ISSN: 0975-833X

Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol. 13, Issue, 10, pp.19023-19026, October, 2021

DOI: https://doi.org/10.24941/ijcr.42284.10.2021

RESEARCH ARTICLE

BREAST CANCER DETECTION AND RECOGNITION BY USING DEEP LEARNING TECHNIQUES - ULTRASOUND IMAGES CLASSIFICATION IN TO BENIGN, MALIGNANT AND NORMAL TISSUE BY THE RESNET MODEL

***Vanga Achyuthanwesh, Chandra Shekhar, T. and sandeep, N.**

4th Year Student - computer Science, Engineering, Sir Padampat Singhania University

ARTICLE INFO

Article History:
Received 29th July, 2021
Received in revised form
27th August, 2021
Accepted 15th September, 2021
Published online 30th October, 2021

Key Words:

Breast Cancer, CNN, RESNET9, PyTorch, Deep Learning, Accuracy.

****Corresponding author:***
Vanga Achyuthanwesh

ABSTRACT

Breast cancer has become a growing concern nowadays for global countries. In 2020, there were 2.3 million women diagnosed with breast cancer and 685,000 deaths globally. It is mostly associated with women. In addition, it is observed that doctors use various techniques such as X-ray based observation - Mammography, MRI, ultrasound, biopsy to diagnose this deadly disease. From the technical point of view, different technologies emerged such as Machine Learning and Deep Learning, subfields of AI for easy and early detection of breast cancer. Many kinds of research were conducted on machine learning algorithms such as KVM, SVM, KNN classifier etc to predict breast cancer. In our research, we used an approach called CNN (convolutional neural networks) in deep learning. It extracts the best features of the images with accuracy far greater than the machine learning models. Our research is based on How accurate a CNN model can be in detecting breast cancer, the model is RESNET9 in PyTorch and also predicting what type of breast cancer it is, like Benign or malignant type of breast cancer. We also considered various performance evaluation metrics such as F1 scores, Precision, Recall for accurate classification of data.

Citation: Vanga Achyuthanwesh, Chandra Shekhar, T. and sandeep, N. *"*Breast cancer detection and recognition by using deep learning techniques - ultrasound images classification in to benign, malignant and normal tissue by the resnet model*", 2021. International Journal of Current Research, 13, (10), 19023-19026.*

INTRODUCTION

Breast disorders can be either benign epithelial lesions which can be non proliferative breast changes (fibrocystic) proliferative changes without n with atypia (altered cell morphology) which have a high risk to develop into breast carcinoma. And all these changes can be seen under biopsy studies based on some special features in fibrocystic changes like cyst or apocrine metaplasia or adenosis. Where it is proliferative without atypia type cells are the same as normal breast but increase in number and show features of epithelial hyperplasia, sclerosing adenosis, papilomas. Breast carcinoma (malignant). Breast carcinoma malignant conditions can be developed from benign proliferative types due to repeated cell cycle division disturbing genetic stability, or estrogen stimulation , cigarette smoking. It's really a time taking process nowadays for initial detection of breast cancer and to classify what type of cancer it is whether it is benign or malignant by the doctors just by looking at the rays-mammography technique or ultrasound images. They go to the next diagnosis test called biopsy to confirm what type of breast cancer it is (1).

It is indeed it is a time taking process on the other hand, that might prove to be costly in the later stages to diagnosis the cancer. In contrast, our research helps in detecting what type of cancer it is instantly by training a deep learning model called RESNET9 by taking breast ultrasound images as input and achieving accuracy almost above 91% and the output is is 1.Malignant or 2.Benign or 3.Normal is identified. This data helps in initial diagnosis of relevant types of cancer before confirming with the biopsy result(4).Deep learning is gaining significance as it explores areas of machine learning and Artificial intelligence to learn features straightaway from the given data(5). Many researches were conducted on other models such as VGG Net, Inception, Exception and Res Net (7). However, using ResNet has significantly enhanced the performance of neural networks with more layers with less error percentage when comparing it with neural networks with plain layers(8).Here as an experiment we went with RESNET9, a RESNET deep learning model to accurately predict breast cancer, however, for in depth analysis following models can also be used for enhanced results only difference is the increase in number of layers and bit more details can be identified but to train the modelit takes a bit more time (12).

To complete the training fast and to check the accuracy we are using ResNet9 over others as it is easy to train and achieving greater accuracy. We are successful in achieving an accuracy of 90% in detecting breast cancer and type of breast cancer compared with MobileNet(58%),inception V3(83%) according to the paper ”Breast cancer detection using deep learning technique” by shweta K,spoorthi M,Sindhu S S, chaitra D(18).

- ResNet50V2
- ResNet101V2
- ResNet152V

Advantages compared to other models

•Networks with large numbers of layers can be trained easily without increasingthe training error percentage.
•ResNets help in tackling the vanishing gradient problem using identity mapping.

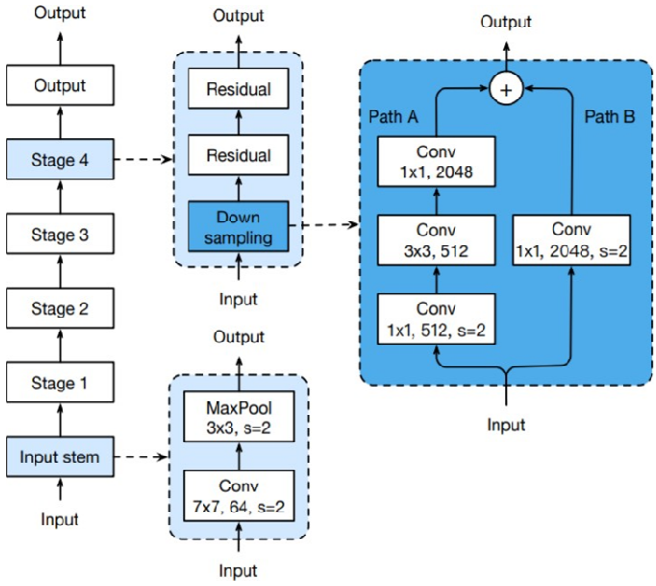
Deep learning is the subset of machine learning and on the other hand it is the subset of artificial intelligence.It was inspired from the inner structure of the human brain to think like humans and find the accurate conclusions from the given data. It uses a multilayer structure called neural networks. It contains 3 layers named as input layer, output layer and hidden layer where it performs mathematical computations on the input data. Neural network is the system of neurons. The neuron sets the input fields such as set of weights, and an activation function thenthe neuron translates that input into single output , which can be taken as input as another layerof neurons..For the classification of the breast cancer dataset, Convolution Neural Network is used. Convolutional Neural Network is used to classify the images i.e for the classification purpose. It takes the images of the breast cancer dataset as an input. CNN takes the images asan input associated with their corresponding weights. The weights are adjusted to minimize the error and enhance the performance. CNN contains many layers such as convolution layer, pooling layer, ReLU layer and fully connected layer. In the convolution layer, a feature map is used to bring out the features of the given image and makes the original image more compact. Pooling layer is used to minimize the dimensions of the image. The ReLU layer is used as an activation function in which it checks if the value of the activation function is present in a given range or not. Fully connected layer is the last layer of the model. It combines the results of all layers and applies the softmax function to give the probability to each class of the output.

Literature Review

Deep Learning to Improve Breast Cancer Detection on Screening Mammography by Li Shen,Laurie R.Margolies, Joseph H. Rothstein, Eugene Fluder, Russel McBride & Weiva Sieh. They used a VGG model and ResNet 50 model to detect breast cancer using mammography datasets.The accuracy achieved in ResNet50 was 86% and VGG was about 85%. ”Breast cancer detection using deep learning technique” by shweta K,spoorthi M,Sindhu S S, chaitra D.They evaluated different models Such as MobileNet,Inception V3, where they found that InceptionV3 achieved an accuracy of 83% whereas Mobilenet 58% in detecting the breastcancer.“A review paper on Breast Cancer Detection Using Deep learning” by Kumar Sanjeev Priyanka-2021.In this paper the author expressed the importance of Deep learning and CNN is the most popular technique to classify images compared to the machine learning algorithms such as KNN, SVM, naive bayes etc(13).“Whole Mammogram Image Classification with Convolutional Neural Networks” by Nathan Jacobs, Jinze Liu and Erik Y. Han, 2017. They experimented with 7 various CNN architectures and concluded that combining both data augmentation and transfer learning methods with a convolutional neural network is the most effective and efficient way in improving classification performance. Different features affect performance of the classifier so it is important to extract the useful features that are able to differentiate between benign and malignant classes. On the other hand, The architecture of neural networks affects the overall performance of the classification. The architecture with more hidden nodes consistently improves the classifier performance. Let us say 100 hidden nodes increases the performance by 10% compare to the architecture with only 3 hidden nodes regardless of the input feature given into the classifier

METHODOLOGY

RESNET architecture



The ResNet (Residual Network) was introduced after CNN (Convolutional Neural Network). Additionallayers are added to a deep neural network(DNN) to improve accuracy and performance and are useful in solving complex problems. The intuition was that these layers would progressively learn the features. But it has been found that there is a maximum threshold for depth with the traditional Convolutional neural network model. That is with adding more layers on top of a network, its performance degrades. This problem of training very deep networks has been alleviated with theintroduction of ResNet or residual networks.

The following diagram illustrates a residual block, where:

- x is the input to the ResNet block—output from previous layers
- F(x) is a small neural network with several convolution blocks

Dataset collection & preprocessing: The available dataset was a total of ultrasound images with 3 categories mixed together they were benign, malignant, normal were divided into batches of size and each batch size was 128 as it helps the model to train fast.original image size was 512 X 512 it was converted to 64 X 64.

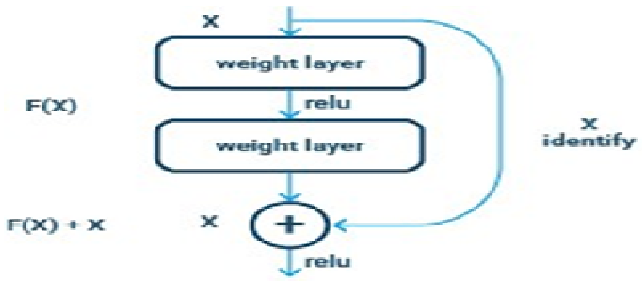
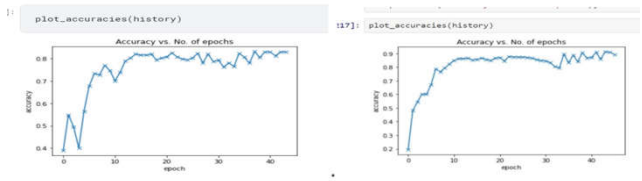


Figure 2. Resideual learning: a building block.

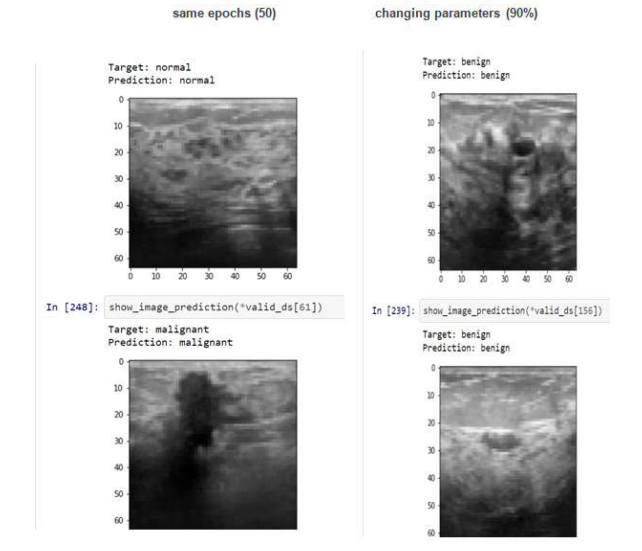
Training: The batches were trained accordingly by the model and the parameters were number of epoch,learning rate,optimizer and GPU was used for better results as it helps in fast computation when dealing with pictures almost 10% accuracy difference can be found while using and not using GPU-"cuda".

RESULTS

Satisfactory results has been obtained using the RESNET9 model with 90% accuracy and model was almost successful in predicting whether cancer exists or not and what type of cancer it is which is far greater than the reference articles. Surprisingly, it was found that changing the optimizers between Adam and SGD simultaneously with the change in learning rates helped the model to achieving greater accuracy.



Constant parameters (81%)



Accurately predicting the type of breast cancer

By having constant optimizer and learning rate it achieved an accuracy just above 80% but with constant changing it was successful in achieving accuracy of 90% with less data loss. The training was done for 50 epochs and desirable results obtained at last. Clearly from below pictures it can be seen that RESNET model works well with changing parameters for same training epochs

Conclusion

In this paper we proposed how accurate and effective a RESNET deep learning model can be in predicting the breast cancer with minimal errors on ultrasound image dataset and how changing parameters affect the overall accuracy and data loss compared to not changing the parameters of the model. It is always preferable to detect the cancer in early stages so that it can be cured easily. The model achieved an accuracy of 90% in detecting the breast cancer and also what type of breast cancer it is.

REFERENCES

1. "On the need for biopsy confirmation at suspected first recurrence of cancer" David M Mintzer 1, Bernard A Mason
2. Poorolajal, J., et al., Breast cancer screening (BCS) chart: a basic and preliminary model for making screening mammography more productive and efficient. J Public Health (Oxf), 2017: p. 1-8.
3. Z. Jiao, X. Gao, Y. Wang, and J. Li, "A deep feature based framework for breast masses classification," Journal of Neurocomputing, vol. 197,pp. 221-231, 2016.
4. J. Arevalo, F. A. González, R. Ramos-Pollán, J. Oliveira, and M. A.Lopez, "Representation learning for mammography mass lesion classification with convolutional neural networks," Comput. Methods Program Biomed, vol. 127, pp. 248-257, 2016.
5. Deng, L., Yu, D.: Deep Learning: Methods and Applications. Now publishers, Boston (2014).
6. Krizhevsky, A., I. Sutskever, and G.E. Hinton. Imagenet classification with deep convolutional neural networks. in Advances in neural information processing systems. 2012.
7. Image Net: VGG Net, Res Net, Inception, and Xception with Keras by Adrian Rosebrock on march 20,2017
8. Riaz ullah khan, Xiasong Zhang, Rajesh Kumar, Emelia Opoku:"evaluating the performance of RESNET model based on Image Recognition
9. Deep Learning to Improve Breast Cancer Detection on Screening Mammography by Li Shen, Laurie R. Margolies, Joseph H. Rothstein, Eugene Fluder, Russel McBride & Weiva Sieh.
10. Kui YI, Yue-Hua DING, "32-bit RISC CPU Based on MIPS", International Joint Conference on Artificial Intelligence 2009.
11. Mrs. Rupali S. Balpande, Mrs. Rashmi S. Keote, "Design of FPGA based Instruction Fetch and Decode Module of 32-bit RISC (MIPS) Processor ", International Conference on Communication Systems and Network technologies, 2011.
12. An overview of ResNet and its Variants by Vincent Feng-july 16,2017
13. "A reiew paper on Breast Cancer Detection Using Deep learning" by Kumar Sanjeev Priyanka-2021

14. J. C. Tobias Charistian Cahoon, Melanie A.Sutton, “Three-class mammogram classification based on descriptive CNN features,” 2000.
15. S. Sharma, M. Kharbanda, and G. Kaushal, “Brain tumor and breast cancer detection using medical images,” International Journal of Engi-neering Technology Science and Research, vol. 2, 2015.
16. P. Hankare, K. Shah, D. Nair, and D. Nair, “Breast cancer detection using thermography,” Int. Res. J. Eng. Technol, vol. 4, 2016.
17. Z. Mohammadzadeh, R. Safdari, M. Ghazisaeidi, S. Davoodi, and Z. Azadmanjiri, “Advances in optimal detection of cancer by image processing; experience with lung and breast cancers,” Asian Pacific journal of cancer prevention: APJCP, vol. 16, no. 14, 2015
18. ”Breast cancer detection using deep learning technique” by shweta K,spoorthi M,Sindhu S S, chaitra D.-2018(IJERT)

****