BONE TUMOR DETECTION USING MARKOV RANDOM FIELD SEGMENTATION

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Abstract: Enchondroma, a benign tumor is found in the bone marrow. It represents up to 10-25% of the individuals with favorable tumors. In this paper, the enchondroma tumor is identified through Magnetic Resonance images(MRI). Pre-preparing procedures like Gaussian filters are used in order to remove the noise and smooth images. Segmentation is one of the techniques that provides knowledge regarding the Markov random filed approach of the images. The affected tumor cells are detected by effective methods like feature extraction and Naive Bayes classifier. This method helps in detecting the presence of Enchondroma in the MR images.

Index terms: *Enchondroma, tumor detection, Markov Random Field Segmentation, Morphological.*

I. INTRODUCTION

The uncontrollable and abnormal division of cells in the human body forms a lump of tissue which is called tumour. These tumours form and occupy the area in the bones. If the tumour growth goes abnormal, the healthy tissues will be replaced by the abnormal tissues. Based on the nature, they can be either benign or malignant.

Benign tumour aren't malignant. It does not affect the nearby tissue and it may be cured by treatment. But, abnormal growth of benign tumour cells also causes serious future issues as it suppresses the healthy bone tissues.

Malignant tumours are dangerous. As the cells continue to divide, the abnormal growth can cause cancer which spread throughout the body. When compared to malignant tumour, benign tumours are more common. Osteochondroma is the most common type of benign tumour (Bone) according to the American Academy of Orthopaedic Surgeon(AAOS). This type accounts from 35 to 40 percent of all benign tumours. They develop merely in adolescents and teenagers.

The tumours form and grow near the actively growing end of the long bones(i.e, arm and leg bones). These tumours mostly affect the lower end of the thigh bone(femur),the upper end of the lower leg bone(tibia) and the Upper arm bone(humerous).

Segmentation process is used to variate the tumour cells and fuzzy methods integrates the images using multi-spectral analysis[2].By using the MATLAB software, in this research an algorithm has been set to detect enchondroma.

II. LITERATURE SURVEY

An investigation demonstrated that 57% of patients are influenced by enchondroma and they are for the most part between the ages of 9 and 30 years. Enchondroma obsessive crack of the ulnar nerve and spiral bone was talked about in the investigation by [2] is utilized to group the cerebrum tumor cells by actualizing the feed-forward and back-proliferation technique. Grey Level Co-Occurrence Matrix (GLCM) highlights are utilized to recognize the typical and anomalous mind tumors.The morphological activity (Chanda et al., 1998) is gotten to play out the edge location by taking the distinction between a picture and its disintegration /enlargement picture by organizing the component.Both the enlargement/disintegration edge finders are clamor delicate.The multi-scale morphological edge finder is utilized to separate the fine varieties of dark level surface to expel clamor.

Thresholding strategy is utilized in the current framework and it is the most well-known method,which partitions picture into a binary picture. In some cases thresholding technique will need affectability required for precise grouping. In the proposed framework, we have utilized the Markov Random Field, include extraction and classifier to get exact consequence of the picture.

III.   METHODOLOGY

1.   IMAGE ACQUISITION

The picture is acquired to process further stages that lead to explaining and division of the region of tumor cells. It is useful to distinguish the amiable phase of the tumor and altogether expands the opportunity of fix. The X-ray (Mahnkenet al., 2005) arrangements with T1, T2, STIR and PDW give diverse data about the tumor.

2.   IMAGE CONVERSION

The acquired image is then converted to a greyscale image (Figure 1). The picture helps us to identify the important edges (monochromatic shades from black to white), whereas the RGB images failed to evolve the same. Then a low pass filter(LPF) is generated.
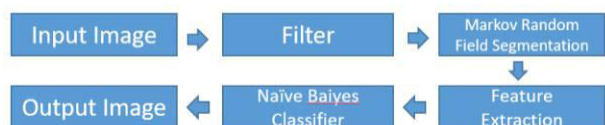

FIGURE 1 FLOW CHART TO DETECT THE ENCHONDROMA

3.   FILTER

Filtering procedure is essential to evacuate the noise just as it smoothes the pictures in view of the captured picture will be in low quality. Among the others MR imaging system is best a result of its higher goals pixels, it depends on the procedure that utilizations exceptionally charged magnetic fields to make pictures of inside the body.

IV.   IMAGE SEGMENTATION

Medicinal Image Segmentation is the procedure of programmed or self-loader detection of limits inside a 2D or 3D picture. Picture division is the high fluctuation in medicinal pictures. As a matter of first importance, the human life systems itself shows real methods of variety. Moreover various modalities (X-ray, CT, MRI, microscopy, PET, SPECT, Endoscopy, OCT, and some more) are utilized to make medicinal pictures. The result of the division would then be able to be utilized to acquire further diagnostic insights. Potential applications are the programmed estimation of organs, cell tallying, or recreations dependent on the extracted limit data. Next stage is division which basically focuses on tumor detection.

1.   MARKOV RANDOM FIELD SEGMENTATION

This technique is applied to the separated picture in which a intensity picture is changed over to a binary picture. To change over it into a binary picture, an edge worth is picked by this strategy to limit the intra-class difference of the foundation and closer view pixels. Setting all area as N and neighbors as S, the Markov structure is utilized to characterize the area of the pixels, F is a MRF on S concerning F if and only if

$$P(f)>0,f \qquad\qquad (1)$$

$$P(f_i|f_s-\{i\})=P(f_i|f_s) \qquad (2)$$

Equation (1) (2) prove the Markov property. If it follows it gives us a perfect output.
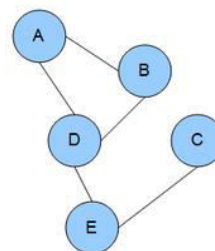

FIGURE 2 UNDIRECTED GRAPH

Applications of Markov Random Field are image and texture synthesis, image compression and restoration, stereo matching, super resolution, image segmentation.

2.   MORPHOLOGICAL OPERATION

For the examination of spatial structures, morphological activity depends on the set hypothesis, basic geometry and cross section variable based math. The numerical morphology is utilized for picture filtering (enhancing object structure), division (watershed), estimations (territory, border, granulometry), pattern recognition and texture analysis. In this paper, morphological activity is applied to smooth the edges on the grounds that the edges of the yield picture become sporadic in the wake of applying the edge. At that point the morphological close and open activity is applied to the binary picture. The edge identifier (Leela and Kumari, 2014) isn't delicate to edge course; in this way, the morphological activity based edge locator shows the monotonic diminishing reaction as the edge moves from the focal point of the area.

3. NAÏVE BAYE'S CLASSIFER

Naive Bayes classifier is applied for better analysis of the enchondroma disease in the case: benign that is affected or typical image. Naive Bayes classifiers can be given a set of variables, $X = \{x1, x2, x,...,xd\}$; set of possible outcomes $C = \{c1, c2, c,...,cd\}$. In a more familiar language, X is the indicators and C is the arrangement of straight out levels present in the reliant variable. Using Bayes' rule:

$$P(Cj|\ x1, x2, x,...,xd)\ P(c1, c2, c,...,cd|Cj)\ P(Cj) \quad (3)$$

where $p(Cj|x1, x2, x,...,xd)$ is the posterior probability of class membership, i.e. the probability that X belongs to Cj. Since naive Bayes assumes that the conditional probabilities of the independent variables are statistically independent, we can decompose the likelihood to a product of terms:

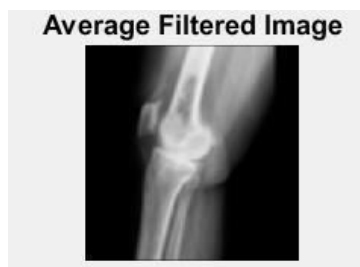$$p(X|\ Cj)\alpha\prod_{k=1}^{d}p(x_k|Cj)$$

V. RESULT AND DISCUSSION

The data contains both affected and non-affected images of enchondroma. MR images are given as input and processed.

Figure 3 Input Image

Original image

Figure 4 Average Filter Image

Average Filtered Image

It will take the mean value of its neighbors and itself. filter according to that mean average value.This has the effect of Pixel Eliminating and which is unnatural of the surroundings.

Figure 5 Enchondroma Affected Image

Enchondroma affected Image

Enchondroma affected image pre-processing techinique , inorder to remove noise and to smooth image. Average Filter and Bilateral Filter are widely used to achieve the image.

Figure 6 Morphological Operations

Morphological Operations – Erosion

Erosion in Wu and Aghajan (2007) is used to decrease or eliminate small objects.

Morphological Operations – Dilation

Figures 6 show the filtered image using Gaussian method and Markov random field segmented image.

Figure 7 Fcm Clustered Segmented Image

FCM clustered segmented image with 3 bins
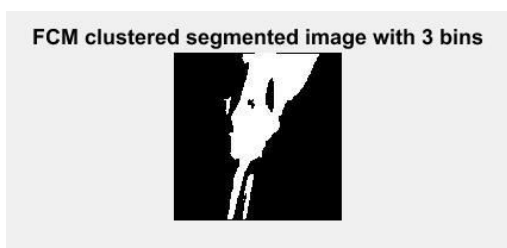
The experimental results of the cases and it describes the images affected by enchondroma tumor cells.

VI.   CONCLUCION

Enchondroma is a benign phase of bone cancer and it represents 5–25% of individuals with benign cancers. The proposed framework utilizes the MR pictures to distinguish the enchondroma cells, in which the framework is applied and executed utilizing the MATLAB programming. The element extraction and the naive Bayes classifier works successfully and distinguishes the cancer cells which are influenced by enchondroma. Also, the division utilizing the MRF(Markov Random Field) division technique and morphological activities is utilized to get exact division.

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