Breast Cancer Classification Based on Transfer Learning using Mammogram

Hama Soltani*, Mohamed Amroune, Issam Bendib, Mohamed-Yassine Haouam, Imene Othmani

LAMIS LAboratory, Echahid Cheikh Larbi Tebessi University, Tebessa-Algeria

*Corresponding author's e-mail: hama.soltani@univ-tebessa.dz

ABSTRACT

Although breast cancer has come a long way over the past few decades, women are still facing a lot of anxiety due to a high false-positive rate. So, there is a strong need to reduce unnecessary and burdensome emotional stress for women. Meanwhile, more precise diagnosis can help reduce the number of false-positives. In this study, we propose a method to identify and classify mammogram images into three classes: normal, benign, and malignant, to reduce the rate of false positives and assistthe radiologist in making a correct decision. Our approach involves convolutional neural networks,which are a very advanced and efficient technique when dealing with images in deep learning. To provide an efficient solution, transfer learning makes it possible to obtain high performances on small datasets, which were reached with a pre-trained EfficientNet, a state-of-the-art neural network optimized through fine-tuning hyperparameters and data pre-processing. We also used image augmentation techniques to further improve the efficiency of the solution. With the aforementioned architecture and the LAMISDMDB dataset, we achieved an accuracy of 83% and a precision of 83%

Keywords: Breast Cancer, Transfer Learning, Abnormality Classification

1 Introduction

Breast cancer is a global health concern, with the WHO reporting 2.3 million new diagnoses and 685,000 deaths in 2020 [1]. Mammography, a crucial tool for early detection, is constrained by the need for expert radiologists, high costs, and the incidence of false-positive results [2]. Machine learning, especially deep learning, has gained traction in improving mammogram analysis by automating detection and classification, potentially reducing costs and enhancing patient care [3]. We introduce an approach using the LAMIS-DMDB dataset, coupled with data augmentation techniques, to train an EfficientNet deep learning model based on transfer learning for accurate mammogram recognition and classification.

2 Related Works

The application of machine learning for mammography analysis has surged, driven by deep learning. Researchers have employed deep convolutional neural networks (CNNs) to detect correlated features in mammograms and predict breast cancer [4]. Additional techniques, including generative adversarial networks (GANs) for data augmentation [5], have been explored. For example, one study employed a binary CNN classifier for distinguishing normal from abnormal cases and trained a MobileNet-based architecture for identifying mammographic flaws [6]. Another study introduced a customized DCNN architecture for efficient differentiation between benign and malignant breast masses, with SVM classification [7]. In another instance, transfer learning with fine-tuning was used on CNNs to categorize breast lesions, introducing a fifth category for normal tissues [8]. These approaches represent strides in improving the efficiency and accuracy of breast cancer detection.

3 Methods and Results

Our process involves two stages: pre-processing and classification. DICOM images, prevalent in medical imaging, undergo initial pre-processing to isolate the breast organ, enhance contrast, and remove noise. Pre-processed mammograms are then classified into normal, benign, and malignant cases using

DOI: 10.21467/abstracts.163 ISBN: 978-81-965621-5-1 (eBook)

EfficientNet-based transfer learning. The model is trained, validated, and tested on the LAMIS-DMDB dataset, consisting of digital mammograms. Experimental results show the value of data augmentation and pre-processing. The model with data augmentation outperformed others, achieving a classification accuracy of 83%.

4 Conclusion

Transfer learning, particularly employing pre-trained convolutional neural networks, proves effective in mammogram classification. Our findings demonstrate the suitability of EfficientNet-based transfer learning for this field. As a next step, we plan to apply our approach to additional datasets and explore the use of generative adversarial networks for data augmentation. Ultimately, our goal is to develop an efficient and comprehensive computer-aided detection system based on machine learning and deep learning.

5 Declarations

5.1 Acknowledgments

This work is related to a research project of a mixed team of researchers titled "Intelligence Artificielle au Service de la detection du cancer du sein" at the Echahid Cheikh Larbi Tebessi University, Tebessa- Algeria.

5.2 Competing Interests

The authors declared that no conflict of interest exists in this work.

How to Cite

H. Soltani, M. Amroune, I. Bendib, M. Y. Haouam, I. Othmani, "Breast Cancer Classification Based on Transfer Learning using Mammogram", *AIJR Abstracts*, pp. 126–127, Feb. 2024.

References

[1] M. Arnold *et al.*, "Current and future burden of breast cancer: Global statistics for 2020 and 2040," *Breast*, vol.66, pp. 15–23, Dec. 2022, doi: 10.1016/j.breast.2022.08.010.

[2] N. M. Hassan, S. Hamad, and K. Mahar, "Mammogram breast cancer CAD systems for mass detection andclassification: a review," *Multimed Tools Appl*, vol. 81, no. 14, pp. 20043–20075, Jun. 2022, doi: 10.1007/s11042- 022-12332-1.

[3] H. Soltani, M. Amroune, I. Bendib, and M. Y. Haouam, "Breast Cancer Lesion Detection and Segmentation Based On Mask R-CNN," in *2021 International Conference on Recent Advances in Mathematics and Informatics (ICRAMI)*, IEEE, Sep. 2021, pp. 1–6. doi: 10.1109/ICRAMI52622.2021.9585913.

[4] H. Cai *et al.*, "Breast Microcalcification Diagnosis Using Deep Convolutional Neural Network from Digital Mammograms," *Comput Math Methods Med*, vol. 2019, pp. 1–10, Mar. 2019.

[5] S. Guan and M. Loew, "Breast cancer detection using synthetic mammograms from generative adversarial networks in convolutional neural networks," *14th International Workshop on Breast Imaging (IWBI 2018)*, Jul. 2018.

[6] W. Ansar, A. R. Shahid, B. Raza, and A. H. Dar, "Breast Cancer Detection and Localization Using MobileNet Based Transfer Learning for Mammograms," *Intelligent Computing Systems*, pp. 11–21, 2020.

[7] S. Shakeel and G. Raja, "Classification of Breast Cancer from Mammogram images using Deep Convolution Neural Networks," *2021 International Bhurban Conference on Applied Sciences and Technologies (IBCAST)*, Jan. 2021.

[8] S. Castro-Tapia *et al.*, "Classification of Breast Cancer in Mammograms with Deep Learning Adding a Fifth Class," *Applied Sciences*, vol. 11, no. 23, p. 11398, Dec. 2021.

ISBN: 978-81-965621-5-1

Series: AIJR Abstracts

DOI: 10.21467/abstracts.163