

Bone Tumor Identification Based on Histogram

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Abstract— There is a large class of bone tumor which are grow in size and have variety of shapes and properties. Modalities of X-ray images of bone tumor may contain various amounts of noise and artifacts. Bone tumor identification is performed manually by radiologist. The process is time consuming and impractical. The main goal of this paper is identification of tumor based on intensity of the histogram combine with enhancement technique that helps the doctor to identify the bone tumor easily and effectively.

Key words: Bone tumor characteristics, Histogram based identification, Max-Min Contrast Stretching, Average Filter

General Terms: Tumor identification, X-ray image Preprocessing

I. INTRODUCTION

One of the challenging approach for identify the bone tumor in recent years. There is a different types of tumor occur in human body like Bone tumor, brain tumor, breast tumor, lung tumor etc. These tumors are identify by different image modalities like X-ray, MRI, CT scan. One of the oldest and cheapest image modality is x-ray rather than others which is used in medical diagnosis [5]. X-ray images that contain high noise, poor contrast and large amount of light radiation [3][4]. There is a one of the oldest methodology that still used for identify the bone tumor by manually just shown in fig.1 as below. Using this methodology that make the process time consuming that sometimes create problem. Because of this time consuming process doctors cannot identify the bone tumor easily and early. Sometimes doctors cannot give proper early treatment to patient that make patient life very hard and create some large problem in human body. A lots of work has been done for automatically detect tumor detection on different image modalities of brain tumor, breast tumor, lung tumor.

Bone tumor identification automatically is challenging task in recent years using X-ray image modalities. X-ray images of bone has a poor quality because of the poor contrast so could not be properly identify the different kind of disease like fracture, tumor, osteoporosis as well as that has been create the problem anatomical structure of the bone. Need to be improve the quality of x-ray images by applying proper pre-processing technique [3]. With low quality and limited information bone tumor detection is a challenging task for early identification of bone tumor. The first priority of this paper is to improve the quality of x-ray images of different kind of bone tumor combine with analysis of intensity of each tumor based on histogram which is further used for segmentation.

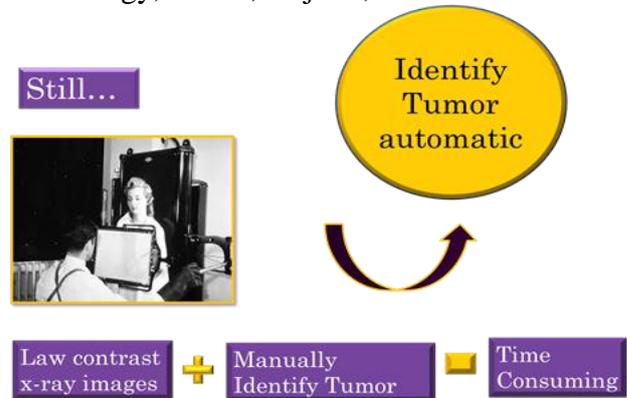


Fig 1: Manually identify converted into automatically.

In previous study of paper there are different kind of approach has been proposed for improve the quality of x-ray image and identify of tumor. There are three different kinds of methods of Histogram equalization, gamma correction technique and contrast limited adaptive histogram equalizer compare each technique based on analyzing histogram of different techniques. The system gives accurate result of method CLAHE which is followed by GC and HE [3]. Dental x-ray image quality enhance by different techniques has been proposed based on contrast enhancement. Author examined implementation of different techniques with histogram. Compare four techniques such as Adaptive histogram equalization (AE), Contrast adaptive histogram equalization (CLAHE), Median adaptive histogram equalization (MAHE) and Sharp contrast adaptive histogram equalization (SCLAHE). Their work improves the diagnostic ability in intra-oral digital images using this enhancement [4]. According to S.K.Mahendran proposed novel approach for detection of long bone fracture and tibia fracture using fusion based classification combine with improve quality of x-ray images of bone fracture of long bone [5].

Enhancement technique classify in two ways: Spatial domain and frequency domain. In each of the spatial domain class classified into two further as: Point processing and Spatial filtering techniques. To enhance the vein pattern in hand captured images using point processing techniques such as Image negative, Gray level slicing, Histogram equalization and Contrast stretching as well as using filtering techniques such as Laplacian sharpening, Unsharp masking and Highboost filtering. At the end they conclude that using histogram equalization of highboost filtering gives better result of enhancement of vein patterns [6].

In [7] M. Jayanthi *et al.*, extracting the liver and tumor from CT images. They has been done the first part of image enhancement buy using contrast enhancement and morphological smoothing. Tumor occurs inside the liver in CT scan images. So, they first segment the Liver inside the CT scan images which have similar intensity as other organ. After enhancement of this image of CT scan they examined the histogram of that pre-processed image and extracting

prior knowledge about of CT image such as shape, location and intensity value which is useful for fast and accurate liver segmentation. After that using region growing segmentation extract the liver easily. Again analyzed the tumor intensity based on histogram analysis identify the threshold value of tumor finally using segmentation technique identify the tumor.

The rest of the paper is presented as follows; Section 2 describes the characteristics of bone tumor. Section 3 describes the proposed method for identify the tumor. Section 4 presents final result. Finally section 5 draws the conclusion and future work.

II. CHARACTERISTICS OF BONE TUMOR

In [2], hand book of orthopaedic disease from that characterised four kinds of bone tumor. Each tumor has different characteristics has different in growth and which have different intensity. Here we gain the knowledge of that tumor and which part of the human bone it generally occur that also analyzed. Generally tumor occur around knee. Difference between the original part of knee and Tumor occur around knee shown in fig. 2 [8].

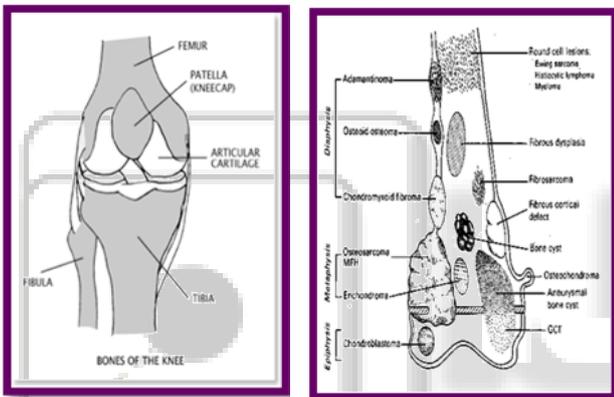


Fig. 2: Difference between the original knee part and Tumor part.

Here we describe only four types of bone tumor like Osteosarcoma, Osteochondroma, Encondroma and Gaint Cell Tumor. These types of tumor have different characteristics with giving figure of each of these tumor that defined as below table 1.

No.	Types	Characteristics	Example
1.	Osteosarcoma	<ul style="list-style-type: none"> - A sarcoma is a tumor of the connective tissues, such as muscles, and bones. - This type of tumor that produces immature bone. - End of long bones, often around the knee. 	
2.	Osteochondroma	<ul style="list-style-type: none"> - Occurs around knee. arises from the surface of a bone. 	

3.	Encondroma	<ul style="list-style-type: none"> - Occur around small bone of hands and knee part. 	
4.	Gaint Cell Tumor	<ul style="list-style-type: none"> - Bones affected commonly are those around the knee. i.e.: the lower end of femur and upper end of tibia. - The tumour is located at epiphysis. - Soap-bubble appearance. 	

Table 1: Characteristics of Bone tumor

III. PROPOSED WORK

Bone tumor identification based on histogram that proposed by framework as given in Fig. 3:

A. Preprocessing:

- Read the input image.
- Convert to grayscale.
- Performing preprocessing using expand the limit of intensity. (Max-Min Contrast Stretching).
- Apply the average filter to remove the noise.

B. Generate and Analysis of Histogram:

After Pre-processing we have taken the histogram of both images and analyzed the intensity range based on that histogram. Which is shown in fig 4.

C. Make Decision Rules:

After Preprocessing analyzed each Tumor image Histogram based on that identify the intensity of each Bone tumor. Decision Rules are shown in fig. 6.

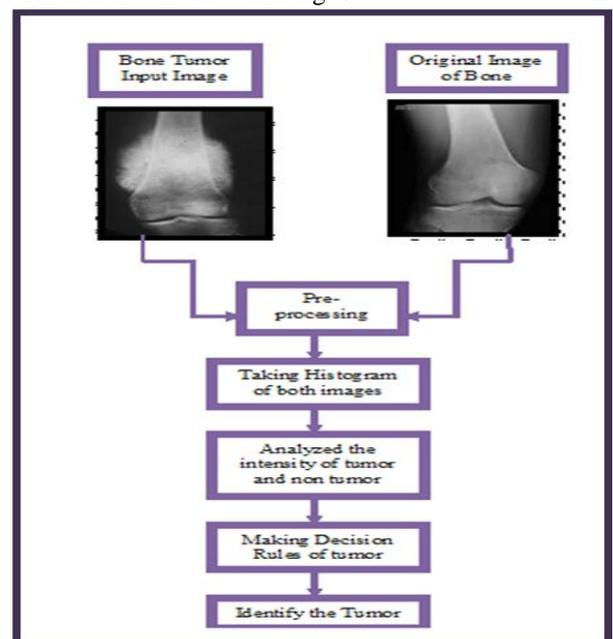


Fig. 3: Proposed work

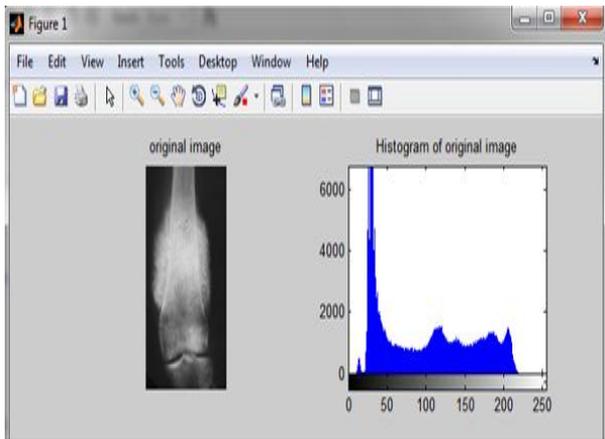


Fig. 4: Histogram of original image

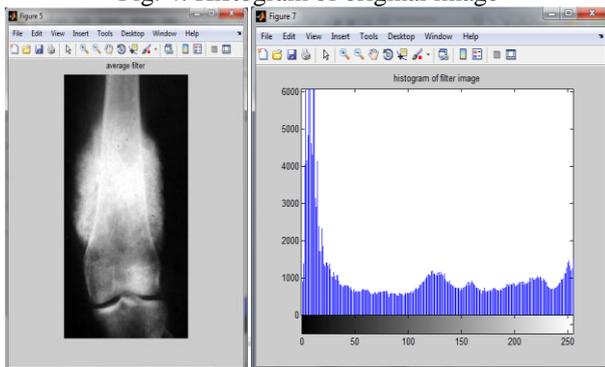


Fig. 5: Histogram of Pre-processed image.

We make the decision rules of each of the four tumor. Based on that identify tumor easily.

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If (I >= 240)
Then
    Osteosarcoma Tumor
If (140 < I < 255)
Then
    Osteochondroma Tumor
If (150 < I < 240)
Then
    Encondroma Tumor
If (90 < I < 140)
Then
    Gaint Cell Tumor    Where, I=Intensity of the tumor.
    
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Fig. 6: Decision Rules of each Bone Tumor.

IV. RESULTS

A. Osteosarcoma Tumor:

1) Femur Part:

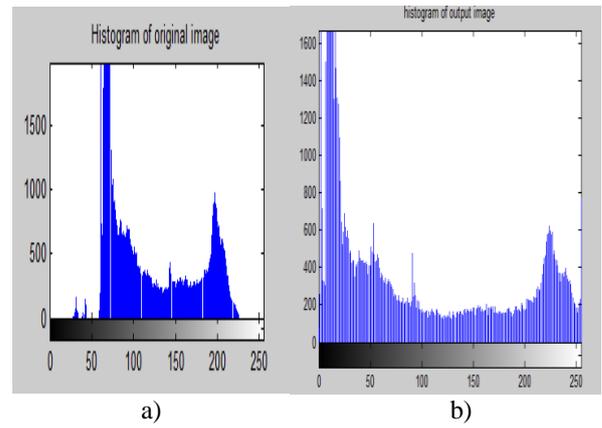
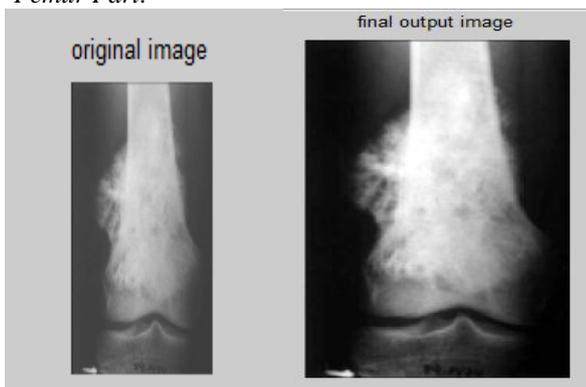


Fig. 7: Histogram of original and Bone tumor Image
(a) Original Image (b) Pre-processed image

2) Fibia Part:

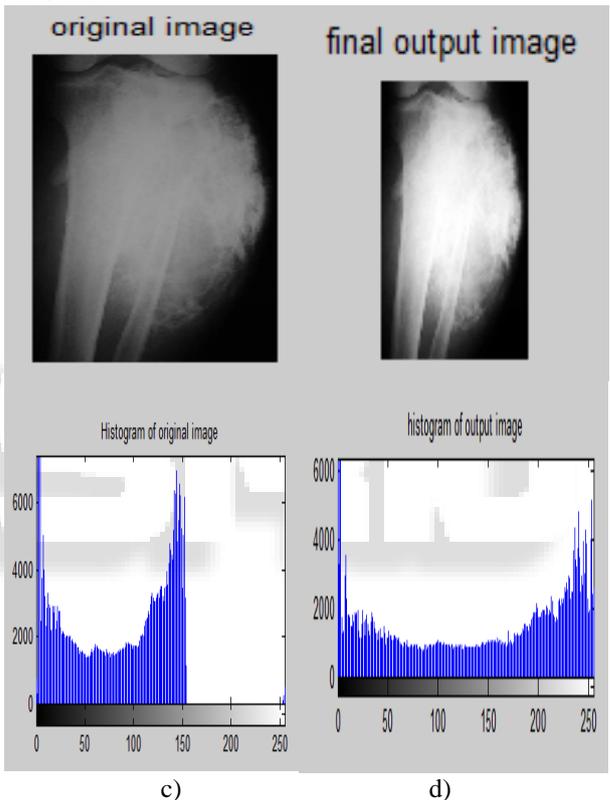
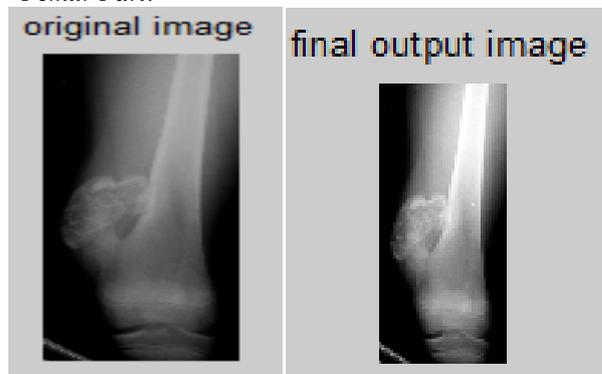


Fig. 8: Histogram of original and Bone tumor Image
(c) Original Image (d) Pre-processed image.

B. Osteochondroma Tumor:

1) Femur Part:



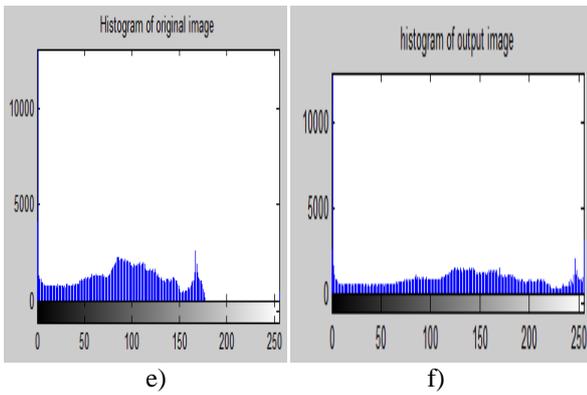


Fig. 9: Histogram of original and Bone tumor Image
(e) Original Image (f) Pre-processed image.

2) Tibia Part:

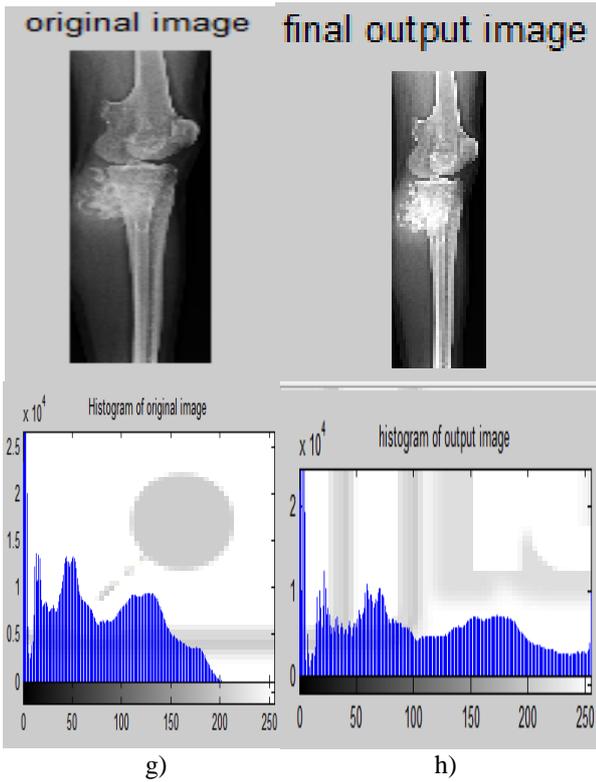


Fig. 10: Histogram of original and Bone tumor Image
(g) Original Image (h) Pre-processed image.

C. Enchondroma Tumor:

1) Femur Part:

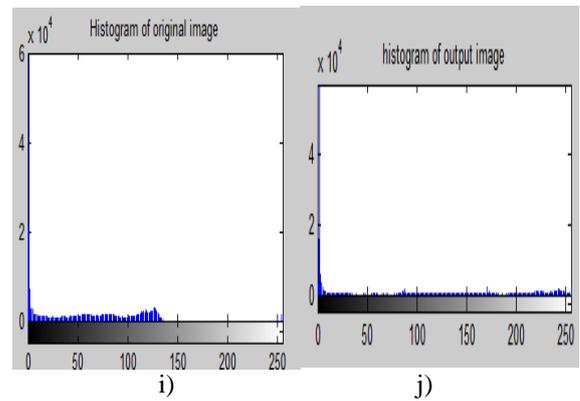
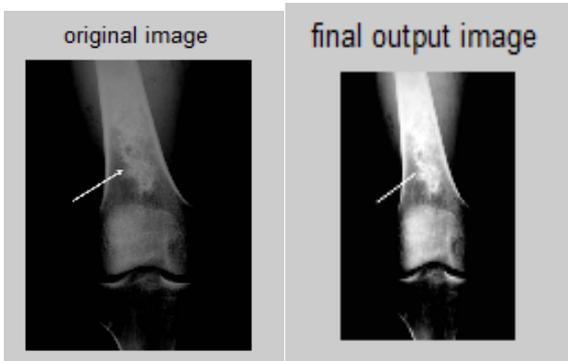


Fig. 11: Histogram of original and Bone tumor Image
(i) Original Image (j) Pre-processed image.

2) Tibia Part:

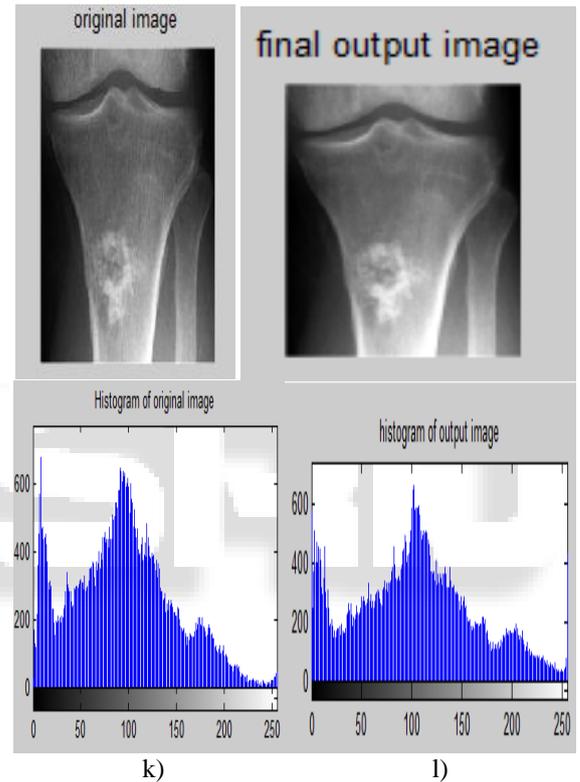
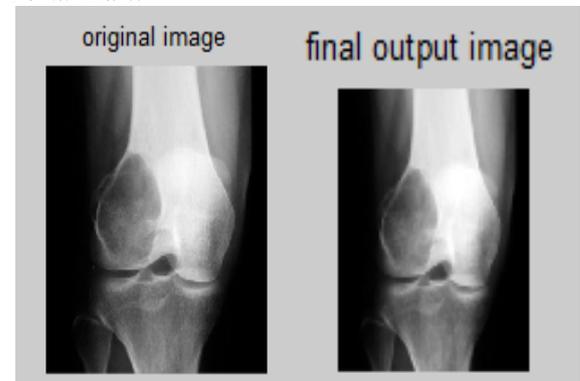


Fig. 12: Histogram of original and Bone tumor Image
(k) Original Image (l) Pre-processed image.

D. Giant Cell Tumor:

1) Femur Part:



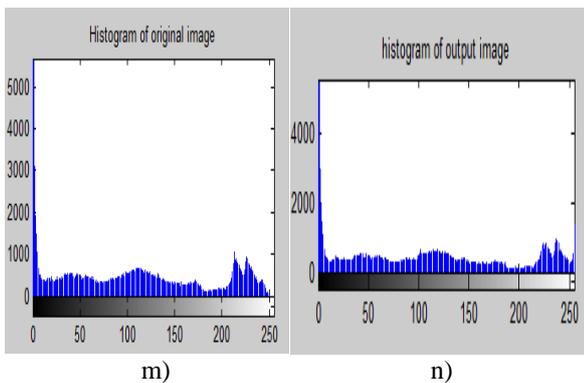


Fig. 13: Histogram of original and Bone tumor Image
(m) Original Image (n) Pre-processed image.

2) Tibia Part:

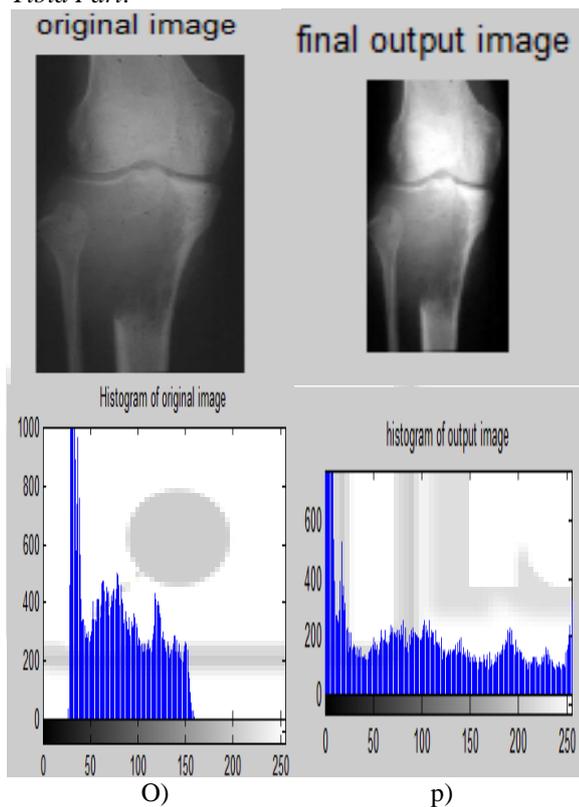


Fig. 14: Histogram of original and Bone tumor Image
(o) Original Image (p) Pre-processed image.

V. CONCLUSION AND FUTURE WORK

To study the different method of x-ray image enhancement as well as from the analysis of tumor intensity based on histogram we make the decision rule easily and differentiate each tumor easily but still got some fuzzy sense of decision rules so will do further analysis to make the decision rules based on characteristics of bone tumor. In the future work can do analysis of tumor on some humerus (Shoulder part of Bone).

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