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Constructing a hybrid activation and parameter-fusion based CNN medical image classifier

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Abstract

In recent years, numerous deep learning models for medical image classification have emerged, with varying accuracies influenced by factors like image quality, content, and the convoluted low-level features. In this article, we aim to identify key features that enhance the precision of convolutional neural networks (CNNs), which are widely employed in this domain. We empirically demonstrate that parameters like activation functions, image augmentation, convolutional layers, filter sizes, and max pooling significantly impact precision, while others like hidden layers, epochs, and batch sizes affect quality and runtime

negatively. To validate our proposal, we use a publicly-available dataset of colored Breast Cancer images which comprises 27,751 images distributed over three sub-datasets as follows: 4162 testing images (2980 no cancer and 1182 with cancer), 19,426 training images (13,911 no cancer and 5515 with cancer), and 4163 validation images (2981 no cancer and 1182 with cancer). Multiple experimental runs were conducted, and the outcomes of each run were recorded, taking into account various evaluation metrics and components of the CNN architecture. Results demonstrate that the highest CNN classifier's accuracy was achieved when coupling ReLU and Sigmoid activation functions using a 3×3 filter with a batch of size 32 and 20 epochs and 2 hidden layers. A Similar accuracy rate (83.55%) has also been achieved when coupling ReLU and Sigmoid activation functions using the DensNet-201 pre-trained CNN model.



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Data availability

Not applicable.

Notes

1. https://www.cdc.gov/cancer/breast/basic_info/symptoms.htm.

2. <https://www.mayoclinic.org/diseases-conditions/breast-cancer/diagnosis-treatment/drc-20352475>.
3. <https://www.kaggle.com/adacslicml/breast-histopathology-images/>.
4. <https://www.image-net.org/>.

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Ethics declarations

Conflict of interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript. The authors did not receive support from any organization for this work. The study was conducted on a publicly available dataset as cited within.

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