Chapter 3
Early Detection of Cancer Using Smartphones

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ABSTRACT

Cancer disease is the second largest disease in the world with high death mortality. Cancer is an abnormal growth of a normal cell. There are more than 100 types of cancer like blood cancer, brain cancer, small intestine cancer, lung cancer, liver cancer, etc. The type of cancer can be classified by the type of cell which is initially affected. When cancer grows it does not show any symptom. The symptom will appear when the cancer cell grows in mass and the symptom of cancer depends on the type of cancer. The cause of cancers is environmental pollutants, food habits, inherited genetics, tobacco, stress, etc., but in practice, it is not possible to prove the cause of cancer since various cancers do not have specific fingerprints. After the heart attack, cancer is a second killer disease in India. The death mortality is high in cancer because in most of the cases it is identified at the final stage which causes more death. According to ICMR, among 1.27 billion Indian populations, the incidence of cancer is 70-90 per 100,000 populations and 70% of cancer is identified in the last stage accounting for high morality. There are many types of treatment to treat cancer and they are surgery, radiation therapy, chemotherapy, targeted therapy, hormone therapy, stem cell transplant, etc. All cancer treatments will have side effects and the treatments will help only if the cancer cells are identified at the early stage. So time factor is important in diagnosing of cancer cells; hence, early detection of cancer will reduce the mortality rate. This chapter proposed the early detection of cancer cells using image processing techniques by the structure of circulating tumor cell. Early detection of cancer cells is very difficult because the concentration of cancer cells are extremely small and about one million malignant cell is encountered per billion of healthy cells. The circulating tumor cells, CTC, are shed into the bloodstream as a tumor grows, and it is believed these cells initiate the spread of cancer. CTC are rare, existing as only a few per one billion blood cells, and a highly efficient technology like chip-based biosensor platforms is required to capture the CTC, which in turn helps to detect cancer cell at an early stage before spreading. In proposed method, the circulating tumor cell has used a marker to detect cancer at early stage.

INTRODUCTION

Image processing technique plays a crucial role in the field of healthcare industries especially in the diagnosis of diseases.

The tumors can be classified into two types, they are, benign tumors and malignant tumors. The benign tumors remain in one place and do not appear to spread. The malignant tumors are more dangerous, spreads to other parts of the body through the blood stream or lymphatic system. When cancer spreads it is very hard to treat. Treatments for of cancer are surgery, chemotherapy, radiation and the advanced named Targeted treatment and Immunotherapy. The targeted treatment includes Erlotinib, Afatinib, Gefitinib, Bevacizumab, Crizotinib and Ceritinib. The immunotherapy treatment includes Monoclonal antibodies, Checkpoint inhibitors, Therapeutic vaccines and Adoptive T-cell transfers. But all these types of treatments may cause side effects. The cancer diagnosis highly requires histological examination of tissue abnormalities detected by radiological, clinical or endoscopic examination of patients. Even though the tests, technologies and treatments are available, if the cancer cells are not diagnosed at early stage, i.e., before Metastasis stage, then the possibility of life-saving is 30% only. Metastasis, spreading of cancer, is the cause of most cancer mortality. When primary tumors grow at the higher rate, the cells are released from the origin organ to others parts of the body through the blood stream or lymphatic system. These cells are named as circulating tumor cell. The circulating tumor cells, CTC, are shed into the bloodstream as the tumor grows and it is believed these cells initiate the spread of cancer. CTC, are rare, existing as only a few per one billion blood cells and highly efficient technology like chip based biosensor platforms is required to capture the CTC, which in turn helps to detect cancer cell at the early stage before spreading. Because by successful dissemination, the tumor cells surrounding around the primary tumor, intravasate into a blood and lymphatic vessels to form a metastasis. This CTC's when invading through the blood and lymphatic vessels it will get shed into the vasculature. Before forming to metastases when the CTC travels through the blood vessels the system is proposed to identify the cancer cell with its cell structure.

LITERATURE REVIEW

Cancer Detection Using CAD

Khosravi, F., et.al (2016) proposed a nanotube CTC chip to detect metastatic cancer. The researchers manufactured a 76-element single wall carbon nanotube array using photo lithography, metal deposition and etching techniques to identify the metastatic cancer cells in a small amount of blood drawn from cancer patient [6].The Nanochip –CTC chip is capable of detecting and capturing of cancer cells without any pre-labeling and processing steps. Blood is simply absorbed and by using electrical sensing and DTW (Dynamic Time Warping) the detection and stratification can be enabled. The electrical signal will be then confirmed using optical/confocal microscopy to hold spiked cancer cells. The nanotube–CTC chip has the potential for clinical translation by using higher information content both in detection and capture about the disease status.

Singh, S.P., Urooj, S., & Lay-Ekuakille, A. (2016) proposed Breast Cancer Detection Using CAD system. The X-ray image sensing is very challenging to visualize the abnormality. The human factor often causes the low degree of accuracy. Hence a Computer-aided detection is proposed to reduce the

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