequence diagram simply depicts interaction between objects in a sequential order i.e., the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

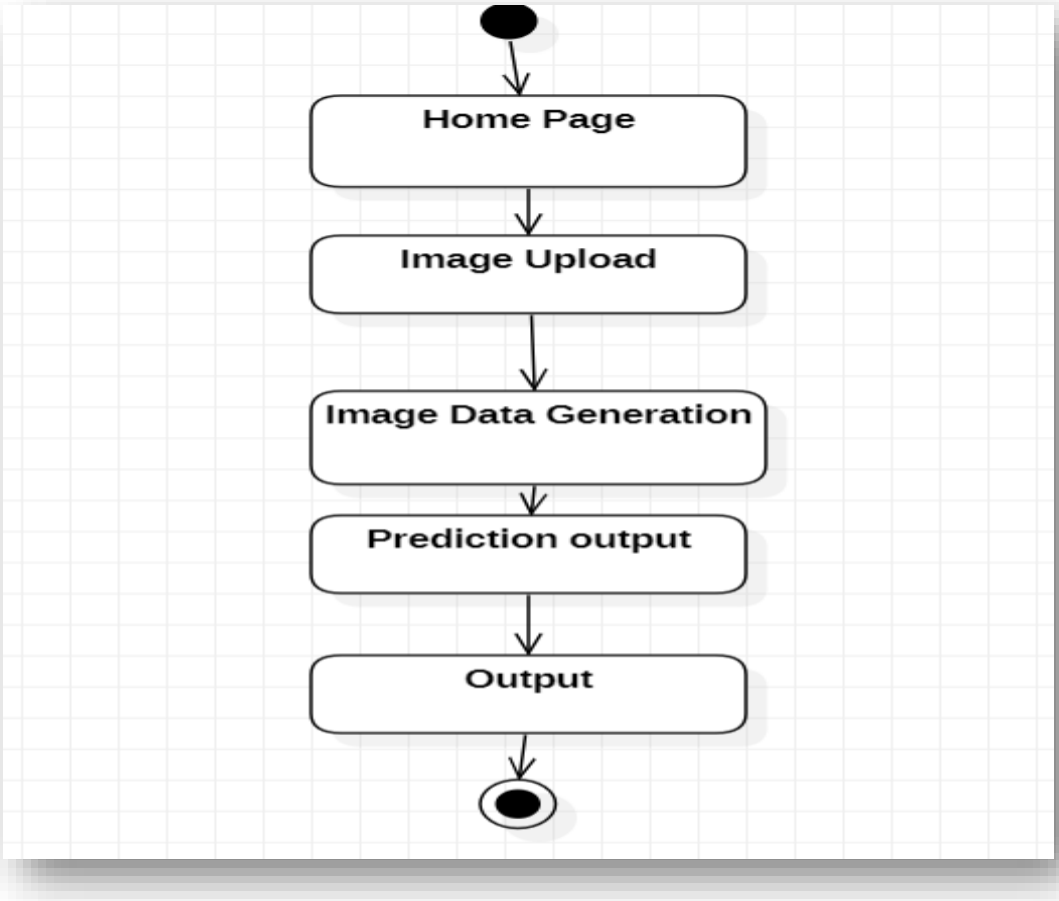


Figure 3.5 Activity Diagram for Breast Cancer Classification Using CNN

4. IMPLEMENTATION

4. IMPLEMENTATION

4.1 SAMPLE CODE

app.py

```
from __future__ import division, print_function
# coding=utf-8
import sys
import os
import glob
import re
import numpy as np
# Keras"""
from tensorflow.keras.applications.imagenet_utils import preprocess_input,
    decode_predictions
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
# from tensorflow.applications.imagenet_utils import preprocess_input,
    decode_predictions
# from tensorflow.models import load_model
# from tensorflow.preprocessing import image
# Flask utils
from flask import Flask, redirect, url_for, request, render_template
from werkzeug.utils import secure_filename
import sqlite3
app = Flask(__name__)
UPLOAD_FOLDER = 'static/uploads/'
# allow files of a specific type
ALLOWED_EXTENSIONS = set(['png', 'jpg', 'jpeg'])
# function to check the file extension
def allowed_file(filename):
return '.' in filename and \
filename.rsplit('.', 1)[1].lower() in ALLOWED_EXTENSIONS
model_path2 = 'model3.h5' # load .h5 Model
CTS = load_model(model_path2)
from tensorflow.keras.preprocessing.image import load_img, img_to_array
def model_predict2(image_path,model):
print("Predicted")
```

```
image = load_img(image_path,target_size=(224,224))
image = img_to_array(image)
image = image/255
image = np.expand_dims(image,axis=0)
result = np.argmax(model.predict(image))
if result == 0:
return "BENIGN","after.html"
elif result == 1:
return "MALIGNANT","after.html"
@app.route("/")
@app.route('/home')
def home():
return render_template('home.html')
@app.route('/predict2',methods=['GET','POST'])
def predict2():
print("Entered")
print("Entered here")
file = request.files['files'] # fet input
filename = file.filename
print("@@ Input posted = ", filename)
file_path = os.path.join(UPLOAD_FOLDER, filename)
file.save(file_path)
print("@@ Predicting class.....")
pred, output_page = model_predict2(file_path,CTS)
return render_template(output_page, pred_output = pred,
    img_src=UPLOAD_FOLDER + file.filename)

if __name__ == '__main__':
app.run(debug=False)
home.html
<!DOCTYPE html>
<html>
<head>
<!-- Basic -->
<meta charset="utf-8" />
<meta http-equiv="X-UA-Compatible" content="IE=edge" />
<!-- Mobile Metas -->
<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-
    fit=no" />
```

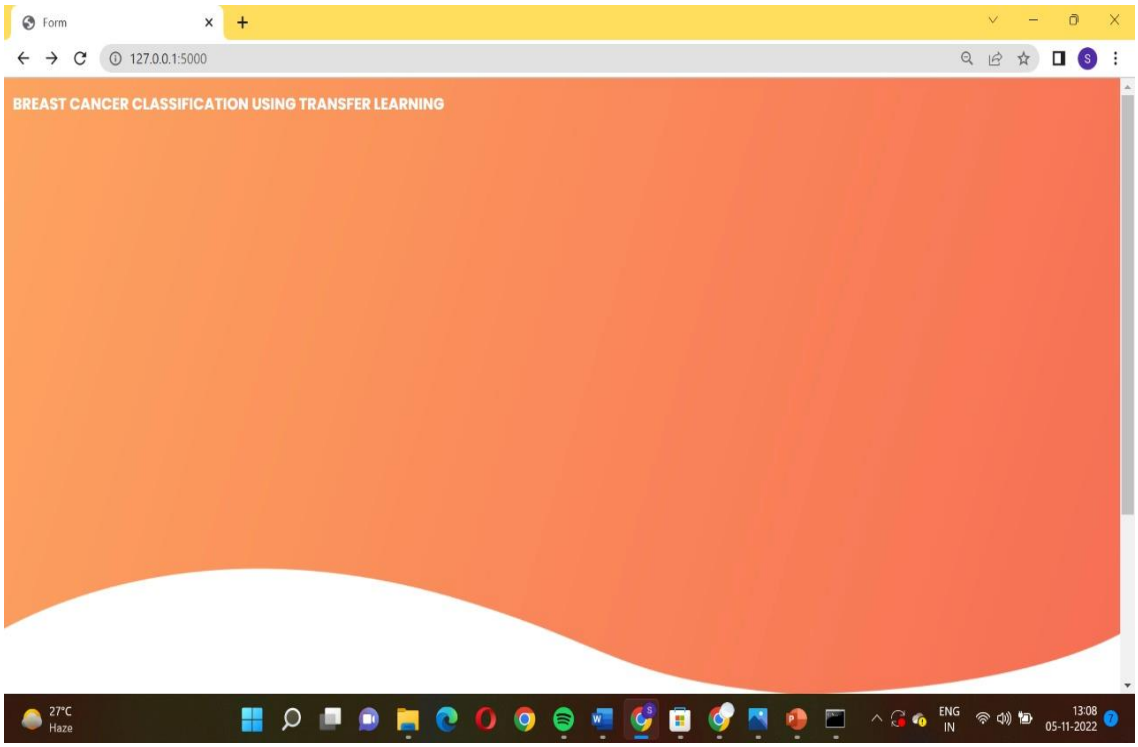
```
<!-- Site Metas -->
<meta name="keywords" content="" />
<meta name="description" content="" />
<meta name="author" content="" />
<title>Form</title>
<!-- slider stylesheet -->
<!-- bootstrap core css -->
<link rel="stylesheet" type="text/css" href="static/css/bootstrap.css" />
<!-- fonts style -->
<link
    href="https://fonts.googleapis.com/css?family=Baloo+Chettan|Dosis:400,600,700
    |Poppins:400,600,700&display=swap" rel="stylesheet" />
<!-- Custom styles for this template -->
<link href="static/css/style.css" rel="stylesheet" />
<!-- responsive style -->
<link href="static/css/responsive.css" rel="stylesheet" />
</head>
<body>
<div class="hero_area">
<!-- header section strats -->
<header class="header_section">
<div class="container-fluid">
<nav class="navbar navbar-expand-lg custom_nav-container">
<a class="navbar-brand" href="/home">
<span>
BREAST CANCER CLASSIFICATION USING TRANSFER LEARNING
</span>
</a>
<div id="myNav" class="overlay">
<div class="overlay-content">
<a style="font-size: large; color: white;" href="/home" class="active">Home</a>
<a style="margin-left: 10px;font-size: large;color: white;" href="#"
    class="active">About</a>
</div>
</div>
</div>
</nav>
</header>
</div>
```

```
<section class=" slider_section position-relative">
<div id="Customcarousel1" class="carousel slide" data-ride="carousel">
<div class="carousel-inner">
<div class="carousel-item active">
<div class="container">
<h1 class="text-dark mb-2">Upload your image to be classified!</h1>
<h4 class="text-dark mb-5">
(Please upload images less than 500kb in size)
</h4>
<form enctype="multipart/form-data" action="/predict2" method="post">
<p class="text-dark">
<input type="file" name="files" />
<input type="submit" value="Upload" />
</p>
</form>
</div>
</div>
</div>
</div>
</div>
<br><br>
</section>
<!-- end about section -->
<div class="footer_bg">
<!-- end info_section -->
<!-- footer section -->
</div>
<script type="text/javascript" src="static/js/jquery-3.4.1.min.js"></script>
<script>
function openNav() {
document.getElementById("myNav").classList.toggle("menu_width");
document
.querySelector(".custom_menu-btn")
.classList.toggle("menu_btn-style");
}
</script>
</body>
</html>
```

5. RESULTS

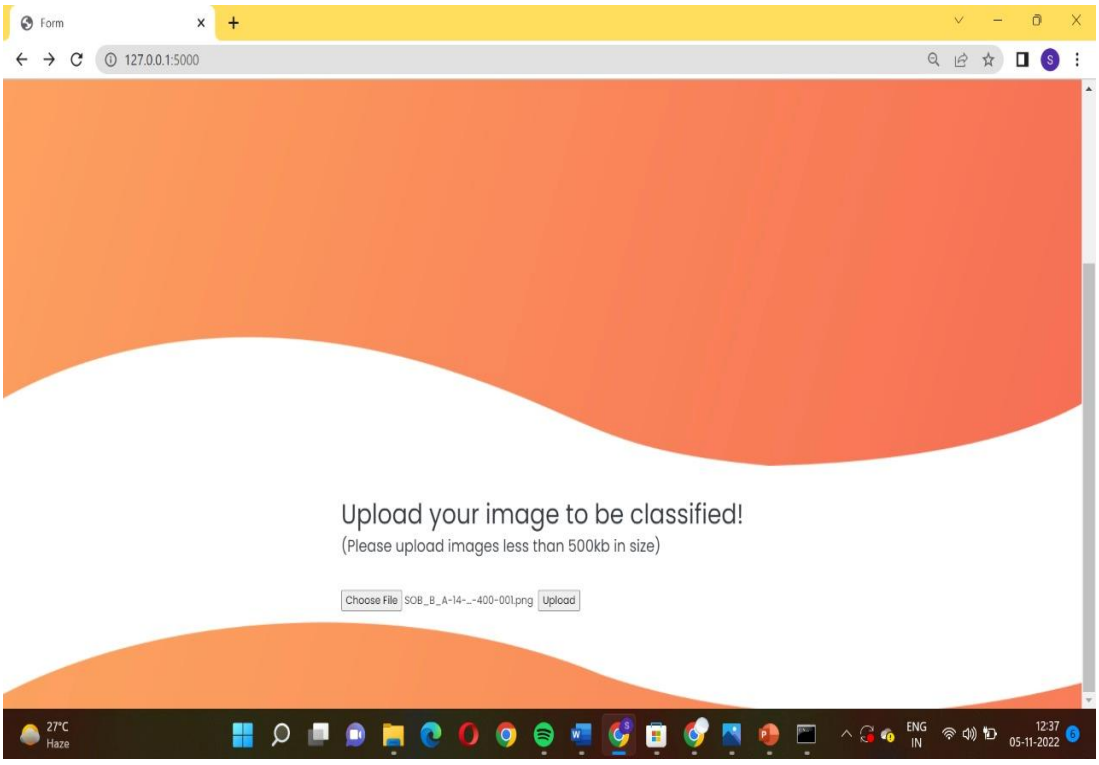
5. RESULTS

This is the main page of the breast cancer classification in this page we will upload the image and it detects and classifies the image that is benign and malignant. We provide the Homographic images to classify the image accurately.



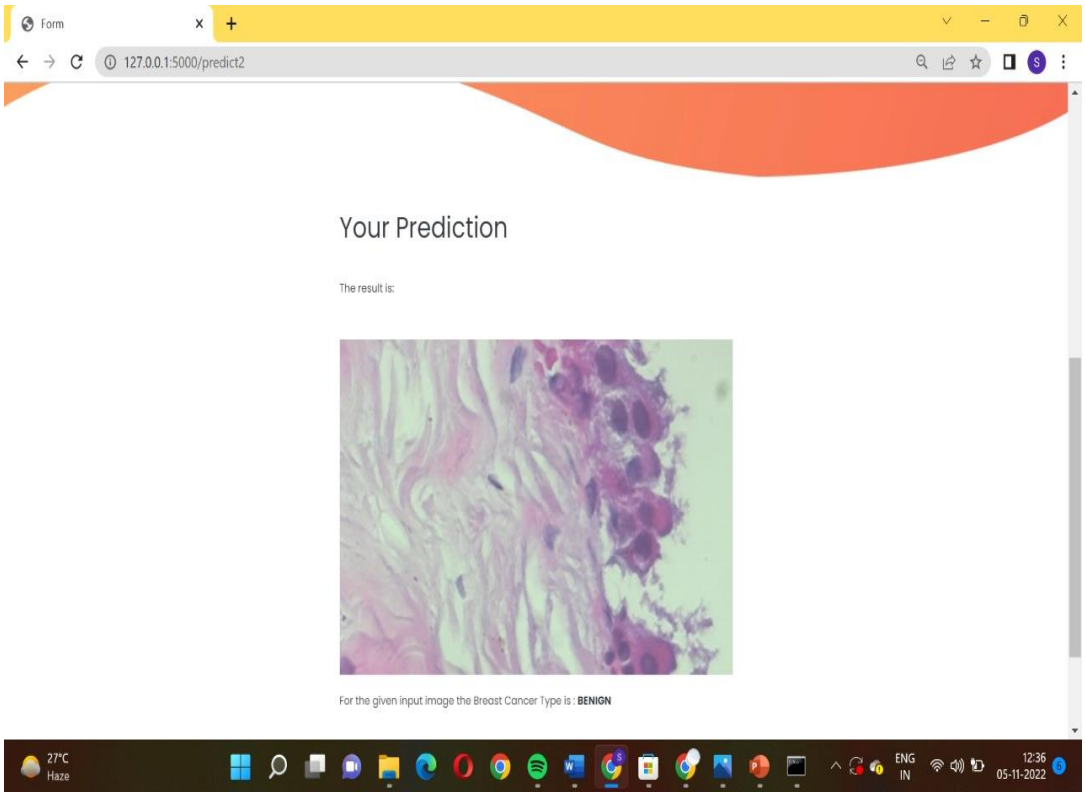
Screenshot 5.1 Home page for breast cancer classification

In this page we upload the images and the images will be detected through the mammograms. At first we need to upload the image from the file and the image should be less than 500kb in size then only it takes the input and it shows the precise output in the page.



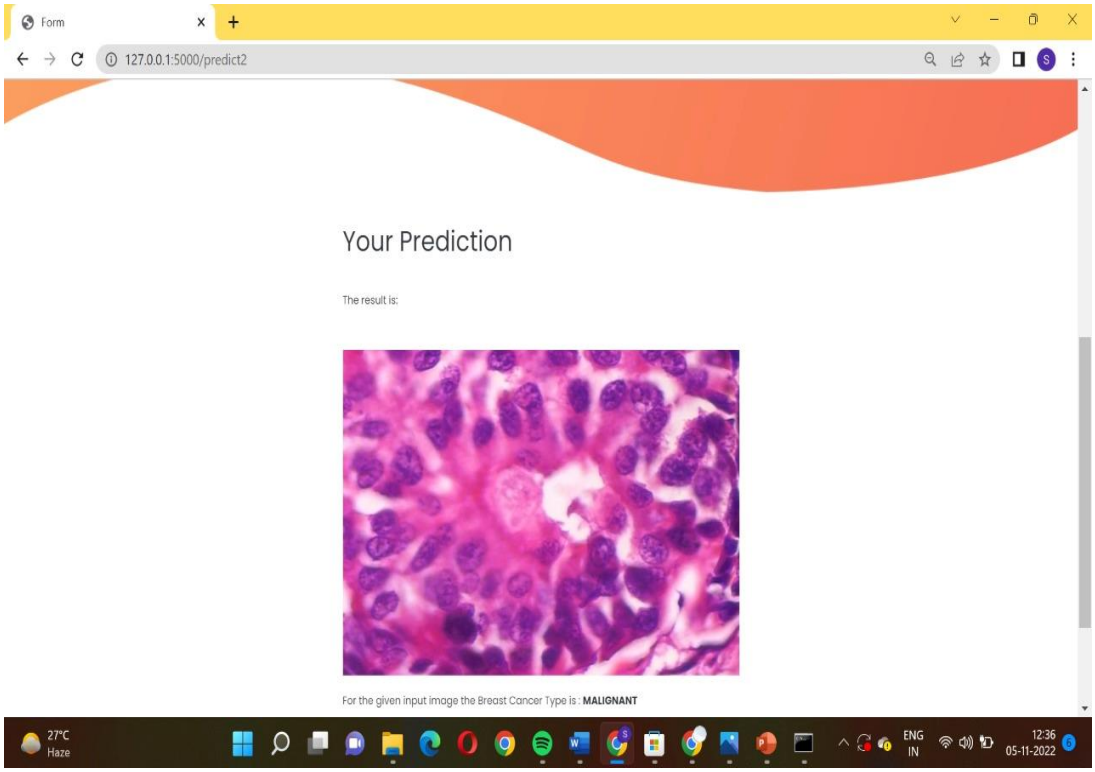
Screenshot 5.2 uploading the Mammographic image

This is the benign classification image from the given input it classifies the breast cancer and it gives the exact result within a short period of time. This classification of the image is benign which means it does not have the cancer to the specified person.



Screenshot 5.3 Benign Classification for Breast Cancer

This is the malignant classification image from the given input it classifies the breast cancer and it gives the exact result within a short period of time. This classification of the image is malignant which means it have the cancer to the specified person.



Screenshot 5.4 Malignant Classification for Breast Cancer

6. TESTING

6. TESTING

6.1 INTRODUCTION TO TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

6.2 TYPES OF TESTING

6.2.1 UNIT TESTING

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

6.2.2 INTEGRATION TESTING

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully

unit testing, the combination of components is correct. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

6.2.3 FUNCTIONAL TESTING

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals. Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.
Invalid Input : identified classes of invalid input must be rejected.
Functions : identified functions must be exercised.
Output : identified classes of application outputs must be exercised.
Systems/Procedures : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

6.3 TEST CASES

6.3.1 CLASSIFICATION

Test case ID	Test case	Purpose	Input	Output
1	Upload the image	To detect the cancer image	The user gives the input in the form of a Mamographic image.	The output will classifies the benign or malignant.

7. CONCLUSION

7. CONCLUSION & FUTURE SCOPE

7.1 PROJECT CONCLUSION

Our results show that the pre- trained CNN model (VGG-16) can automatically extract features from mammographic images, and a good NN classifier can be trained by these features without providing hand-crafted features. The purpose of this model is to help medical doctors in BC detection and diagnosis. The MIAS images were divided into three different classes, benign, malignant, and normal. Finally, it can be concluded that integrating the CNN using learning transfer in the screening mechanism, a clear improvement can be achieved compared with other existing approaches.

7.2 FUTURE SCOPE

In this research work, the detection of breast cancer has been done through the use of mammographic images.

Mammograms are the best way to find breast cancer early, when it is easier to treat and before it is big enough to feel or cause symptoms. Having regular mammograms can lower the risk of dying from breast cancer.

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8. BIBLIOGRAPHY

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8.2 GITHUB LINK

https://github.com/Student-639/breast-cancer