Pytorch Deep learning Approach for Detection of Breast Cancer by Digital Holographic Method

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Abstract: The digital holographic method performs quantitative analysis of phase images. This interferometric method gives access to biophysical attributes of cells such as refractive index, dry mass, volume, and morphology. Pytorch deep learning library with transfer learning is employed thereby improving the classification accuracy of breast cancer tissues.

1. Introduction

The incidence of breast cancer is increasing in the developing world due to increased life expectancy, increased urbanization, and the adoption of western lifestyles. The death rate from breast cancer cases is high among Indian women primarily due to a lack of awareness and delayed detection[1].Digital holographic method is an interferometric method and provides a quantitative phase imaging of the histopathological breast tissue taking into account the optical path length changes. In digital holography, the holographic interference pattern is optically generated by the superposition of object and reference beams, that is digitally sampled by a charge-coupled device (CCD) camera and transferred to a personal computer as an array of numbers[2,3]. The propagation of optical fields is absolutely and correctly denoted by diffraction theory, which permits numerical reconstruction of the image as an array of complex numbers representing the amplitude and phase of the optical field.

2. Proposed work

The digital hologram is obtained with a Mach Zehnder interferometric set up as shown in Fig. 1(a). It consists of a He-Ne laser source of wavelength 632.8nm.The beam splitter splits the laser beam into two beams namely, object beam and the reference beam. The spatial filter is used to eliminate high-frequency fluctuations and to get a clear expanded laser beam.

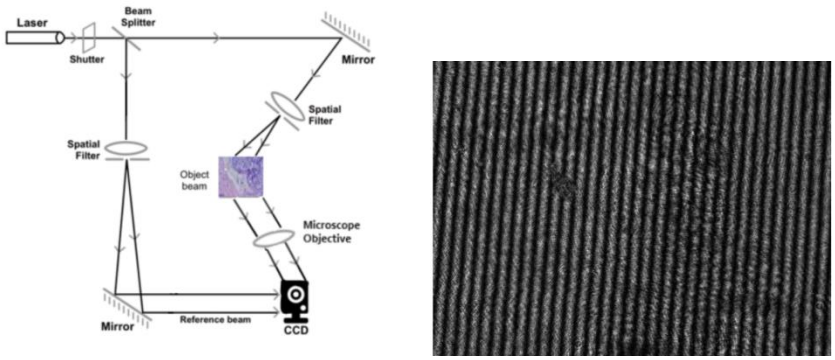

Fig. 1. a) Digital holographic set up b) Digital hologram

The microscopic breast tissue is placed as sample and a microscopic objective (MO) is used to magnify the microscopic tissue. The object beam and reference beam interfere on the CCD camera and a digital hologram is recorded. The digitized hologram is stored on a computer.

The digital holograms are taken for benign and malignant tissues and dataset are formed. In this paper, a pre trained deep learning network with pytorch is employed. Transfer learning using resnet is adopted that fine tunes the network. This helps to reduce the training time and data required for training. During training there will be a forward pass and followed by back propagation. In the forward pass images are given to the begin point of network and thereby generating an output that is a function of loss or error happened. In back propagation a backward pass happened where gradients are calculated using partial derivatives with respect to loss and thereby make changes to the weights of the network. The given network is observed with an accuracy of 94.3%.

3. Conclusion

The diagnosis and detection of breast cancer is very important. The digital holographic method will provide additional features relating to phase. Along with the resnet model using pytorch improves the accuracy and computation time of the network.

4. References

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