Breast Cancer Detection & Segmentation Using Deep Learning

GROUP NO. 3

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OUTLINE

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- Literature Survey
- Problem Statement
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- Implementations/Experimental Results
- Publication & Achievements
- Conclusion/Future Plans
- References

MOTIVATION FOR PROJECT

- Breast cancer has the second highest mortality rate in women next to lung cancer.
- There is need for a more robust, fast, accurate, and efficient non-invasive cancer detection system. an automated system is required for achieving error-free detection of breast cancer using mammogram.
- If the cancer is detected early, it increases expectancy of survival rate/mortality of patient.

PROJECT OBJECTIVES

- To classify the tumors as Benign and Malignant tumors.
- To detect location of the tumour.
- To evaluate the performance of various Deep Learning approaches for detection and segmentation of tumours

PROJECT OUTCOMES

- Software tool which automatically detects cancerous tissues.
- Software will be able to identify location of tumour and detect volume of tumour.
- It will act an an assisting tool to radiologists to classify or choose the abnormal mammogram and prioritise based on level of concern.

LITERATURE SURVEY

- Discussing the clinical aspect of the project.
- Studying the Breast Anatomy and various quadrants.
- Looking at the statistics of occurrence of breast cancer around the world.
- Types of Breast cancer and which part tumor can be formed.
- The amount of screening methods available to this date.
- Moving ahead with the technical aspect of our project learning about Deep Learning and Deep Neural Networks.

LITERATURE SURVEY

- AlexNet convolutional neural network(CNN) for Image classifications using graphics processing units (GPU) for training of the models.
- Deep learning algorithms to accurately detect breast cancer on screening mammograms using an end to end approach.
- Breast Cancer detection using deep convolutional neural networks and support vector machines and by selecting ROI.
- Unsupervised deep learning applied to breast density segmentation and mammographic risk scoring.

LITERATURE SURVEY

- Detection of masses in mammograms via statistically based enhancement , multilevel-thresholding segmentation, and region selection.
- Region and boundary segmentation of microcalcification using seed-based region growing and mathematical morphology.
- Segmentation of pectoral muscle and detection of masses in mammographic images.
- Segmentation of masses from breast ultrasound images using parametric active contour algorithm.

PROBLEM STATEMENT

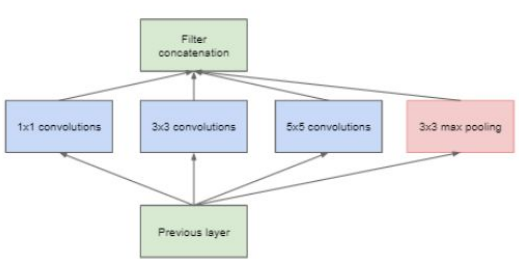
To develop an automated detection and segmentation of tumours using mammogram in Cranial-Caudal and Medial-lateral oblique (CC and MLO) views using Deep Learning Techniques

VGG16

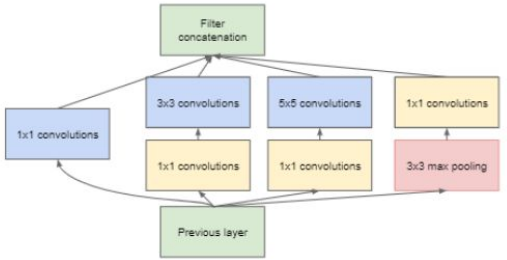

3x3 conv, 64
3x3 conv, 64
pool/2
3x3 conv, 128
3x3 conv, 128
pool/2
3x3 conv, 256
3x3 conv, 256
3x3 conv, 256
pool/2
3x3 conv, 512
3x3 conv, 512
3x3 conv, 512
pool/2
3x3 conv, 512
3x3 conv, 512
3x3 conv, 512
pool/2
fc 4096
fc 4096
fc 4096
Size:224
Size:112
Size:56
Size:28
Size:14
Size:7

GOOGLENET

- 22 layers deep.
- The architecture was designed to keep computational efficiency in mind. The idea behind that the architecture can be run on individual devices even with low computational resources.
- Uses many different methods such as 1x1 convolution and global average pooling that enables it to create a deeper architecture



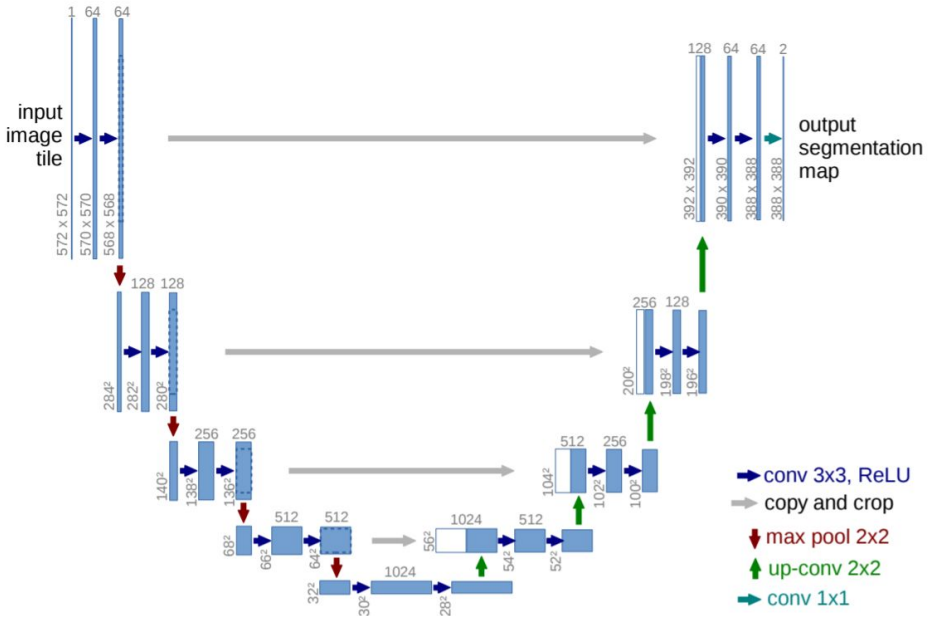
(a) Inception module, naïve version



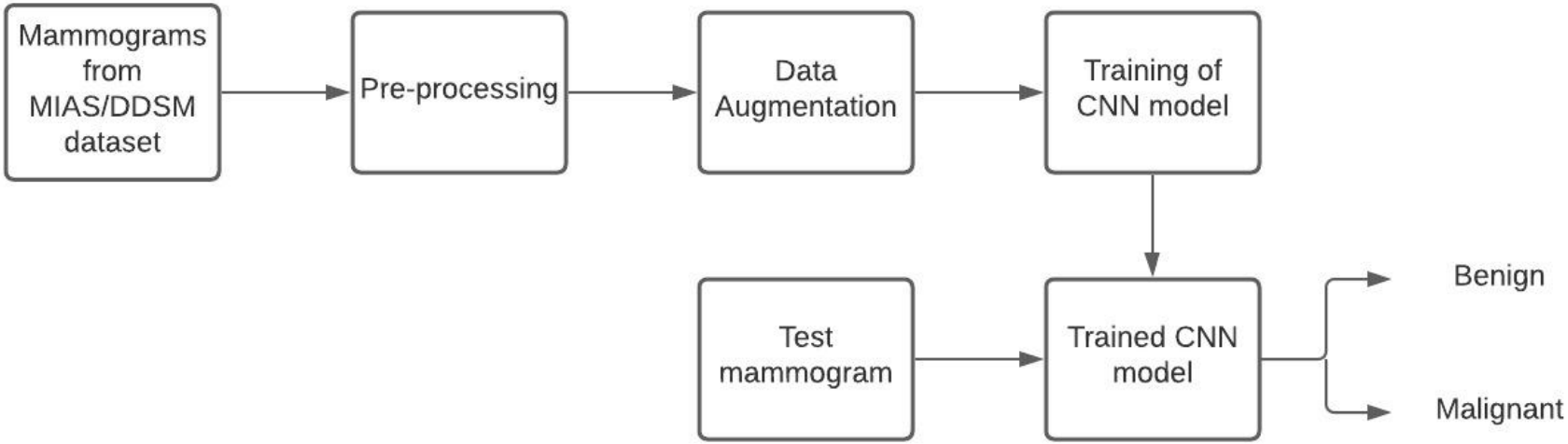
(b) Inception module with dimension reductions

U-NET

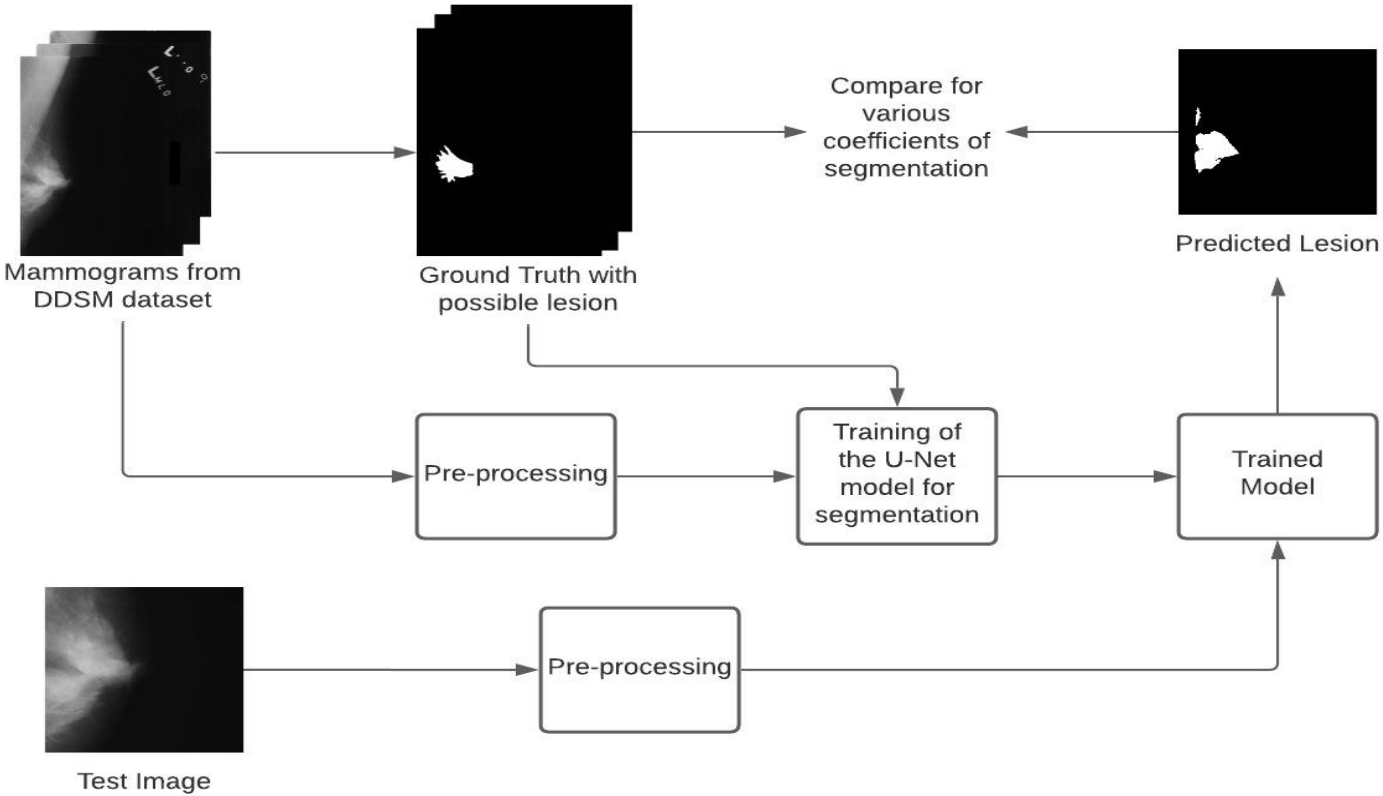
- Uses the end to end approach for segmentation
- Proposed specifically for medical imaging
- Excessive data augmentation heps in training low number of images and producing better output
- 23 convolutional layers in total
- Fully connected layers are not used
- Left side is the contracting path and right is the expanding path



BLOCK DIAGRAM - DETECTION



BLOCK DIAGRAM - SEGMENTATION



IMPLEMENTATION RESULTS - DETECTION

```
    path='/content/pretrained_model/AbnormalNormal.h5',
    file='/content/drive/MyDrive/Dataset/Test_set/Abnormal/C_0391_1.RIGHT_MLO.png'  )

pred.load_model()
pred.makepredictions()
```


```
Start predicting...
WARNING:tensorflow:11 out of the last 11 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7f87b4715710> triggered tf
Prediction completed: This is Malignant
```

IMPLEMENTATION RESULTS - DETECTION

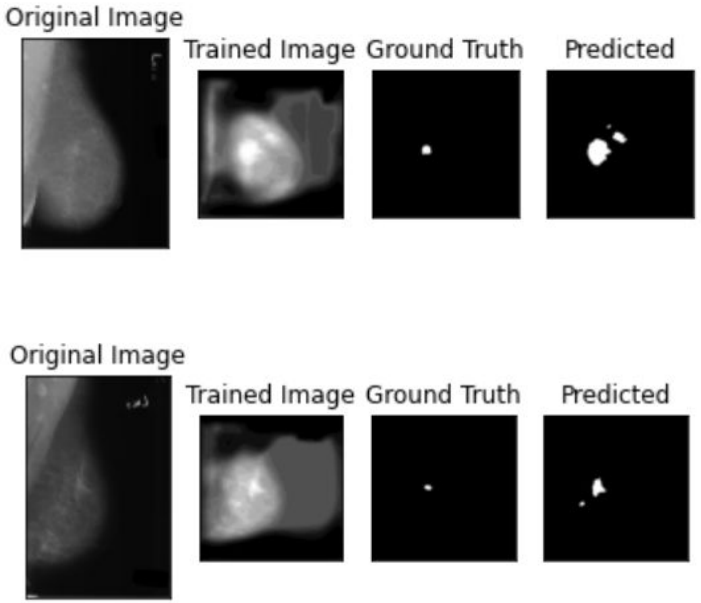
```
pred = Predict(
    path='/content/pretrained_model/AbnormalNormal.h5',
    file='/content/drive/MyDrive/Dataset/Test_set/Normal/A_2029_1.RIGHT_CC.png' )

pred.load_model()
pred.makepredictions()
```

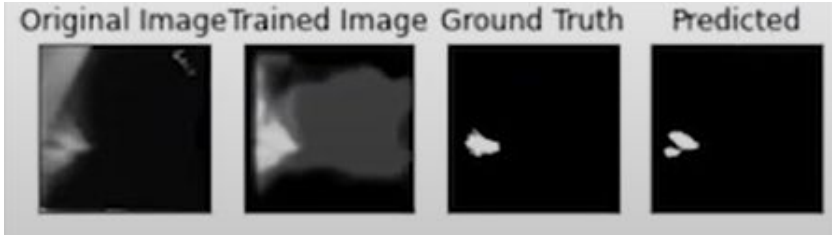
```
Start predicting...
WARNING:tensorflow:11 out of the last 11 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7f87b4b7fcb0> triggered tf
Prediction completed: This is Benign
```

IMPLEMENTATION RESULTS - COMPARISON OF MODELS

Name of Model	Number of Layers	Validation Accuracy (%)	Precision	Recall	F1 Score
Alex Net	8	61.00	0.65	0.71	0.67
VGG-16	16	82.00	0.78	0.81	0.79
EfficientNet	17	82.72	0.81	0.77	0.78
Google Net	22	91.36	0.85	0.81	0.82
Resnet50	50	79.00	0.79	0.80	0.79

IMPLEMENTATION RESULTS - SEGMENTATION





IMPLEMENTATION RESULTS - SEGMENTATION

SEGMENTATION RESULTS	
Accuracy	99.72%
Validation Accuracy	97.42%
DSC(Dice Similarity Coefficient)	0.82
IOU/Jaccard Index	0.98

PUBLICATIONS & ACHIEVEMENTS

- Published a technical paper on ‘Breast Cancer Detection in Mammograms Using Deep Learning’ in the book “*Applied Information Processing Systems*” by Springer Nature Singapore Ltd., 2021.

- Won the “Viewer’s Choice” award in intra-college Final year project competition “Innovex 2021”

CONCLUSION & FUTURE PLANS

- The proposed work detects mass abnormality and classifies the mammograms into benign and malignant.
- The segmentation model helps with localization of tumor and automates the manual process of contouring done by radiologists.
- The proposed system can help patients in planning their treatments.
- All these suggest future work for creating a clinical tool which contributes towards healthcare.

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THANK YOU