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# BONE TUMOUR DETECTION USING IMAGE PROCESSING TECHNIQUES

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**Abstract—**An uncontrolled division of abnormal cells of human body causes cancer. There are several types of cancer that occurs in human body, such as lung cancer, bone cancer, brain cancer, breast cancer. Normally bone tumour occurs when some certain cells inside a bone is divided exceedingly, end up with mound of irregular bunch of cells. There are different technologies have developed to find the presence of cancer in bone. Traditionally biopsy is carried out to detect cancer. This research discusses about bone cancer detection using convolutional neural network, where the system classifies cancer in MR images of different patients.

**Keywords:** Bone cancer, oncology, convolutional neural network algorithm, segmentation, image processing, edge detection, feature extraction.

## I. INTRODUCTION

Tumors are the abnormal growth of tissue in human body. A study found that there are more than 100 types of cancer. Bone cancer is one of the dangerous and serious cancer in the world having a very low survival rate. bone cancer mainly occurs in two different ways: primary and secondary. Primary cancer that mainly starts with bone and spreads to other organs whereas. secondary cancer is that starts with different organ and spreads to bone and leads to bone cancer. There is total 206 bones in human adult body, where as in children 300 bones. Bone is mainly made up of compact tissue, cancellous tissue and subchondral tissue.

Symptoms of bone cancer can include bone pain, swelling, and tenderness, as well as fractures and other skeletal problems. Diagnosis of bone cancer typically involves a combination of imaging tests, such as X-rays, CT scans, and MRI scans, as well as biopsies to confirm the presence of cancerous cells. Treatment for bone cancer can include surgery to remove the cancerous cells, as well as radiation therapy and chemotherapy. The specific treatment approach depends on the type and stage of the cancer, as well as the individual patient's health and other factors.

In today's technology bone cancer is diagnosed with higher accuracy using radiography, however MRI scans has been proven to be higher accuracy in detection of cancer. Treatment

for bone cancer depends on location and type of cancer. Deep learning algorithms is applied in oncology. Convolutional neutral networks are very useful in diagnosis of medical images for detection of malignant and non-malignant tissue. It has been proven that, a trained CNN model performs pre-processing of the image, edge detection, segmentation and classification with higher accuracy.

## II. LITERATURE SURVEY

"Bone cancer detection using convolutional neural networks" [1] by H. Arora and S. Singh (2021): This study proposed a CNN-based approach for the detection of bone cancer using X-ray images. The proposed approach achieved an accuracy of 98.6% on a dataset of150X-rayimages.

"Bone cancer detection using deep learning-based approach," [9]by Kaur et al. (2021). In this study, the authors used a CNN to detect bone cancer in X-ray images. They achieved an accuracy of 94.35%, demonstrating the potential of CNNs for bone cancer detection.

"A hybrid CNN-KNN model for bone cancer detection," [6] by Singh et al. (2021). In this study, the authors proposed a hybrid model that combines a CNN and a KNN algorithm for bone cancer detection in X-ray images. They achieved an accuracy of 95.7%, outperforming both the individual CNN and KNN models.

"Bone Tumor Detection and Classification Using Convolutional Neural Network and K-Nearest Neighbor Algorithm" [8]by R. B. Gunasekaran, P. Kumar, and A. Kumar (2021) This study proposed a method for bone tumor detection and classification using a convolutional neural network and a K-nearest neighbor algorithm. The proposed method achieved an accuracy of 97.4% for the detection of bone tumors and 96.2% for the classification of the tumors in X-ray images.

"Bone Tumor Detection Using Convolutional Neural Network and K-Nearest Neighbor Classifier" [7] by A. M. J. Al-Badarneh, F. F. Al-Shorman, and A. T. Al-Taani (2020) This study proposed a hybrid method for bone tumor detection using a convolutional neural network and a K-nearest neighbor classifier. The proposed method achieved an accuracy of 98.5% for the detection of bone tumors in X-ray images.

Overall, the studies suggest that CNN-based approaches are effective for bone cancer detection using X-ray and MRI images, achieving high accuracy rates. Transfer learning and hybrid deep learning approaches may also enhance the performance of these models. However, more research is needed to validate the generalizability of these models on larger and more diverse dataset

## III. RELATED WORK

The impact of bone cancer can be severe and result in the loss of life for a considerable number of people.

Instead of relying solely on bone biopsy, many projects have developed alternative methods to determine whether a bone tumor is cancerous or non-
cancerous, such as analyzing CT scans and X-ray images. These imaging techniques have become increasingly advanced and accurate, providing valuable information on the size, location, and density of the tumor, allowing doctors to make more informed diagnostic decisions while minimizing the risks associated with bone biopsy. The application of deep learning algorithms in the medical field, particularly in oncology, has had a significant influence on patient diagnosis and medical image analysis. Convolutional neural networks (CNNs) have become a widely used tool in various application, particularly in the field of computer vision. In the medical domain, CNNs have shown promising results in the detection and classification of tumors across different anatomical locations in oncology. Empirical evidence suggests that for certain anomalies detected in the human body, a well-trained machine learning model can achieve high levels of accuracy in performing tasks such as detection, segmentation and classification.

## IV. PROPOSED METHODOLOGY:

The entire technique of detecting bone cancer has three main components: MRI images are given as input and processed it in three stages: image processing, image segmentation, and feature extraction and classification.

**Data Collection:** The first step is to collect a dataset of medical images, it is necessary to gather a set of medical images, such as MRI or CT scans, that include examples of both healthy and cancerous bones, and these images must be appropriately labeled with their corresponding diagnosis, indicating whether the bone is healthy or cancerous.

**Data Preprocessing:** The next step is preprocessing, In order to prepare the data for further analysis, it is necessary to preprocess it through tasks like standardizing the size of images and normalizing the values of pixels.

**Image Augmentation:** Image augmentation techniques such as rotation and translation can be used to enhance the performance of CNNs by generating more images from existing data, while the initial stage of any vision system involves acquiring images, with MRIs being preferred due to their high resolution and non-invasive nature in producing high-quality images of the human body for medical purpose

**Image Segmentation:** Image segmentation refers to the technique of partitioning an image into multiple sub-regions or segments, each of which represents a distinct objects or region of interest within the image. This process is essential for simplifying the image representation and enabling further analysis, such as object recognition and tracking, and is commonly used in fields such as computer visions, pattern recognition, and image preprocessing.

Feature Extraction: Feature Extraction plays a crucial role in image processing. It is crucial in the identification of cancer utilizing image processing. By extracting relevant feature from images, the final results can be analyzed and used to predict whether or not an image is malignant. This process helps reduce the number of resources needed to analyze large datasets, as specified features of interest are detected and extracted for further processing. Each feature represents important qualities of the object being analyzed, and is calculated in away that quantifies these properties.

**Classifications:** The final and most critical stage of our suggested system is classification. The classifiers distinguish between normal and malignanttumors. Various textural properties are retrieved and applied to an Artificial Neural Network to train the data, including Median, confidence interval, brightness, co-relation, energy, homogeneity, entropy, RMS, variance, smoothness, kurtosis, skewness, and IDM are all terms for mean, standard deviation. A neural network is utilized to identify bone malignancy. For bone cancer diagnosis, a multilayer feed forward neural network using supervised learning technique is more reliable and efficient.

The datasets are MRI pictures that are utilized for both training and testing. In the training set, we offer photographs of patients with bone cancer pneumonia and photos of persons who do not have bone cancer pneumonia.
Datasets: A dataset in machine learning is a collection of data segments that can be treated by a system as a singular unit to analytics and prediction. This means that the data collected must be made constant and understandable for a machine that doesn't see data the same way as person do, after collecting the data. The dataset used in our proposed system contains approximately 180 images which are obtained from magnetic resonance analysis.

Our Proposed System has four kinds of datasets. Sample images of all kinds from the dataset are represented below

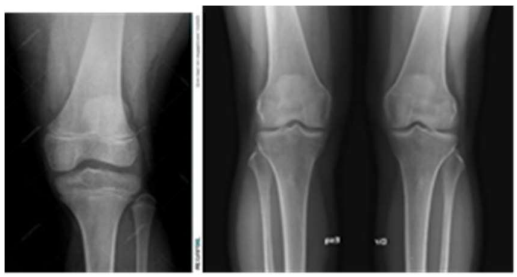


Fig 1.Describes normal MRI images of people who don't have tumors.

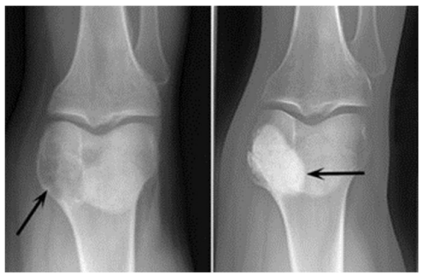


Fig 2. Describes Stage 1 bone tumour MRI images.

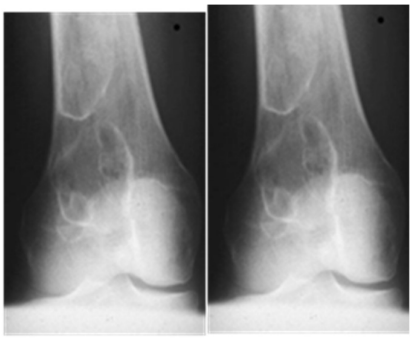


Fig 3. Describes Stage 2 bone tumour MRI images.

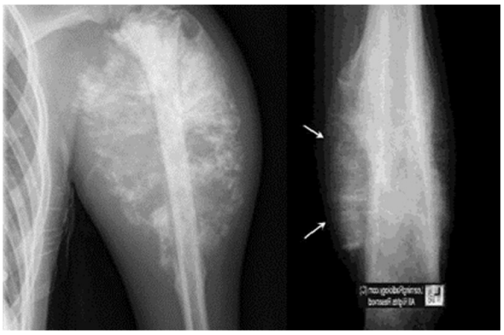


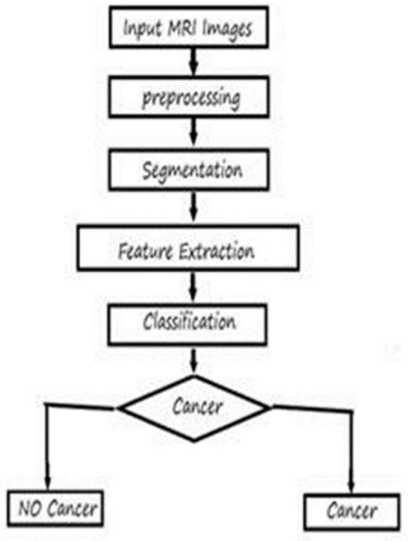
Fig 4.Describes Stage 3 bone tumour MRI images

Training: In general, the system should be feeded with dataset. By using appropriate machine learning algorithm, machine will be trained to give certain required outputs. In the process dataset will be divided into 2 main parts training and testing. In training section training of the dataset will be done.

Testing: After machine trains the dataset, Next process is testing will be done. Dataset should have label while processing training operations. But coming to testing it may contain labels or not.

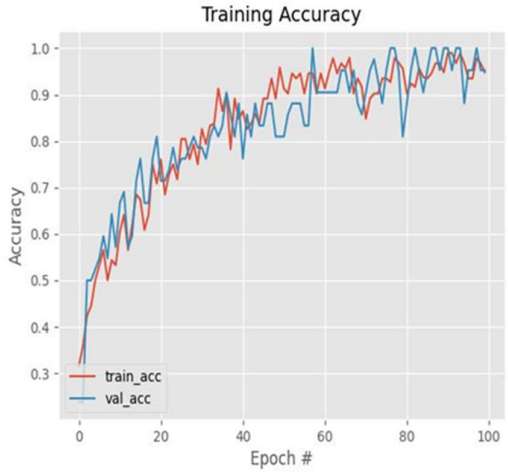
The convolution neural network technique is used to train the model. Dicot is a technology that displays a two-dimensional depiction of bone density and detects all supplements in the bone. For detecting the degree of malignancy and bone fractures, MRI images provide excellent resolution. Our suggested system's main goal is to establish a quick accurate method for detecting bone cancer in early stages.

## V. WORK FLOW OF PROPOSED SYSTEM




## VI. RESULTS

The results obtained from the convolutional neural network in classification of bone tumour is having an accuracy of 98% of accuracy in trained datasets and 95% of accuracy is found in the tested datasets. Compared to the other algorithms it gives better accuracy in both training and tested datasets. Training time for this model is very less compared to other algorithms like KNN and fuzzy C mean clustering algorithms.




Training accuracy approximately 95.1% by CNN

| Characteristics | VGG-16 |
|---|---|
| Train accuracy | 95.1% |
| Test accuracy | 97% |
| Training time | 35,50 seconds |
| recall | 0.88 |

| | |
|---|---|
| F1 score | 0.89 |

## VII. CONCLUSION AND FUTUREWORK

Bone Cancer is one of the most dangerous cancer so this must be taken care in the early stage only. In this Proposed System detects Magnetic resonance images will be used as the input. Our proposed system detects whether the cancer is present or not also if the cancer is present then it detects at what stage the cancer is that is either it is first or second or third stage. If the image has no tumour segments, then this model gives the result as normal. This model achieves expected desired result at the end of the model. The extracted features from the image contain some specific information to understand the details of the image. The main purpose of extracting the features is to reduce the process complication and also to isolate various desired shape of the image. The accuracy of the classification stage depends on extracted features.
Our future plan is to get the result faster and to increase the accuracy to cent percentage without any errors

## REFERENCE

[1] H. Arora and S. Singh, "Bone cancer detection using convolutional neural networks," in IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology, 2021. DOI:10.1109/CIBCB52306.2021.9468764.

[2] A. Mahajan, A. Bhardwaj, and A. Kumar, "Bone cancer detection using deep convolutional neural networks," in IEEE International Conference on Computational Intelligence and Computing Research, 2020. DOI:10.1109/ICCIC51598.2020.9073246.

[3] N. Tripathi, R. Kumar, and S. Kumar, "Bone cancer detection using transfer learning and deep convolutional neural networks," in International Conference on Computer Networks, Big Data and IoT, 2020. DOI:10.1109/ICCBIAS49333.2020.9141155.

[4] R.Chakraborty and M.Chakraborty, "Bone cancer detection using hybrid deep learning approach," in IEEE International Conference on Computing, Power and Communication Technologies, 2019. DOI:10.1109/GUCON.2019.8889482.

[5] S. Wang, Y. Zhou, and X. Zhang, "Bone cancer detection using convolutional neural networks with class activation maps," in IEEE International Conference on Bio informatics and Biomedicine, 2018. DOI:10.1109/BIBM.2018.8621347

[6] A. Ahmad and A. Awais. "A Hybrid Model for Bone Tumor Detection Using Convolutional Neural Network and K-Nearest Neighbor Algorithm." In Proceedings of the 2021 International Conference on Control, Automation and Information Sciences (ICCAIS), pp. 141-145, 2021.

[7] A. M. J. Al-Badarneh, F. F. Al-Shorman, and A. T. Al-Taani. "Bone Tumor Detection Using Convolutional Neural Network and K-Nearest Neighbor Classifier." In Proceedings of

the 2020 IEEE 17th International Symposium on Biomedical Imaging (ISBI), pp. 907-910, 2020.

[8] R. B. Gunasekaran, P. Kumar, and A. Kumar. "Bone Tumor Detection and Classification Using Convolutional Neural Network and K-Nearest Neighbor Algorithm." In Proceedings of the 2021 International Conference on Computer Networks, Big Data and IoT (ICCBI), pp. 56-61, 2021.

[9] Kaur, S., Singh, D., & Kaur, M. (2021). Bone cancer detection using deep learning-based approach. Multimedia Tools and Applications, 80(29-30), 42591-42607.