Chapter 10
Detection of Cancer from Microscopic Biopsy Images Using Image Processing Tools

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ABSTRACT

Presently, most cancer diagnosis is based on human visual examination of images in a qualitative manner. Human visual grading for microscopic biopsy images is very time-consuming, subjective, and inconsistent due to inter-and intra-observer variations. A more quantitative and reproducible approach for analyzing biopsy images is highly desired. In biopsy images, the characteristics of nuclei are the key to estimate the degree of malignancy. The microscopic biopsy images always suffer from the problem of impurities, undesirable elements, and uneven exposure. Thus, there is a need of an automatic cancer diagnosis system based on microscopic biopsy images using image-processing tools. Therefore, the cancer and its type will be detected in a very early stage for complete treatment and cure. This system helps pathologists to improve the accuracy and efficiency in detection of malignancy and to minimize the inter observer variation. In addition, the method may help physicians to analyze the image cell by using classification and clustering algorithms by staining characteristics of the cells. The various image-processing steps involved for cancer detection from biopsy images include acquisition, enhancement, segmentation, feature extraction, image representation, classification, and decision-making. With the help of image, processing tools the sizes of cells, nuclei, and cytoplasm as well as the mean distance between two nearest neighboring nuclei are estimated by the system.

INTRODUCTION

Cancer is one of the most dangerous diseases of the human body. It is the uncontrolled growth of abnormal cells anywhere in the body. The abnormal cell is considered as either a malignant cell or tumor. The cancer is nothing but an advance stage of tumor. Cancer is easier to treat and cure if it has diagnosed early. There are about 200 types of cancer according to national cancer institute. This chapter provides the basic cancer detection techniques as well as advanced cancer diagnostic methodology with new and accurate techniques for detection of cancer from microscopic biopsy images.

What is Cancer?

Cancer is nothing but an advance stage of tumor. Cancer is easier to treat and cure if it has been diagnosed early. All cancers begin in cells, the body's basic unit of life. To understand cancer, it is helpful to know what happens when normal cells become cancer cells. Many types of cells make the body. These cells grow and divide in a controlled way to produce more cells as they needed to keep the body healthy. When cells are becoming old or damaged, are died and replaced by new cells. However, sometimes this orderly process goes wrong. The genetic material (DNA) of a cell can be damaged or changed, producing mutations that affect normal cell growth and division. See Figure 1. When this happens, cells do not die when they should and new cells form when the body does not need them. The extra cells may form a mass of tissue called a tumor. Malignant tumors are cancerous. Cells in these tumors can invade nearby tissues and spread to other parts of the body. The spread of cancer from one part of the body to another part of the body called metastasis. Some cancers do not form tumors. For example, leukemia is a cancer of the bone marrow and blood.

Figure 1. Understanding cancer mutation: cancer
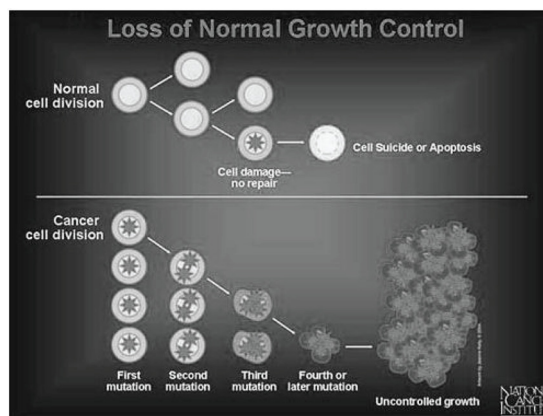
Types of Cancer

There are about 200 type of cancer according to national cancer institute. Most of the cancer falls in following categories.

Carcinoma

The most common types of cancer arise from the cells that cover external and internal body surfaces. Lung, breast, and colon are the most frequent cancers of this type of cancer begin in the skin or tissues that line or cover internal organs.

Sarcoma

This type of cancer begins in the bones, Cartilage, fat, mussels, and blood vessels or other connectives or supportive tissues.

Leukemia

This type of cancer starts in forming blood forming tissue, such as bone marrow and causes a large number of abnormal blood cells.

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