Deep Learning of Mammogram Images to Enable Automatic and Accurate Breast Cancer Screening

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Breast cancer is currently the second leading cause of death among American women even though breast cancer mortality rates have decreased by 36% since 1989-2012. This decline has often been attributed to early detection of breast cancer. The most widely used form of detection is an x-ray of the breast called mammography. Although tremendously beneficial to early detection, mammography is not without its limitations. Due to the high variability in tumor size, shape, and breast density, a large number of false positive determinations are made causing unnecessary further intrusive testing. Current evaluation of mammograms is also time costly and largely ineffective, with manual analysis of mammograms by trained radiologists producing accuracies of only Convolutional neural networks (CNNs) have emerged in the recent years as state of the art image classifiers. In this study, three different CNN models- AlexNet, InceptionV3, and ResNet50- were built and trained to classify mammography datasets. Methods including transfer learning and data augmentation were used on the data and neural networks to make training as efficient and effective as possible. Other techniques such as saliency maps were calibrated to find ways to best visualize the areas of the mammogram the CNN considered important to classification. The highest accuracy achieved was 92.345%, exceeding human performance. The results show that CNNs have strong potential to aid radiologists as a tool for automatic detection of breast cancer on mammograms.

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