RESEARCH PROPOSAL

Breast cancer is one of the most common cancers in women. Typically, the course of the disease is asymptomatic in the early stages of breast cancer. According to World Health Organization (WHO), it is estimated that 6,27,000 females died of breast cancer in 2018 which is roughly 15% women around the world and the rates are rapidly growing worldwide. Breast cancer accounts for 14% of cancers in Indian women. It is reported that with every four minutes, an Indian woman is diagnosed with breast cancer. Breast cancer is on the rise, both in rural and urban India. A 2018 report of Breast Cancer statistics recorded 1,62,468 new registered cases and 87,090 reported deaths. Cancer survival becomes more difficult in higher stages of its growth, and more than 50% of Indian women suffer from stage 3 and 4 of breast cancer. Post cancer survival for women with breast cancer was reported 60% for Indian women, as compared to 80% in the U.S.

One in twenty-eight Indian women is likely to develop breast cancer during her lifetime. It is more (1 in 22) for urban women than the rural group (1 in 60). A report stated that cancer caused 5% of the total disability-adjusted life years (DALYs) in the Indian population in 2016. The numbers are staggering and constantly rising. The Indian Council for Medical Research published a report which stated that in 2016 the total number of new cancer cases is expected to be about 14.5 lakhs. This figure will likely increase to 17.3 lakhs in 2020.

Under this circumstances, early detection of breast tumor is essential to considerably decrease the mortality rates of female due to the fact that "according to a statistical report it was found that survival rate of breast tumor patients is almost 96% over five years because their tumors were identified at the early stage". The diagnosis of breast cancer can be done using imaging tests and biopsy. Mammography (MM), ultrasound imaging (US), positron emission tomography (PET), computed tomography (CT), and magnetic resonance imaging (MRI) are considered the most commonly used imaging modalities to diagnose the breast cancer. These imaging techniques differ in terms of effectiveness, price, type of physical phenomenon, the impact on the patient and its availability.

Among these modalities, mammography is considered as the standard breast tumor screening technique. Although it is a conventional screening method, mammography has less efficacy for patients under the age of 40 and dense breasts, less sensitivity to tiny tumors as well as does not indicate any possible outcome of the disease. Ultrasound is considered as an additional screening tool with only a small contribution to early cancer detection in conjunction with MRI and mammographically dense breast in women. On the other hand, Magnetic resonance imaging (MRI) is capable of detecting minor lesions that mammography and ultrasound cannot detect. By different studies, contrast-enhanced breast MRI has been established as a screening modality for women with familial risk for breast cancer growth. It demonstrates elevated sensitivity as twice as mammography and specificity around 97%, with the same range of positive predictive values for biopsy compared to mammography. There are numerous studies carried out using MRI images to identify breast tumor. Computer Aided (CAD) breast imaging programs have been developed to overcome the constraints of MRI such as needing significant time to acquire, process and interpret images. The proposed method consists of three phases including pre-processing, thresholding, and identification of region of interest (ROI).

Computed Tomography (CT) uses high dose x-ray radiation to generate the detailed scans or images of inside body. In most of the cases, CT machines generate continuous pictures in a helical (or spiral) fashion rather than producing a series of pictures of individual slices of the body. Helical CT has several advantages such as it is fast, it produces better 3-D images and it has better sensitivity in the detection of small abnormalities. The newest CT scanners, called multislice CT or multidetector CT scanners, allow more slices to be imaged in a shorter period of time.

In Positron Emission Tomography (PET) imaging system, a radioactive substance is injected into the blood to identify the most active body cells, especially the cancerous tissues. PET scan can be added with computed tomography (CT) so that both anatomical and functional views of the suspected cells can be observed. PET is not restricted to breast density and is useful in identifying axillary nodes and distant metastates. However, it has poor sensitivity in detecting small tumors because of their small size.

An important role in breast lesion segmentation is played by contour-based methods. This is especially true in case of the so-called active contours, i.e. dynamic curves moving towards the lesion boundary. There are various types of active contours: geodesic magnetostatic level sets etc. These methods are particularly effective in the case of a significant gradient at the boundaries of the lesion.

MRI has a higher sensitivity and PET/CT has a higher specificity in predicting the pathologic response in patients with breast cancer. PET/CT has some limitations compared with MRI. First, as a functional imaging technology, the anatomic discriminative resolution of PET/CT is lower than that of MRI. Second, the most appropriate pSUV cut-off value for predicting a pCR with PET/CT cannot be determined. The cost of PET/CT is higher, which could lead to a greater financial burden for patients.

CNN is one of the deep learning techniques for image recognition. Unlike conventional machine learning techniques, CNN trains itself using existing data without requirement of human-made feature values. Therefore, CNN has potential to discover unknown patterns of MRI, CT and PET that are associated with tumor hypoxia. Because localizing hypoxia is important for surgical resection and radiation therapy planning.

The aim is to develop an automated approach for the diagnosis of breast cancer tumors using histopathological images which can be trained in convolutional neural network, for breast cancer image classification. To develop a model which can learns rich and discriminative features from the histopathological images and classifies different images obtained from MRI, PET and CT into benign and malignant classes with higher accuracy.

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