International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 08, August 2015
Available at http://internationaljournalofresearch.org

Automatic Cancer Detection Using Decision Making Dataset Algorithm

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ABSTRACT:

The capability to screen for leukemia based on bone marrow samples could facilitate the doctors in confirming the occurrence of leukemia from blood test. However, the images of the bone marrow slide have several drawbacks such as the appearance of unwanted regions. Due to these matters, a digital image processing system with classification capability is built up in this research which aims to reduce the drawbacks arise from manual screening of bone marrow slide. In this research, two steps were used to improve the appearance of the acquired bone marrow slide images. These two techniques are to create the dataset using the cancerous images and make decision for images (whether cancerous or non cancerous).Use of both techniques together produced better results. Several features were extracted to test whether an image is cancerous or non cancerous. These features include: mean, standard deviation and variance for red channel, green channel and blue channel separately of the image. Then, the test image is also processed for these features. Finally based upon the calculated features of the dataset and that of the test image, we will conclude that the given image is cancerous or not.

Key Words: Bone marrow; Leukemia; Dataset; Decision Making Algorithm; WBC

1. Introduction

Cancer medically known as malignant neoplasia is a broad group of diseases involving unregulated cell growth. In cancer, cells divide and grow uncontrollably, forming malignant tumors, which may invade nearby parts of the body. The cancer may also spread to more distant parts of the body through the lymphatic system or bloodstream. Not all tumors are cancerous; benign tumors do not invade neighboring tissues and do not spread throughout the body. There are over 200 different known cancers that affect humans [1].
The causes of cancer are diverse, complex, and only partially understood. Many things are known to increase the risk of cancer, including tobacco use, dietary factors, certain infections, exp-osure to radiation, lack of physical activity, obesity, and environmental pollutants, these factors can directly damage genes or combine with existing genetic faults within cells to cause cancerous mutations. Approximately 5–10% of cancers can be traced directly to inherited genetic defects. Many cancers could be prevented by not smoking, eating more vegetables, fruits and whole grains, eating less meat and refined carbohydrates, maintaining a healthy weight, exercising, minimizing sunlight exposure, and being vacc-inated against some infectious diseases [1].

2. Signs and Symptoms

When cancer begins, it invariably produces no symptoms. Signs and symptoms only appear as the mass continues to grow or ulcerates. The findings that result depend on the type and location of the cancer. Few symptoms are specific, with many of them also frequently occurring in individuals who have other conditions. Cancer is the new "great imitator". Thus, it is not uncommon for people diagnosed with cancer to have been treated for other diseases, which were assumed to be causing their symptoms [1].

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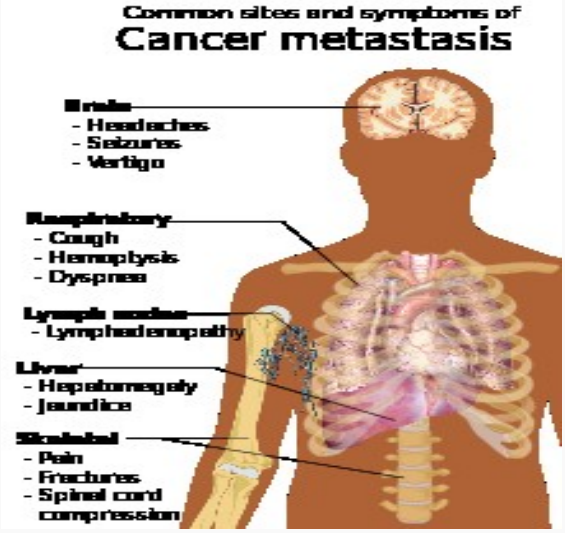

Figure 1: Symptoms of cancer metastasis depend on the location of the tumor.

3. Metastasis

Cancer can spread from its original site by local spread, lymphatic spread to regional lymph nodes or by blood to distant sites, known as metastasis. When cancer spreads by a haematogenous route, it usually spreads all over the body. However, cancer 'seeds' grow in certain selected site only ('soil') as hypothesized in the soil and seed hypothesis of cancer metastasis. The symptoms of metastatic cancers depend on the location of the tumor, and can include enlarged lymph nodes (which can be felt or sometimes seen under the skin and are typically hard), enlarged liver or enlarged spleen, which can be felt in the abdomen, pain or fracture of affected bones, and neurological symptoms.

The great majority of cancers, some 90–95% of cases, are due to environmental factors. The remaining 5–10% are due to inherited genetics [2]. Environmental, as used by cancer researchers, means any cause that is not inherited genetically, such as lifestyle, economic and behavioral factors, and not merely pollution. Common environmental factors that contribute to cancer death include tobacco (25–30%), diet and obesity (30–35%), infections (15–20%), radiation (both ionizing and non-ionizing, up to 10%), stress, lack of physical activity, and environmental pollutants [2].

4. Diet and Exercise

Diet, physical inactivity, and obesity are related to up to 30–35% of cancer deaths. In the United States excess body weight is associated with the development of many types of cancer and is a factor in 14–20% of all cancer deaths. Correspondingly, a UK study including data on over 5 million people showed higher body mass index to be related to at least 10 types of cancer, and responsible for around 12,000 cases each year in that country [3]. Physical inactivity is believed to contribute to cancer risk, not only through its effect on body weight but also through negative effects on the immune system and endocrine system. More than half of the effect from diet is due to over nutrition (eating too much), rather than from eating too few vegetables or other healthful foods.

5. Heredity

The vast majority of cancers are non-hereditary ("sporadic cancers"). Hereditary cancers are primarily caused by an inherited genetic defect. Less than 0.3% of the populations are carriers of a genetic mutation that has a large effect on cancer risk and these causes less than 3–10% of all cancer. Some of these syndromes include: certain inherited mutations in the genes BRCA1 and BRCA2 with a more than 75% risk of breast cancer and ovarian cancer, and hereditary nonpolyposis colorectal cancer (HNPCC or Lynch syndrome), which is present in about 3% of people with colorectal cancer [4] among others.

6. PATHOPHYSIOLOGY

Genetics:

Cancer is fundamentally a disease of tissue growth regulation failure. In order for a normal cell to transform into a cancer cell, the genes that regulate cell growth and differentiation must be altered [5].

The affected genes are divided into two broad categories. Oncogenes are genes that promote cell growth and reproduction. Tumor suppressor genes are genes that inhibit cell division and survival. Malignant transformation can occur through the formation of novel oncogenes, the inappropriate over-expression of normal oncogenes, or by the under-expression or disabling of tumor suppressor genes. Typically,

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changes in many genes are required to transform a normal cell into a cancer cell [6].

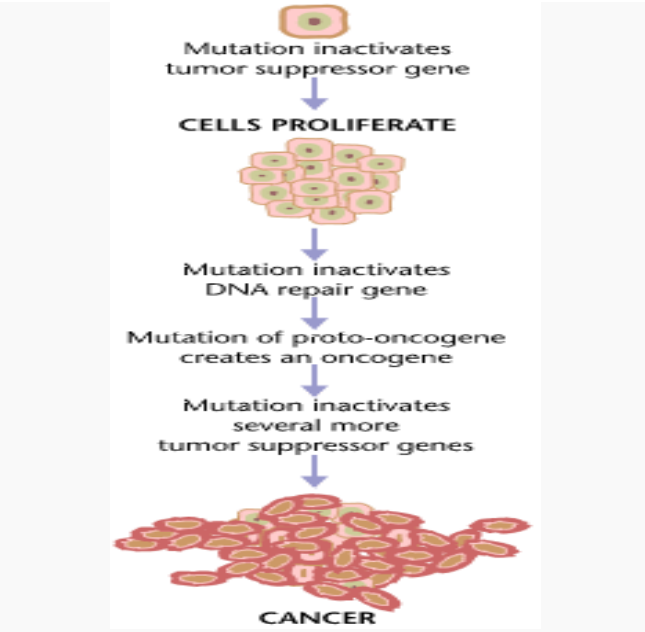

Figure 2: Cancers are caused by a series of mutations. Each mutation alters the behavior of the cell.

Genetic changes can occur at different levels and by different mechanisms. The gain or loss of an entire chromosome can occur through errors in mitosis. More common are mutations, which are changes in the nucleotide sequence of genomic DNA.

Large-scale mutations involve the deletion or gain of a portion of a chromosome. Genomic amplification occurs when a cell gains many copies (often 20 or more) of a small chromosomal locus, usually containing one or more oncogenes and adjacent genetic material. Translocation occurs when two separate chromosomal regions become abnormally fused, often at a characteristic location. A well-known example of this is the Philadelphia chromosome, or translocation of chromosomes 9 and 22, which occurs in chronic myelogenous leukemia, and results in production of the BCR-abl fusion protein, an oncogenic tyrosine kinase.

Small-scale mutations include point mutations, deletions, and insertions, which may occur in the promoter region of a gene and affect its expression, or may occur in the gene's coding sequence and alter the function or stability of its protein product. Disruption of a single gene may also result from integration of genomic material from a DNA virus or retrovirus, leading to the expression of viral oncogenes in the affected cell and its descendants.

7. SCREENING

Unlike diagnosis efforts prompted by symptoms and medical signs, cancer screening involves efforts to detect cancer after it has formed, but before any noticeable symptoms appear. This may involve physical examination, blood or urine tests, or medical [7].

Cancer screening is currently not possible for many types of cancers, and even when tests are available, they may not be recommended for everyone. Universal screening or mass screening involves screening everyone. Selective screening identifies people who are known to be at higher risk of developing cancer, such as people with a family history of cancer. Several factors are considered to determine whether the benefits of screening outweigh the risks and the costs of screening [7]. These factors include:

- Possible harms from the screening test: for example, X-ray images involve exposure to potentially harmful ionizing radiation.
- The likelihood of the test correctly identifying cancer.
- The likelihood of cancer being present: Screening is not normally useful for rare cancers.
- Possible harms from follow-up procedures.
- Whether suitable treatment is available.
- Whether early detection improves treatment outcomes.
- Whether the cancer will ever need treatment.
- Whether the test is acceptable to the people: If a screening test is too burdensome (for example, being extremely painful), then people will refuse to participate.
- Cost of the test.

8. LEUKEMIA

Leukemia is a disease that affects blood-forming cells in the body. It is a cancerous condition characterized by an abundance of abnormal white blood cells in the body. Leukemia begins in the bone marrow and spreads to other parts of the body. Both children and adults can develop leukemia [8].

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There are 4 common types of leukemia:

- Acute Myelogenous Leukemia (AML)
- Acute Lymphocytic Leukemia (ALL)
- Chronic Myelogenous Leukemia (CML)
- Chronic Lymphocytic Leukemia (CLL)

Leukemia can affects any five types of the WBCs;
neutrophils, basophils, eosinophils, monocytes and lymphocytes. The acute type of leukemia progresses more rapidly than the chronic leukemia. The term lymphocytic indicates that the cancerous change takes place in a type of marrow that forms the Lymphocytes. While the term myelogenous indicates that the cell change takes place in a type of marrow cell that normally goes on to form red cells, some types of white cells and platelets.

Causes and Risk Factors of Leukemia
Researchers have identified several causes and risk factors for leukemia. It happens in:

- People older than the age of 60, but it can occur in younger people
- People who smoke.
- People who have undergone previous chemotherapy or radiation therapy.
- People infected with the human T-cell leukemia virus, a virus that infects T-cells that is spread by sharing syringes and used to inject drugs; through blood trans-fusions; through sexual contact; and from mother to child at birth or through breastfeeding.
- People with myelodysplasctic syndrome, a blood disorder.
- People with Down syndrome [8].

Symptoms of Leukemia
Leukemia symptoms can occur all of a sudden or gradually. The symptoms are broad, but there are specific signs of leukemia to keep an eye out for:

- Fever
- infection
- excessive bruising
- fatigue
- physical exercise intolerance
- abdominal pain, or generally feeling fullness
- weight loss
- abnormal bleeding
- enlargement of the lymph nodes, spleen or liver
- weakness [8]

9. Methodology and Technique used
The whole implementation is broadly divided into 2 parts:

1. create the dataset using the cancerous images
2. make decision for images (whether cancerous or not)

In the first part, various features are extracted from the sample images. In this project, a total of 35 sample images are taken as input. This sample size can be changed. More number of sample images tends to increase the accuracy of the decision. Also, after extraction of features, range is set for each feature. This range will be used in step 2 for classification.

In step 2, range from step one is taken into account. The test image is inputted (for which the decision is to be made). Features are extracted for this image. These features are then tested with the range of features as calculated from step 1. This is how the decision is made whether an image is cancerous or not.

10. Results and Discussion
Following are the implementation results for the scenario as per given in the previous chapter Methodology. Now the method to analyze the image is:
If the input image's red, blue and green channels are coming in between the MIN and MAX values that means the image is cancerous and suppose that channels are not coming in the range that means image is not cancerous. So according to that we implemented it on various images to check the images are cancerous or not shown.

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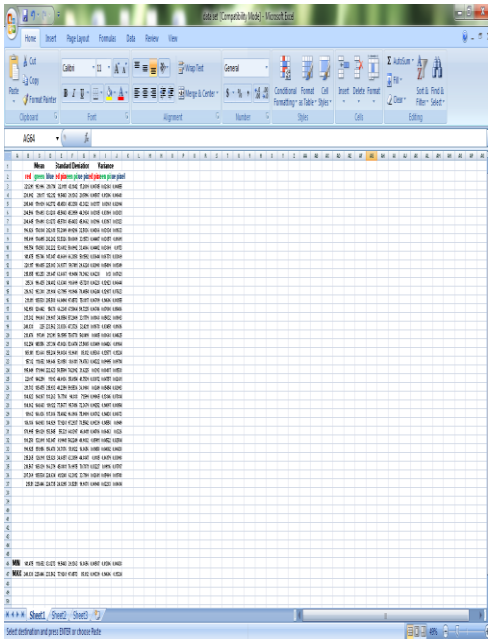

Figure 3: Data set of 35 images.

Single image checked

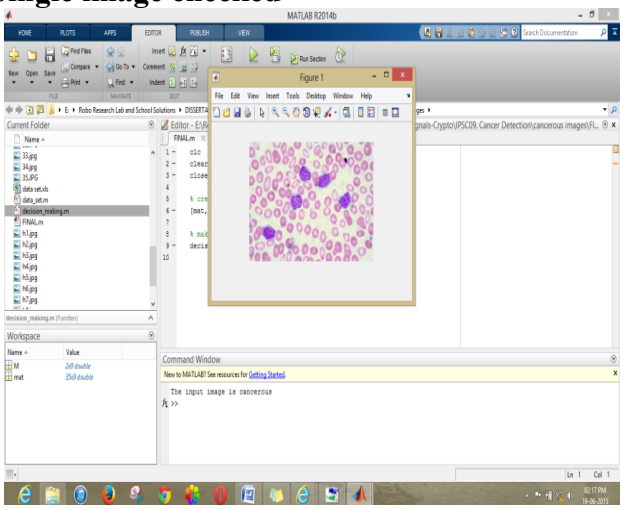

Figure 4: Cancerous Image

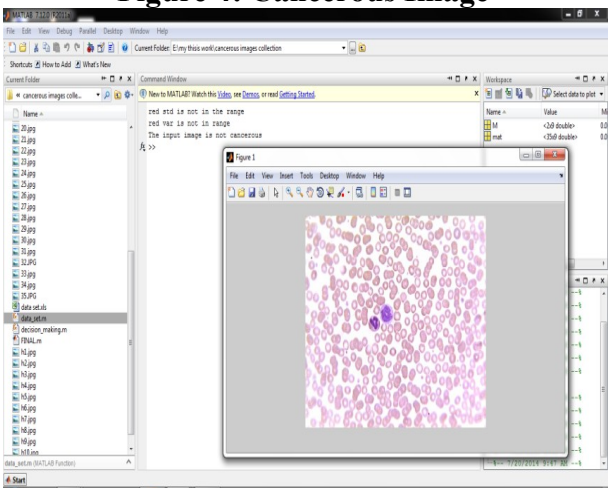

Figure 5: Non Cancerous Image

11. Conclusion

This analysis involves detecting leukemia (a kind of cancer) mistreatment using microscopic blood sample pictures. This system uses microscopic pictures and extracts its features like changes on texture, geometry, colors associate degreed applied mathematics analysis so uses them as an input to the classifier. The image process technique that's utilized here has been ready to perceive the infected cells present in Red Blood Cells (RBC) in case of the sick/infected patient. The system ought to be economical, reliable, less time interval, smaller error, high accuracy, cheaper price and should be strong towards varieties that exist in individual, sample assortment protocols, time and etc. The use of such microscopic pictures of blood samples may be accustomed give information concerning pathologic patient a lot of quickly. The image process techniques used has helped us to raised perceive the sickle-cells present in Red Blood Cells (RBCs) in case of sickle-cell patient.

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