Multi-class Breast Cancer Classification by a Novel Two-Branch Deep Convolutional Neural Network Architecture

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Abstract:

One of the main reasons for death among women is breast cancer. The traditional diagnosis process of breast cancer is time-consuming and expensive. Also, an early cancer diagnosis may reduce the breast cancer death rate. With the help of computer-aided diagnosis system, the efficiency increased and the cost is reduced of the cancer diagnosis. Traditional classification methodologies are based on feature extraction techniques. Currently, deep learning techniques have become the alternative solution for diagnosis and overcame the problems of the handcrafted features methods. Increasing the depth in a deep convolutional neural network makes the network suffer from gradient vanishing problems, which are not caused by overfitting but instead by an increase in depth. Therefore, our proposed network is designed based on the idea of increasing the width of the network. A novel two-branch deep convolutional neural network is proposed for the classification of histopathological breast images. The proposed network is trained on the dataset of ICIAR-2018 to classify images into four classes; invasive carcinoma, in situ carcinoma, benign lesion, and normal tissue image. The proposed network is beneficial for gradient propagation as the error can be back-propagated through multiple paths. It also helps to combine different levels of features at each step of the network since it is a two-

branch network. The proposed network is superior to the existing methods by achieving a patch-wise classification accuracy of 83.6% and image-wise classification accuracy of 91.3% on the divided part from the training set. Moreover, we have achieved an image-wise classification accuracy of 89.4% on the unseen test images of ICIAR-2018.