Novel Implementation of Deep Learning for Breast Cancer Detection Using Convolutional Neural Networks and Transfer Learning

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Machine learning can assist radiologists in detecting breast cancer by increasing efficiency and accuracy, which is vital to its treatment. This project introduces a novel, Java-based implementation of a convolution neural network (CNN) for classifying benign and malignant tumors in mammograms. The Curated Breast Imaging Subset of DDSM (CBIS-DDSM) is used for it provides the Region of Interest (ROI) cropouts. Data augmentation in the form of rotation is applied to increase the size of the input data. A series of Java-based preprocessing of this data is deployed to prepare it for training and testing. 20% of the data was randomly preserved for testing. A VGG16 architecture initialized with pre-trained ImageNet weights is employed for transfer learning. Its fully connected layers were swapped out and repurposed for classifying 2 classes instead of 1000. The CNN is trained with the data prepared, and the loss as calculated by the loss function is returned every 10 iterations. A graph of this loss shows significant improvement in the performance of the CNN within the train set data, as a local minimum of loss is reached and is reflected by the flattening curve. A comparison of the CNN before and after 1 epoch of training also shows some improvement, as the precision increased from 0.00% to 36.84%. This project can be a valuable reference for future researchers looking to implement CNN and transfer learning for breast cancer detection in Java, as very few of such published studies have used Java as their primary language. For future work, additional hyperparameter tuning and training need to be done to improve the performance of the CNN. The methods described are universally applicable for classification problems.

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