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A NOVEL APPROACH FOR CANCER CELL DETECTION AND PREDICTION IN BONE USING DIGITAL IMAGE PROCESSING

R.Kavitha,Assistant Professor,
Department of Electronics and Communication Engineering
Bharathiyar Institute of Engineering for Women
Tamil Nadu, India
kavitharbe@gmail.com

Abstract:

Image processing are used widely in several medical applications for improving earlier detection and treatment stages, where factors are very important to discover the disease of patients as fast as possible Most commonly used method to detect cancer cells are MRI,CT-SCAN,X-RAY,BIOPSY and FNAC , etc. In day today practice, doctors are commonly using X-Ray as initial step followed by MRI. BIOPSY is a final ultimate tool to detect the cancer cells.Nowadays PET scan is being used for detection of the metastasis and also the site of primary cancer from where the cancer can arise initially which is not visible outside. Time factor is important to detect cancer earlier .In the proposed research work, an efficient system will be developed that detects, classifies and also recognizes the stage of the detected tumour. Further, abnormal cell in bone marrow results in immature appearance called acute leukemia which is to be solved by segmenting the bone marrow by using watershed transformation.

Key-Words: Cancer, PET Scan Imagery, Region Growing Algorithm, Segmentation process.

1 Introduction

Cancer is considered to be a multifarious genetic syndrome that is caused due to variousenvironmental factors. It is also identified as a malevolent neoplasm, which is indicated to be a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. Possible signs and symptoms include: a new lump, abnormal bleeding, a prolonged cough, unexplained weight loss, and a change in bowel movements, among others.

There are over 100 different known cancers that affect humans. In 2012 about 14.1 million new cases of cancer occurred globally. It caused about 8.2 million deaths or 14.6% of all human deaths. The most common types of cancer in males are lung cancer, prostate cancer, colorectal cancer, and stomach cancer, and in females, the most common types are breast cancer, colorectal cancer, lung cancer, and cervical cancer. If skin cancer other than melanoma were included in total new cancers each year it would account for around 40% of cases. In children, acute lymphoblastic leukemia and brain tumors are most common except in Africa where non-hodgkin lymphoma occurs more often. In 2012, about 165,000 children under 15 years of age were diagnosed with cancer. The financial costs of cancer have been estimated at $1.16 trillion us dollars per year as of 2010. Each year, around 3,000 cases of cancer of the bones and joints are diagnosed in the USA. Primary bone cancers are not common and make up less than 0.2% of all cancers.

Bone cancers are more common in young adults and children than in older people. Cancer found in the bones of an older adult most likely is metastatic from another location in the body. Bone tumors develop when cells in the bone divide without control, forming a mass of tissue. Most bone tumors are benign, which means they are not cancer and cannot spread. However, they may still weaken bone and lead to fractures or cause other problems. Bone cancer destroys normal bone tissue and may spread to other parts of the body (called metastasis).

As with other cancers, there is no one cause of bone cancer. In general, cancers arise when

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pathways that control normal cell growth and
proliferation are disrupted, allowing abnormal cells to divide and grow uncontrollably. A number of hereditary and environmental factors are likely involved in the development of bone cancers. . Less than 5% of cases occur in patients younger than 20.

There are several different types of bone cancer that can affect different patient populations and they are often treated differently. Some of the most common types of bone cancer are osteosarcoma, chondrosarcoma, ewing's sarcoma, pleomorphic sarcoma, fibrosarcoma. The American Cancer Society (www.cancer.org) estimates for cancer of the bones and joints for the year 2014 as about 3,020 new cases will be diagnosed, 1,460 deaths due to bone cancers are expected. Primary cancers of bones account for less than 0.2% of all cancers.

Staging the bone cancer: Bone cancer has different stages which describes its level of advancement.

Stage I - the cancer has not spread out of the bone. The tumor is not an aggressive one.

Stage II - same as Stage I, but it is an aggressive cancer.

Stage III. Tumors exist in multiple places of the same bone (at least two).

Stage IV. The cancer has spread to other parts of the body.

The best way of facing it is to detect it at the earliest stage and take appropriate measure. The American Cancer Society's estimates for cancer of the bones and joints are about 2,970 new cases will be diagnosed about 1,490 deaths from these cancers are expected.

Some of the estimated cancer cases and deaths across USA is tabulated in Table below.

Cancer	Estimated cases		Estimated deaths	
	Male	Female	Male	Female
Pancreas	23,530	22,890	20,170	19,420
Stomach	13,730	8,490	6,720	4,270
Liver	24,600	8,590	15,870	7,130
Lung	116,00	108,210	86,930	72,330
	0			
Breast	2,360	232,670	430	40,000
Thyroid	15,190	47,790	830	1,060
Eye	1,440	1,290	130	180
Intestine	4,880	4,280	640	570
Brain	12,820	10,560	8,090	6,230
Bone	1,680	1,340	830	630

Table 1. Estimated Cancer Cases and Deaths across USA

Some of the estimated cancer cases and deaths across globe is shown below.

Cancer type	Estimated cases	Estimated deaths
Prostate	233,000	29,480
Leukemia	52,380	24,090
Endometrial	52,630	8,590
Thyroid	62,980	1,890
Kidney	63,920	13,860
Lymphoma	70,800	18,990
Bladder	74,690	15,580
Melanoma	76,100	9,710
Colon	136,830	50,310
Breast	232,670	40,000
Lung	224,210	159,260

Table 2. Estimated Cancer Cases and Deaths across Globe

The study of cancer, called oncology, is the work of countless doctors and scientists around the world whose discoveries in anatomy, physiology,chemistry, epidemiology, and other related fields made oncology what it is today. Despite revolutionary advances in medicine and its practice -over the past two centuries, cancer treatment has gone through a comparatively slow process of development. In regard to the same, this paper contributes a methodology to compute PET scan image and perform some segmentation process for detecting the cancer and its stage. This process is carried out in four stages namely seed point selection, collection of additional image data, Determination of thresholding value, checking the similarity threshold value.

2 Relevant Work

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Pabitra Roy and Sudipta Roy [1] proposed an automated method for detection of brain abnormalities from MRI scan images. The methodology introduced the segmentation of tumor tissue, location of abnormal region.

Leela G A and H.M Veena Kumari [2] proposed a Morphological approach for the detection of Brain Tumour and cancer cells.

Rohit S. Kabade and M. S. Gaikwad [3] implemented a method for calculating the brain tumour shape and tumor area and its stages.

Detection resists the accurate determination of stage and size of tumour. The experiment made use of computer aided method for segmentation of brain tumour based on the combination of two algorithms that is k-means and Fuzzy c-means algorithms. This method gives the segmentation of tumour tissue with accuracy comparable to manual segmentation.

3 Bone Cancer Formations

Bones are not solid, but instead are made up of two distinct regions. The outer, weight-bearing area is hard, compact, and calcium-based, surrounded by lattice-work of fibrous bone known as cancellous tissue. The inner region, or marrow, which is one of the largest organs of the body, is located within the bones. It fills the shafts of the long bones, the trabeculae (spaces within cancellous tissue), and extends into the bony canals that hold the blood vessels.

Bone marrow may contain fat cells, fluid, fibrous tissue, blood vessels, and blood-forming (hematopoietic) cells. Marrow appears yellow in color when it holds many fat cells and red when it has more blood-forming material. The marrow is the principal site for blood formation (hematopoietic), which occurs primarily in the bones of the legs, arms, ribs, breastbone (sternum), and spine (vertebrae).
Bone cancer is a rare type of cancer that forms as a painful lump (‘tumour’) in bone. It is also known as bone sarcoma. When a bone cancer begins to grow, the cancer cells multiply and start to destroy the bone. The affected bone becomes weak and starts to cause problems. The most common places where bone cancer develops are around the knee, the wrist, the shoulder and the pelvis. There are over 30 types of bone cancers. The most common type is osteosarcoma, which is made up of millions of abnormal bone producing cells.

Chondrosarcoma is a bone cancer that is made up of millions of abnormal cartilage cells. Ewing’s sarcoma is another type of bone cancer. Some types of bone cancer affect the soft tissues of the body.These are called soft tissue sarcomas. Bone cancer is rare. About 50 Victorians are diagnosed with some type of primary bone cancer each year (a rate of about 1 case per 100,000 people). Rates for males and females are very similar.
The basic cause for bone cancer is not exactly known but suffers with several risk factors.
Age Bone cancer commonly affects teenagers and young adults, and people over the age of 55. Bone cancer that develops later in life is usually linked to a prior disease of the bone, such as Paget’s disease, Radiotherapy treatment. There is a very small risk of bone cancer for people who had radiotherapy, but it might sometimes affect bone in the treatment area.

The risk is higher for people who had high doses of radiotherapy at a very young age. Most people who have had radiotherapy in the past will not develop a bone cancer. However, at times genetic factor could also be the cause of bone cancer as some people inherit conditions that put them at higher risk, such as Li-Fraumeni syndrome. This condition runs in families and puts the individual at higher risk of several types of cancer, including bone cancer. On the whole comparatively a small number of people develop bone cancer due to genetic changes that happen during their lifetime, rather than inheriting a faulty gene.
The most common symptom of bone cancer

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is a painful swelling. Pain may not be constant. It may be much worse at night or during activity.

Taking pain-relieving tablets may not help. As the cancer grows over weeks or months the pain may get worse and become constant. The pain may cause problems with movement. Treatment may include surgery, chemotherapy and radiotherapy. Surgery is the main treatment for most types of bone cancer.

This usually means removing the cancer as well as some healthy tissue around the tumour. Doctors call this a 'wide local excision.' The healthy tissue is taken away to help decrease the risk of the cancer coming back in that area. Bone cancer is one of the few cancers that may still be cured even if it has spread.

4 Proposed Methodology

The experimentation proposed is initiated the processing of bone cancer imagery, so as to identify the region of bone cancer through PET scan image and evaluate it by segmentation and finally based on the results it is concluded whether the detected area is affected by cancer or not and also its stage.

Initially, the method requires scan imagery of bone with or without noise. If it is having noise, the image must be denoised before processing it.

Clustering is a process applied for denoising the image, in which pixels are classified based on standardized characteristics .In order to construct cluster based segmentation, the pixels must follow the homogeneity condition of the cluster to which they are assigned. Presently, seeded region growing algorithm is most frequently used for image segmentation, as it doesn't depend on the training process. The first step in region growing is the selection of the required seed points. The initial region is the exact location of the seed. The regions are then grown from the seed points to adjacent points according to a region membership criterion or thresholding technique. If the principle criterion is a pixel intensity threshold value, data are collected from the histogram of the image to establish a suitable threshold value for the region membership criterion. The four main important elements of the region growing algorithm are:

1) Seed point selection: The selection of seed points depends on the image. For a gray-level lighted image, segment the lightning from the background.

Then observe the histogram and select the seed points from its highest range.

2) Collection of additional image data: The connectivity or pixel neighbouring information facilitates the determination of the threshold and seed points.

3) Determination of thresholding value: In the region growing method all regions must be within the threshold value which is fixed determined prior to the process.

4) Checking the similarity threshold value: If the difference in the pixel-value is less than the similarity threshold, that region is treated as the same region.

Several advantages in using the region growing algorithm are as follows: First, region growing methods can accurately separate the regions; second, region growing methods give the original images if the image has clear edges with good segmentation results; Third, the idea is simple. Only seed point selection, that seed point grows the region; fourth, they are not sensitive to noise and therefore their performance is high. If any noise problem occurs, it is easily overcome by using a mask to filter the holes or outliers. These are the major reasons for choosing this algorithm for segmenting bone cancer medical images.

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Figure-1. PET Scan image

The following Figure shows the detection of images of bone

Figure-2. Edge detected images of bone.

6. CONCLUSIONS

The detection of Bone cancer from PET scan images and takes away the images that do not have a tumour or an unrelated image requires two main steps. In the preprocessing step, average filter and bilateral filter smooth the area of interest and remove noise. We combined thresholding segmentation and edge detection to get precise segmentation. In addition, the objects which are found in the margin area of the image will be removed by finding the centroid of each object. We developed an application to assess the performance of the proposed method.

REFERENCES

[1] Pabitra Roy and Sudipta Roy. 2013. An Automated Method for Detection of Brain Abnormalities and Tumor from MRI Images. International Journal of Advanced Research in Computer Science and Software Engineering. pp. 1528-1589.

[2] Leela G A and H.M VeenaKumari. 2014. Morphological Approach for the Detection of Brain Tumour and Cancer Cells. Journal of Electronics and Communication Engineering Research. pp. 07-12.

[3] Rohit S. Kabade and M. S. Gaikwad. 2013. Segmentation of Brain Tumour and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm. International Journal of Computer Science and Engineering Technology. pp. 524-531.

[4] Navneet Kaur and Mamta Juneja. 2014. A Novel Approach of Brain Tumor Detection Using Hybrid Filtering. Journal of Engineering Research and Applications. pp. 100-104.

[5] Ashwini S. Zade and MangeshWanjari. 2014. Detection of Cancer Cells in Mammogram Using Seeded Region Growing Method and Genetic Algorithm. Journal of Science and Technology. pp. 15-20.

[6] Manoj K Kowar and Sourabh Yadav. 2012. Brain Tumor Detction and Segmentation Using Histogram Thresholding. International Journal of Engineering and Advanced Technology. pp. 16-20.

[7]Adele P. Peskin and Karen Kafadar," Robust Volume Calculations Of Tumors Of Various Sizes" Scientific Application and Visualization Group National Institute of Standards and Technology, Boulder, Colorado 80305 USA.

[8]D.Narain Ponraj and M.Evangelin Jenifer," A Survey on the Preprocessing Techniques of Mammogram for the Detection of Breast Cancer", Journal of Emerging Trends in Computing and Information Sciences, Vol. 2, December 2011, 656-664.

[9]Sasikala and Vasanthakumar, "Breast Cancer-Classification and Analysis using Different Scanned Images," International Journal of Image Processing and Visual Communication, 2012, pp.1-7.

[10] Juliet R Rajan and Jefrin J Prakash, "Early Diagnosis of Lung Cancer using a Mining Tool," International Journal of Emerging Trends and Technology in Computer Science, 2013.

[11] P. Rajeswari and G. Sophia Reena, "Human Liver Cancer Classification using Microarray Gene Expression Data," International Journal of Computer Applications, 2011, pp. 25-37.

[12] Michael Feldman, John Tomaszewski and Anant Madabhushi, "A Boosted Bayesian Multi resolution Classifier for Prostate Cancer Detection From

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ISSN 2394-3785
(Online)
Available online at www.ijartet.com

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Digitized Needle Biopsies," IEEE Transactions on Biomedical Engineering, 2012, pp.1205-1218.

[13] Karthikeyan Ganesan, U. Rajendra Acharya, Chua Kuang Chua, Lim Choo Min, K. Thomas Abraham and Kwan- Hoong Ng, "Computer- Aided Breast Cancer Detection