International Journal of Research in Engineering, Science and Management
Volume-3, Issue-7, July-2020
journals.resaim.com/ijresm | ISSN (Online): 2581-5792

Breast Tumor Detection in Automated Breast Ultrasound Using 3-D CNN and 3TP U-Net Deep Convolutional Neural Network

A. N. Srikanth[1*], H. S. Arvinda[2]
[1]*M.Tech. Student, Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Bengaluru, India*
[2]*Associate Professor, Department of Electronics and Communication Engineering, JSS Academy of Technical Education, Bengaluru, India*
*Corresponding author: srikanthabhi58@gmail.com

***Abstract*: Breast cancer affects one out of eight females worldwide. It is diagnosed by detecting the malignancy of the cells of breast tissue. Modern medical image processing techniques work on histopathology images captured by a microscope, and then analyze them by using different algorithms and methods. Machine learning algorithms are now being used for processing medical imagery and pathological tools. Manual detection of a cancer cell is a tiresome task and involves human error, and hence computer-aided mechanisms are applied to obtain better results as compared with manual pathological detection systems. In deep learning, this is generally done by extracting features through a convolutional neural network (CNN) and then classifying using a fully connected network. Deep learning is extensively utilized in the medical imaging field, as it does not require prior expertise in a related field. In this paper, we have trained a convolutional neural network and obtained a prediction accuracy of up to 99.86%.**

***Keywords*: Convolutional Neural Network (CNN), Artificial Neural Networks (ANN).**

1. Introduction

Breast cancer is the second leading cause of death for women in the world. Early detection and treatment resulting to be the most important factor for a positive prognosis and reduce the mortality rates.

Mammography put pressure breast and increase pain due to flatting of breast while taking image which last up to 20sec for per image, so we propose a Dynamic Contrast Enhanced-Magnetic Resonance Imaging (DCE- MRI) or Automated whole breast ultrasound scan(ABUS). 3TP U-Net, a U-shaped Deep Convolutional Neural Network that exploits the well-known Three Time Points approach to improve lesion segmentation performances.

2. Literature Survey

Tsung-Chen Chiang et al. [1] proposes the Automated whole breast ultrasound (ABUS) technology for taking breast image for the identification, because reviewing hundreds of slices produced by ABUS is time consuming process, so a fast and effective computer-aided detection (CADe) system based on 3D convolutional neural networks (CNN) is proposed. Where the window sliding method is applied for the VOI extraction from the scanned image. Then, each VOI is estimated the tumor probability with a 3-D CNN, and VOIs with higher estimated probability are selected as tumor candidates. This paper on evaluation with a test set of 171 tumors, the method achieved sensitivities of 95% (162/171), 90% (154/171), 85% (145/171), and 80% (137/171) with 14.03, 6.92, 4.91, and 3.62 FPs per patient (with 6 passes), respectively. The method is more general and much faster than the normal ABUS detection.

Gabriele Piantadosi et al. [2] proposes the Dynamic Contrast Enhanced-Magnetic Resonance Imaging (DCE-MRI). Which complementary methodology for breast cancer, with Computer Aided Detection/Diagnosis (CAD) systems becoming essential technological tools to provide early detection and diagnosis of tumor's., It is important to take into account the physiological inheritance of the images under analysis. DCE-MRI consists in the temporal acquisition of 3D volumes before (pre) and after (post) the intravenous injection of a paramagnetic contrast agent, such as Gadolinium-based, resulting in 4-dimensional data. They also propose "3TP U-Net", a U-Shaped Deep Convolutional Neural Network that exploits the well-known Three Time Points approach for the lesion segmentation task. Results show that proposal is able to outperform not only the classical (non-deep) approaches but also some very recent deep proposal, achieving a median Dice Similarity Coefficient of 61.24%.

Zhiqiong Wang et al. [3] This paper explores a breast CAD method based on feature fusion with Convolutional Neural Network (CNN) deep features. A computer-aided diagnosis (CAD) system based on mammograms enables early breast cancer detection, diagnosis, and treatment., They build a feature set fusing deep features, morphological features, texture features, and density features. Extensive experiments demonstrate the accuracy and efficiency of their proposed mass

detection and breast cancer classification method. Its main idea is to apply deep features extracted from CNN to the two stages of mass detection and mass diagnosis. In the stage of mass detection, a method based on sub-domain CNN deep features and US-ELM clustering is developed. In this paper they combine subjective and objective features, taking the doctor's experience and the essential attributes of the mammogram into account at the same time.

3. Convolutional Neural Network

Convolutional neural network (CNN) is a specific type of artificial neural network that uses perceptron's, a machine learning unit algorithm, for supervised learning, to analyze data. CNNs apply to image processing, natural language processing and other kinds of cognitive tasks.

CNN is a modified variety of deep neural net which depends upon the correlation of neighboring pixels. It uses randomly defined patches for input at the start, and modifies them in the training process. Once training is done, the network uses these modified patches to predict and validate the result in the testing and validation process. Convolutional neural networks have achieved success in the image classification problem, as the definednature of CNN matches the data point distribution in the image. As a result, many image processing tasks adapt CNN for automatic feature extraction. CNN is frequently used for image segmentation and medical image processing as well. The CNN architecture has two main types of transformation.

The first is convolution, in which pixels are convolved with a filter or kernel. This step provides the dot product between image patch and kernel. The width and height of filters can be set according to the network, and the depth of the filter is the same as the depth of the input. A second important transformation is subsampling, which can be of many types and used as per requirement. The size of the pooling filter can be set by the user and is generally taken in odd numbers. The pooling layer is responsible to lower the dimensionality of the data, and is quite useful to reduce over fitting. After using a combination of convolution and pooling layers, the output can be fed to a fully connected layer for efficient classification. The visualization of the entire process is presented. Apart from the architecture of CNN, there is an additional key point, that simplicity to the user is helpful on the development side, as CNN requires a tremendous amount of data for training.

4. Artificial Neural Network (ANN)

The term Deep Learning or Deep Neural Network alludes to Artificial Neural Networks (ANN) with multi layers. In the course of the most recent couple of decades, it has been viewed as one of the most incredible assets, and has gotten well known in the writing as it can deal with an enormous measure of information. The enthusiasm for having further shrouded layers has as of late outperformed traditional techniques execution in various fields; particularly in design acknowledgment. One of the most well-known profound neural systems is the Convolutional Neural Network (CNN). It takes this name from numerical direct activity between frameworks called convolution. CNN have various layers; including convolutional layer, nonlinearly layer, pooling layer and completely associated layer. The convolutional and completely associated layers have boundaries however pooling and nonlinearity layers don't have boundaries. The CNN has a superb exhibition in AI issues. Uncommonly the applications that manage picture information, for example, biggest picture arrangement informational collection, PC vision, and in characteristic language handling and the outcomes accomplished were extremely stunning.

A counterfeit neural system, normally called "neural system" (NN), is a scientific model or computational model that attempts to reenact the structure and additionally utilitarian parts of organic neural systems. It comprises of an interconnected gathering of fake neurons and procedures data utilizing a connectionist way to deal with calculation. As a rule, an ANN is a versatile framework that changes its structure dependent on outside or inner data that moves through the system during the learning stage. Neural systems are nonlinear factual information demonstrating instruments. They can be utilized to show complex connections among information sources and yields or to discover designs in information. A neural system is an interconnected gathering of hubs, likened to the immense system of neurons in the human mind.

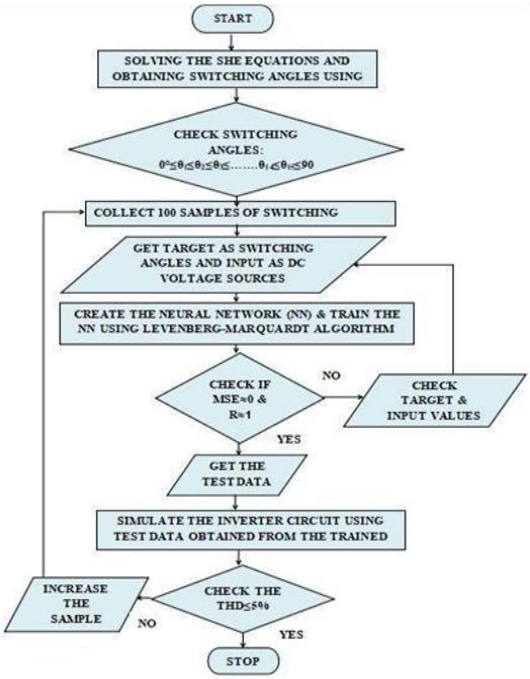

Fig. 1. Flowchart for ANN

5. Deep Convolutional Neural Networks

Profound convolutional neural systems (CNNs) are a specific sort of ANNs that utilization convolution instead of general framework augmentation in at any rate one of their layers. As

opposed to basic neural systems that have one or a few concealed layers, CNNs comprise of numerous layers. Such a component permits them to minimalistically speak to profoundly nonlinear and differing capacities. CNNs include numerous associations, and the engineering is commonly contained various kinds of layers, including convolution, pooling and completely associated layers, and acknowledge type of regularization. So as to learn confounded highlights and capacities that can speak to significant level deliberations, CNNs would require profound models. Profound designs, and CNNs, comprise of countless neurons and different degrees of dormant estimations of nonlinearity. Each degree of engineering of CNN speaks to highlights at an alternate degree of deliberation characterized as a creation of lower level highlights.

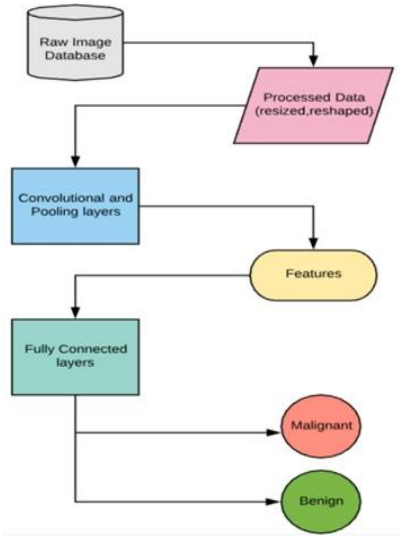

Fig. 2. Dataflow diagram

6. Result and Conclusion

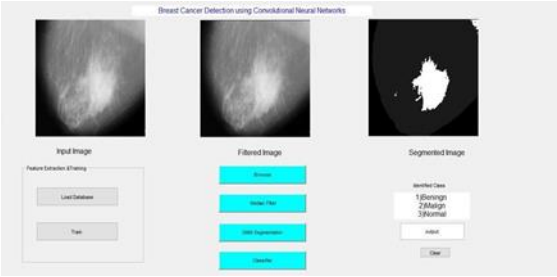

Fig. 3. Breast cancer detection using CNN

Tumors are abnormal growths of body tissue. The word tumor is used to describe both abnormal growths that are new and those present at birth.no matter where they are located in the body, tumors are usually classed as benign or malignant these are identified at output.

Benign breast diseases (BBD) have consistently been ignored in contrast with malignancy, in spite of the way that there are a lot a bigger number of patients with such infections than patients introducing to a bosom facility for disease.

Malignant tumors can aggressive and may spread to other surrounding tissues. A biopsy may be done on a suspicious lump, which can identify whether it is a tumor, and whether it is benign or malignant.

Cells invade neighboring tissues, enters to the blood vessels, cells are cancerous and can spread to other tissues and organs.

From the setup stated above, we obtained a level of accuracy which was improved over many state- of-the-art experimental setups. For comparison, we have compared our result with several published studies. Along with the improvement in accuracy, there is a significant improvement in precision and recall This approach is very useful as this system is fully automated and any user can test a new image just by selecting it by using our implementation. Even at the design stage, there is no need for domain insight as our method provides a high prediction accuracy. We have tested our model with various resolution of histopathology images and the results are relatively insensitive to resolution. By using this automated process there is a possibility of inexpensive detection of cancer in the early stages, which can ultimately increase survival rate among breast cancer patients.

References

[1] Tsung-Chen Chiang, Yao-Sian Huang, Rong-Tai Chen, Chiun-Sheng Huang, “Tumor Detection in Automated Breast Ultrasound Using 3-D CNN and Prioritized Candidate Aggregation,” IEEE, Vol. 38, 2017.

[2] Zhiqiong Wang, Huaxia Wang, Hanyu Jiang, Yudong Yao, Hao Zhang, Junchang Xin “DCE-MRI Breast Lesions Segmentation with a 3TP U-Net Deep Convolutional Neural Network IEEE 32nd International Symposium on Computer-Based Medical Systems (CBMS), 2019.

[3] Zhiqiong Wang, Huaxia Wang, Hanyu Jiang, Yudong Yao, Hao Zhang, Junchang Xin “Breast Cancer Detection Using Extreme Learning Machine Based on Feature Fusion with CNN Deep Features” IEEE Access, vol. 2, pp. 514–525, 2017.

[4] R. K. Samala, H.-P. Chan, L. Hadji ski, M. A. Helvie, J. Wei, and K. Cha, “Mass detection in digital breast tomosynthesis: Deep convolutional neural network with transfer learning from mammography,” 2016.

[5] E. Ali˘ckovi´c and A. Subasi, “Breast cancer diagnosis using GA feature selection and rotation forest,” Neural Computing and applications, vol.28, 2017.

[6] I. A. Ilan, J. Ramirez, J. Gorriz, M. A. Marino, D. Avendano, T. Helbich, P. Baltzer, K. Pinker, and A. Meyer- Baese, “Automated detection and segmentation of non-mass enhancing breast tumours with dynamic contrast-enhanced magnetic resonance imaging,” Contrast Media & Molecular Imaging, vol. 2018,

[7] J. Long, E. Shelhamer, and T. Darrell, "Fully convolutional networks for semantic segmentation," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2015, pp. 3431-3440.

[8] R. L. Siegel, K. D. Miller, and A. Jemal, "Cancer statistics, 2016," CA Cancer J Clin, vol. 66, no. 1, pp. 7-30, Jan-Feb 2016.

[9] J. R. Uijlings, K. E. Van De Sande, T. Gevers, and A. W. Smeulders, "Selective search for object recognition," International journal of computer vision, vol. 104, no. 2, pp. 154-171, 2013.

[10] X. W. Chen and X. Lin, “Big data deep learning: Chal enges and perspectives,” IEEE Access, vol. 2, pp. 514–525, 2014.