Deep Learning Techniques For Breast Cancer Risk Prediction Using IBM Cloud

Developer Name: Logeswaran K

Category: Deep Learning

Skills Required: CNN, Flask Integration, Numpy, Tensorflow, Keras, IBM Watson Studio, Open CV, Deep Learning

Implementation Coding:

Deployment coding can be found at below GitHub Repo link

https://github.com/smartinternz02/SI-GuidedProject-6117-1635490836

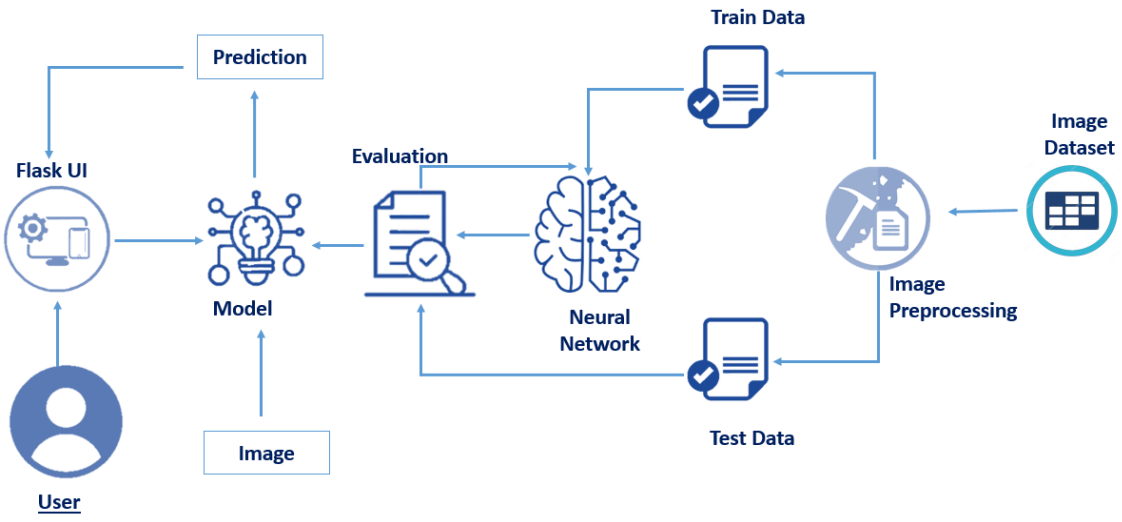
Project Description:

Invasive Ductal Carcinoma (IDC) is the most common subtype of all breast cancers. To assign an aggressiveness grade to a whole mount sample, pathologists typically focus on the regions which contain the IDC. As a result, one of the common pre-processing steps for automatic aggressiveness grading is to delineate the exact regions of IDC inside of a whole mount slide.

Breast cancer is one of the main causes of cancer death worldwide. Computer-aided diagnosis systems showed the potential for improving diagnostic accuracy. But early detection and prevention can significantly reduce the chances of death. It is important to detect breast cancer as early as possible.

The goal is to classify images into two classifications of malignant and benign. As early diagnostics significantly increases the chances of correct treatment and survival. In this application, we are helping the doctors and patients to classify the Type of Tumour for the specific image given with the help of Neural Networks.

Architecture:



Project Flow:

- Download the dataset.
- Classify the dataset into train and test sets.
- Add the neural network layers.
- Load the trained images and fit the model.
- Test the model.
- Save the model and its dependencies.
- Build a Web application using flask that integrates with the model built.

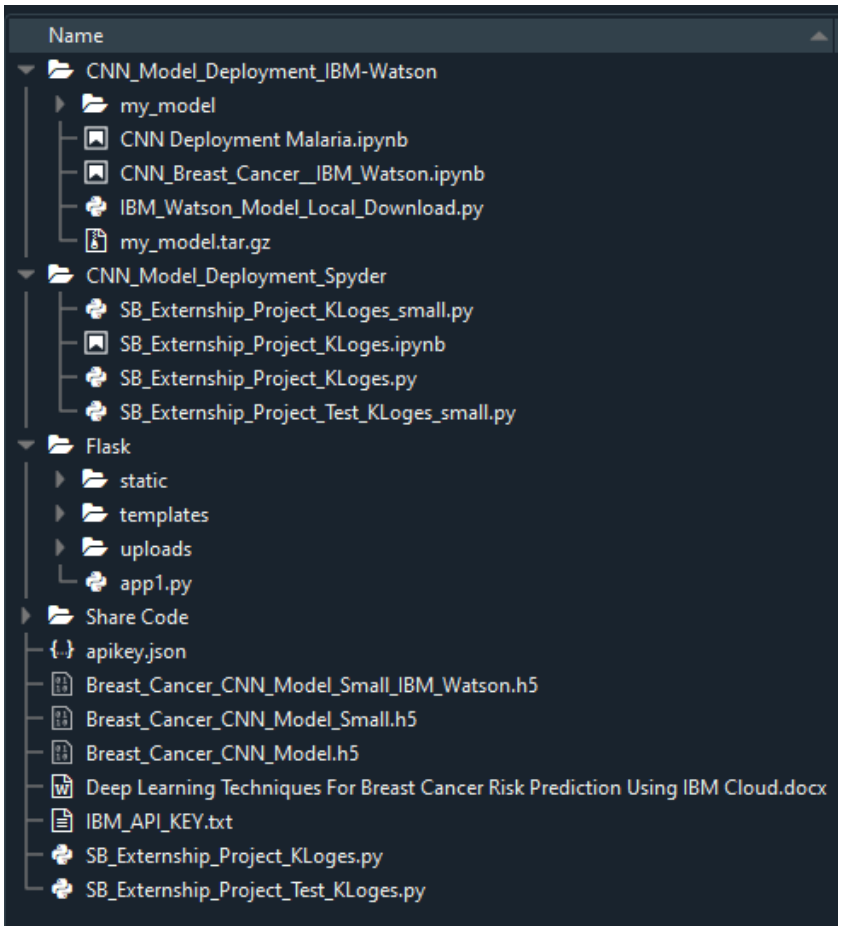
Pre-Requisites:

- Anaconda Navigator
- Tensor flow
- Keras
- Flask

Prior Knowledge:

- Supervised and unsupervised learning
- Convolution Neural Networks
- Flask

Project Structure:



Data Collection:

- Create Train and Test folders with each folder having subfolders with images of breast cancer and who don't. You can collect datasets from different open sources like kaggle.com, data.gov, UCI machine learning repository, etc. The folder contains the datasets which can be used for training.

- Link to download dataset
  https://www.kaggle.com/paultimothymooney/breast-histopathology-images

- Dataset Description
  The original dataset consisted of 162 whole mount slide images of Breast Cancer (BCa) specimens scanned at 40x. From that, 277,524 patches of size 50 x 50 were extracted (198,738 IDC negative and 78,786 IDC positive). Each patch's file name is of the format: uxXyYclassC.png — > example 10253idx5x1351y1101class0.png . Where u is the patient ID (10253idx5), X is the x-coordinate of where this patch was cropped from, Y is the y-coordinate of where this patch was cropped from, and C indicates the class where 0 is non-IDC and 1 is IDC.

Project Implementation - Spyder

- Image Preprocessing

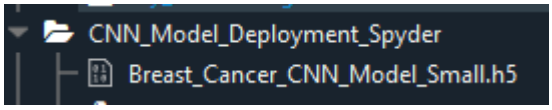
  Image Pre-processing includes the following main tasks
  - ✓ Import ImageDataGenerator Library.
  - ✓ Configure ImageDataGenerator Class.
  - ✓ Applying ImageDataGenerator functionality to the trainset and test set.
  - ✓ Note: The ImageDataGenerator accepts the original data, randomly transforms it, and returns only the new, transformed data.
  - ✓ The dataset images are to be preprocessed before giving it to the model.
  - ✓ Output:

```
Found 16178 images belonging to 2 classes.
Found 3488 images belonging to 2 classes.
{'0': 0, '1': 1}
```

- Model Building

  In this milestone, we start building our model by:
  - ✓ Initializing the mode
  - ✓ Adding Convolution layers
  - ✓ Adding Pooling layers
  - ✓ Flatten layer
  - ✓ Full connection layers which include hidden layers
  - ✓ At last, we compile the model with layers we added to complete the neural network structure
  - ✓ Fit and Save the model
  - ✓ Output:

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 124, 124, 32)      2432
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 62, 62, 32)        0
_________________________________________________________________
flatten (Flatten)            (None, 123008)            0
_________________________________________________________________
dense (Dense)                (None, 128)               15745152
_________________________________________________________________
dense_1 (Dense)              (None, 2)                 258
=================================================================
Total params: 15,747,842
Trainable params: 15,747,842
Non-trainable params: 0
```

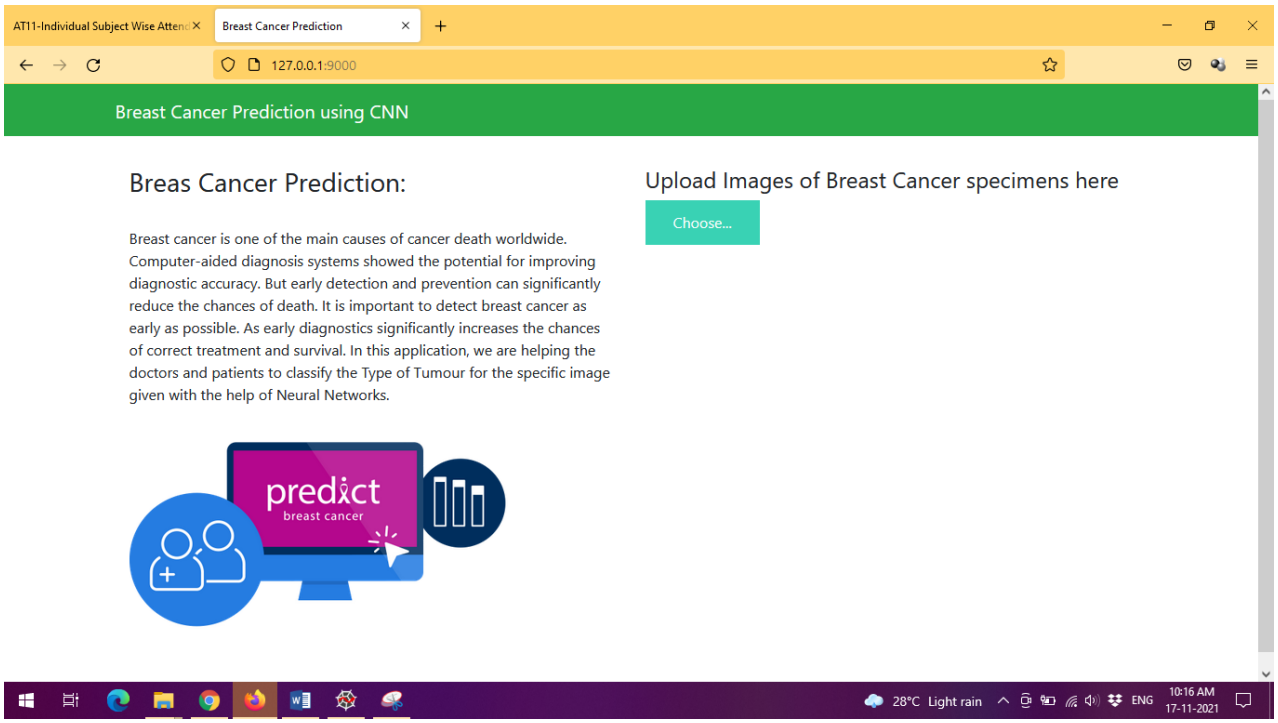


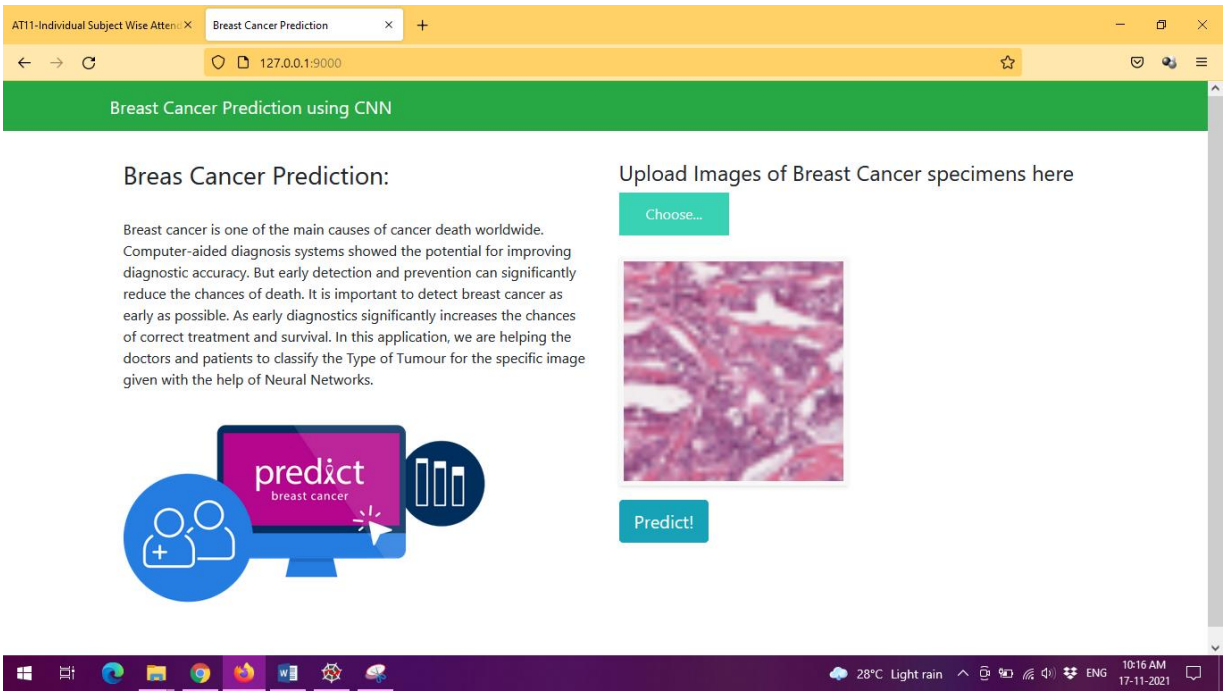
- Test the Model
  - ✓ The model is to be tested with different images to know if it is predicting correctly.
  - ✓ Output:

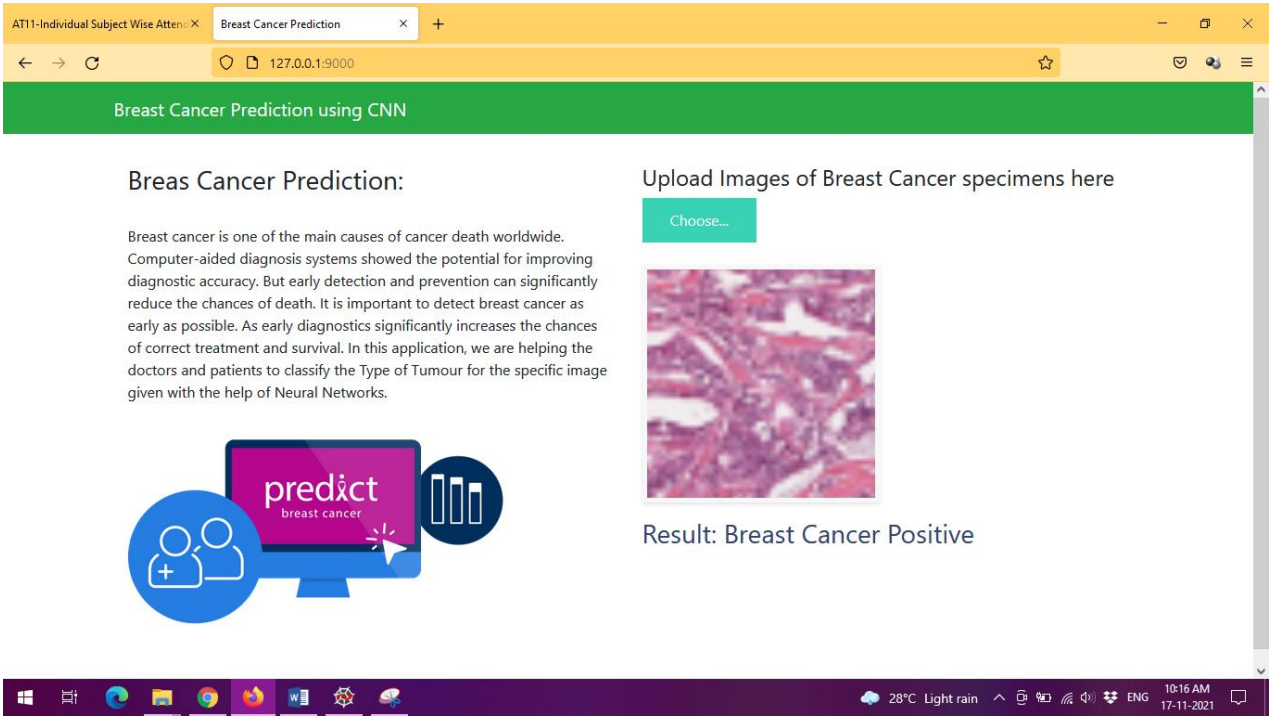
```
In [3]: y=model.predict(x)
   ...: pred= np.argmax(y, axis=1)
   ...: print(pred)
   ...:
   ...: index=['Breast Cancer Negative','Breast Cancer
Positive']
   ...: result=str(index[pred[0]])
   ...: result
[1]
Out[3]: 'Breast Cancer Positive'
```

Flask Application Building

- After the model is built, we will be integrating it into a web application so that normal users can also use it. The users need to give the X-ray images to know the predictions.
- Output:

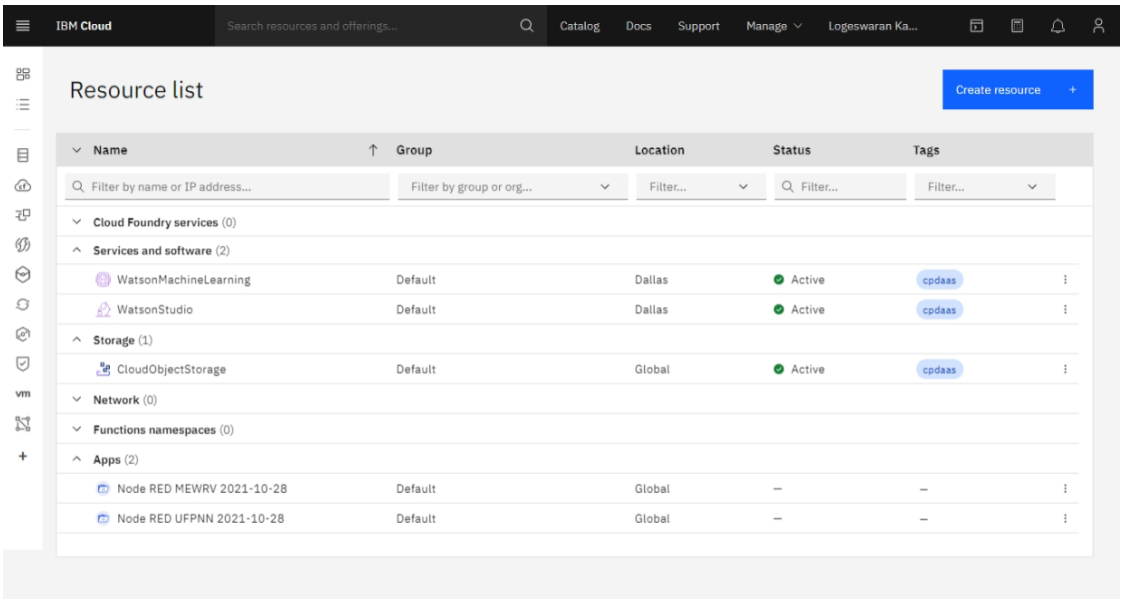


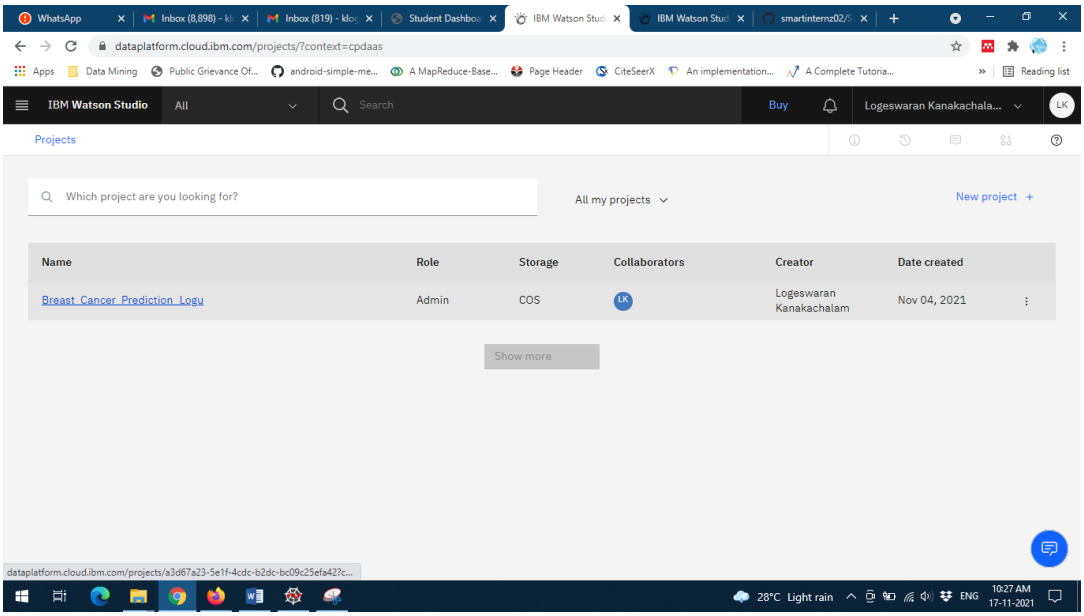

AT11-Individual Subject Wise Atten
Breast Cancer Prediction
127.0.0.1:9000
Breast Cancer Prediction using CNN
Breas Cancer Prediction:
Breast cancer is one of the main causes of cancer death worldwide. Computer-aided diagnosis systems showed the potential for improving diagnostic accuracy. But early detection and prevention can significantly reduce the chances of death. It is important to detect breast cancer as early as possible. As early diagnostics significantly increases the chances of correct treatment and survival. In this application, we are helping the doctors and patients to classify the Type of Tumour for the specific image given with the help of Neural Networks.
predict
breast cancer
Upload Images of Breast Cancer specimens here
Choose...
Predict!
28°C Light rain
ENG
10:16 AM
17-11-2021

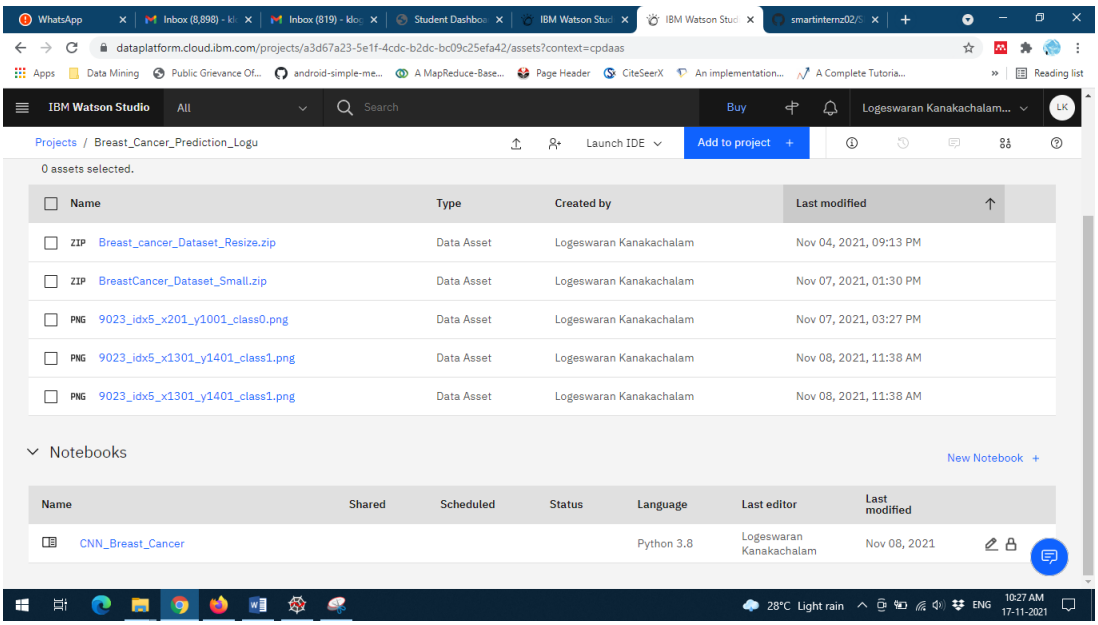

AT11-Individual Subject Wise Atten
Breast Cancer Prediction
127.0.0.1:9000
Breast Cancer Prediction using CNN
Breas Cancer Prediction:
Breast cancer is one of the main causes of cancer death worldwide. Computer-aided diagnosis systems showed the potential for improving diagnostic accuracy. But early detection and prevention can significantly reduce the chances of death. It is important to detect breast cancer as early as possible. As early diagnostics significantly increases the chances of correct treatment and survival. In this application, we are helping the doctors and patients to classify the Type of Tumour for the specific image given with the help of Neural Networks.
predict
breast cancer
Upload Images of Breast Cancer specimens here
Choose...
Result: Breast Cancer Positive
28°C Light rain
ENG
10:16 AM
17-11-2021

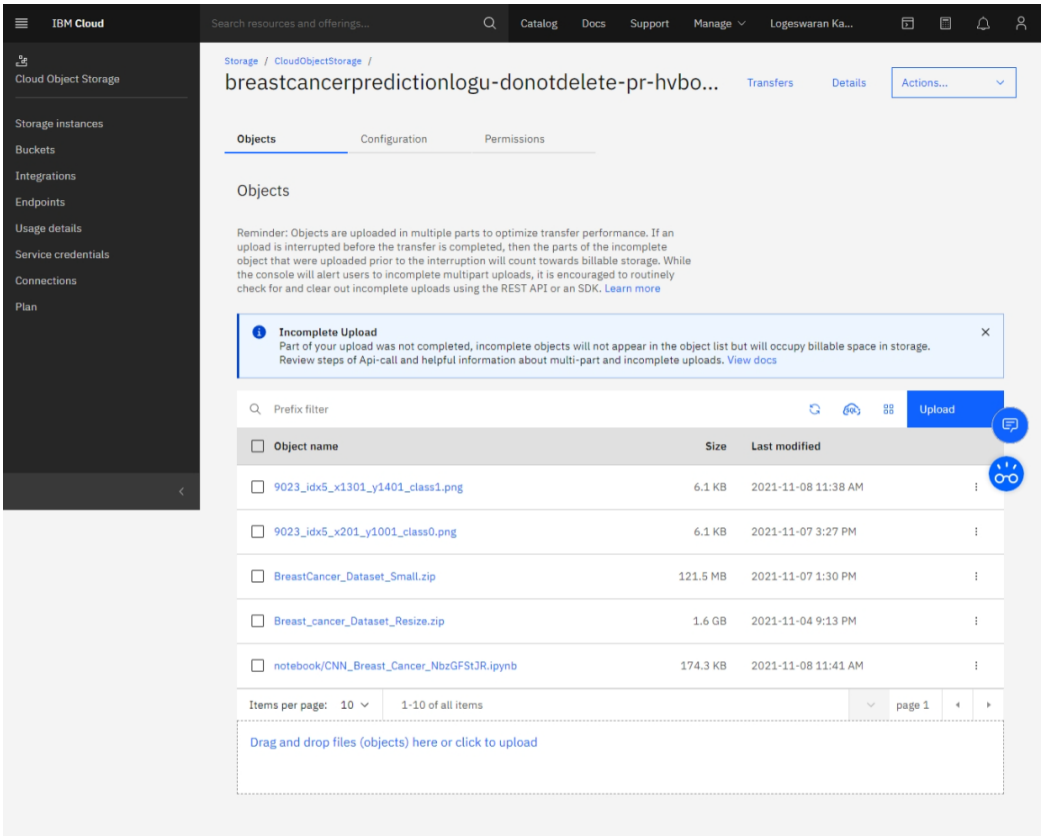
Train the Model on IBM

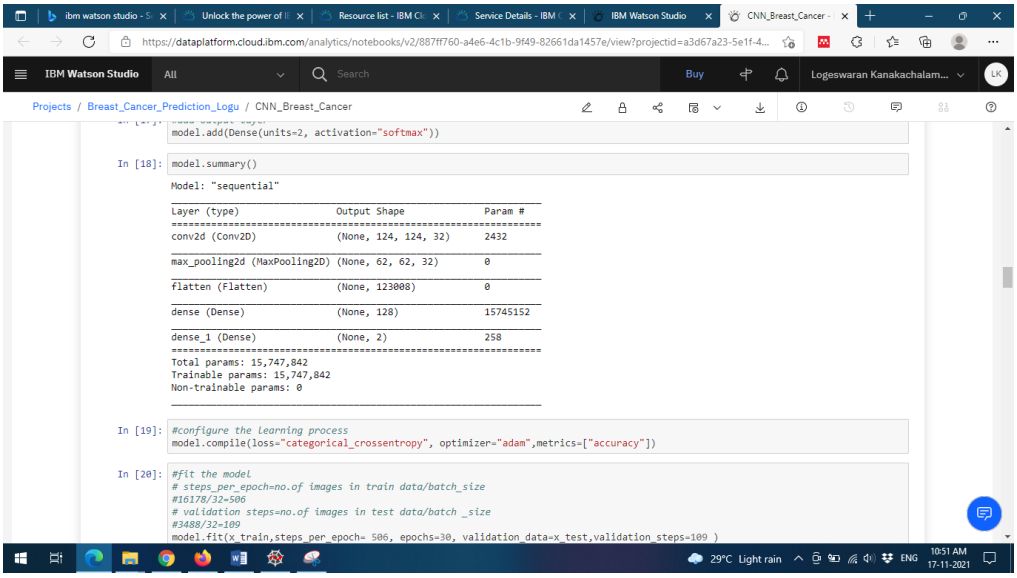
In this milestone, you will learn how to build Deep Learning Model Using the IBM cloud.












```
0.8624
```

Out[20]: <tensorflow.python.keras.callbacks.History at 0x7f79c586eac0>

In [21]:
```
model.save("Breast_Cancer_CNN_Model_Small.h5")
```

In [22]:
```
!tar -zcvf Breast_Cancer_CNN_Model_Small.tgz Breast_Cancer_CNN_Model_Small.h5
```

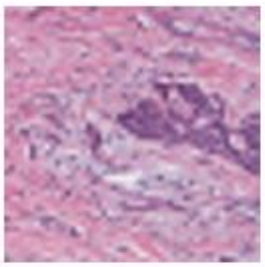
```
Breast_Cancer_CNN_Model_Small.h5
```

In [23]:
```
ls
```

```
Breast_Cancer_CNN_Model_Small.h5   BreastCancer_Dataset_Small/
Breast_Cancer_CNN_Model_Small.tgz
```

In [41]:
```
im1
```

Out[41]:



In [42]:
```
x=image.img_to_array(im1)

x = np.expand_dims(x,axis = 0)

y=model.predict(x)

pred= np.argmax(y, axis=1)

pred

index=['Breast Cancer Negative','Breast Cancer Positive']

a = index[pred[0]]
print(a)
```

```
Breast Cancer Positive
```