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EFFICIENT CNN ALGORITHM BASED OSTEOSARCOMA DETECTION

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Abstract: ***Cancer is a fatal condition that affects people of all ages. With over one out of every three people will experience cancer and at a certain point in their lives. By evaluating diagnostic medical techniques such as X-ray scans, CT scans, the overall purpose is to accurately determine the afflicted area in the bone tract, i.e. abnormal growth and disease phase. Because the scanned visuals may not have a high resolution due to the sheer number of slices per pixel and noise, it is necessary to pre-process the images with a median filter to eliminate the noise. Specific characteristics in the pre-processed image will be evaluated using a genetic approach and retrieved employing CNN. The retrieved pictures are categorized and recorded using a CNN classifier in order to determine the stage of illness, which helps the clinician make treatment recommendations. The outcomes of the suggested method demonstrate a higher incidence of early diagnosis of bone cancer.***

Key Words: Bone cancer, CNN Algorithm,, X-ray images, CT Scans, CNN Classifier, Osteosarcoma, genetic approach, bone tract

1. INTRODUCTION

The bone is the body's hollow support skeleton. The outer portion of bones is a hard tissue structure called calcium salt matrix. The hard out layer is made from cortical bones, it covers the trabecular bone inside and outside the periosteal-covered bone. Some bones are hollow and the soft tissue known as bone marrow contains the medullary cavity. Endosperm is a lining of the tissue. At each bone end is a area of bone like cartilage that's thinner than a bone made from the fibrous matrix of a gel-like substance that doesn't contain much calcium.

The bulk of the bones are like cartilage. Instead the body puts the calcium on the bone. Some cartilage can remain at the ends of the bone formation to serve as reinforcement between bones. The cartilage connects bones to form a joint, along with ligaments and some other tissue. The bone is very rigid and muscular itself. Bone will carry up to 12,000 livers per centimeter per inch. The strain to crack the thigh bone takes as much as 1200 to 1800 pounds. There are two cells in the bone. The Osteoclast is the new bone cell, and the Osteoclast is the old bone cell. Some bones of the marrow are soft tissues. The marrow of certain bones is a concoction of fat cells and blood cells. Blood-forming cells contain red blood cells, white blood cells and blood platelets.

Certain cells in the marrow include plasma cells, fibroblast cells and reticuloendothelial cells. Cancer, which induces unfettered cell formation, can subdivide the cells and grow wild, develop malevolent tumors, and invade neighboring areas of the body. This tumor can expand and obstruct the digestive, nervous, and circulatory systems, and may release hormones that change the function of the body.

Cells which were treated as cancer cells due to DNA damage.

When DNA damaged the cell, the damage is maintained in a regular cell, or the cell dies. If the damaged DNA is not repaired, the damaged DNA will cause unnecessary new cells to die. Cancer cells also travel to other areas of the body and start growing tumors that return to normal tissue. Metastasis is called this phase. After that cancer cells get into the human body’s bloodstream or lymph vessels.There are various types of cancer detected in the human body. If the tumor affects bone directly then that type of disease is known as bone cancer. The sarcomas are called bone cancers. Sarcomas arise in muscle, bone, fibrous tissue, blood vessels, fat tissue and several other tissues. They can grow in the body anyplace.

Bone refashion operation is attributed exclusively to Bone Cancer cells. Standard bone is being tirelessly changed, or conked out and rebuilt. Cancer cells fault equilibrium for cell growth and bone development. If cancer cells are in the bones, then as opposed to normal bone density, the bone structure is bent at a higher rate. The cancer of the bone may either be primary or secondary. Bone cancer occurs primarily in the bone, secondary bone cancer develops in every portion of the body.

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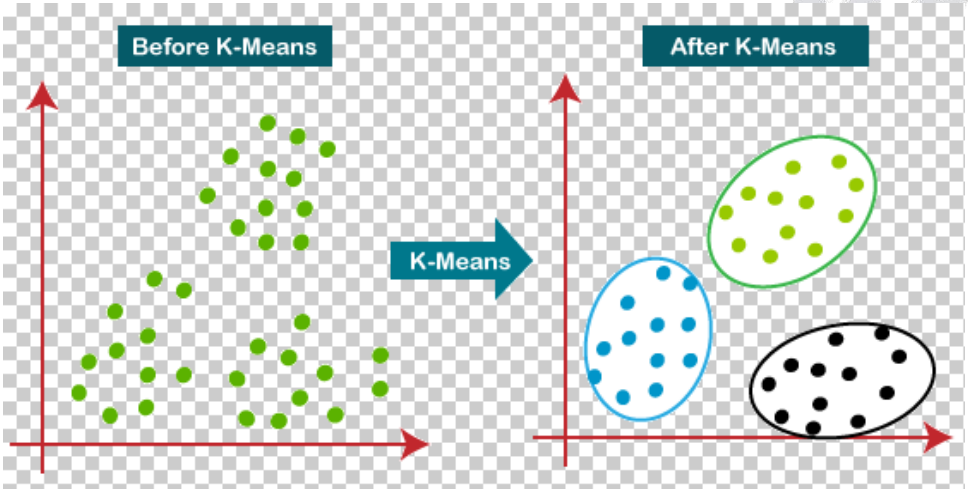
DEEP LEARNING

Deep learning can be considered as a subset of machine learning. It is a field that is based on learning and improving on its own by examining computer algorithms. While machine learning uses simpler concepts, deep learning works with artificial neural networks, which are designed to imitate how humans think and learn. Until recently, neural networks were limited by computing power and thus were limited in complexity. However, advancements in Big Data analytics have permitted larger, sophisticated neural networks, allowing computers to observe, learn, and react to complex situations faster than humans. Deep learning has aided image classification, language translation, speech recognition. It can be used to solve any pattern recognition problem and without human intervention.

Artificial neural networks, comprising many layers, drive deep learning. Deep Neural Networks (DNNs) are such types of networks where each layer can perform complex operations such as representation and abstraction that make sense of images, sound, and text. Considered the fastest-growing field in machine learning, deep learning represents a truly disruptive digital technology, and it is being used by increasingly more companies to create new business models.

EXISTING METHOD

The existing system is to examine the situation in ability to track tumor in bone cancer pictures. In this work, K-means and fuzzy C-Means clustering methods are used to identify presize accuracy tumor percent in the bone. In this study, the segmentation mechanism is examined first, and then the kmeans and fuzzy C-means algorithms are employed to locate the precise position of the tumor in the bone. For importing and segregating pictures, this work makes considerable use of MATLAB as a computer program. Using the fuzzy c-means method, the tumor area may well be identified with 86 percent accuracy. Therefore two methods are used for grouping and classification. Because the accuracy of the two techniques used for clustering and identification of tumor areas is low, the test result predictions may be affected



K-Means Clustering is an Unsupervised Learning algorithm, which groups the unlabeled dataset into different clusters. Here K defines the number of pre-defined clusters that need to be created in the process, as if K=2, there will be two clusters, and for K=3, there will be three clusters, and so on.

It allows us to cluster the data into different groups and a convenient way to discover the categories of groups in the unlabeled dataset on its own without the need for any training. It is a centroid-based algorithm, where each cluster is associated with a centroid. The main aim of this algorithm is to minimize the sum of distances between the data point and their corresponding clusters.

The algorithm takes the unlabeled dataset as input, divides the dataset into k-number of clusters, and repeats the process until it does not find the best clusters. The value of k should be predetermined in this algorithm.

The k-means clustering algorithm mainly performs two tasks:

- Determines the best value for K center points or centroids by an iterative process.
- Assigns each data point to its closest k-center. Those data points which are near to the particular k-center, create a cluster.

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Drawbacks of Existing System

- High Computational load and poor discriminatory power.
- LBP doesn't differentiate the local texture region.
- FNN is slow training for large feature set.
- Less accuracy in classification

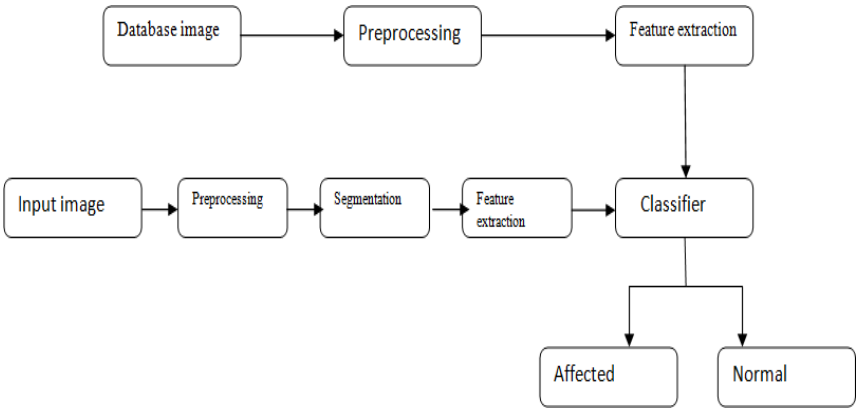
PROPOSED SYSTEM

The proposed system use a Deep learning based CNN architecture. This paper CNN and Open CV Python are used for bone tumor identification with pixel segmentation is built. The suggested technology is specifically designed to identify bone cancer. The system uses training data to discriminate among malignant and non-cancerous pictures, predicts cancer stage, and displays the results on a graphical user interface. Bone cancer detection is conducted out using the pictures provided.

Advantages of the Proposed System

- Fast and better compatible in classification.
- Low computational complexity.
- Better efficiency and less sensitive to noise .
- High accuracy.
- Take less time for process.

SYSTEM ARCHITECTURE DIAGRAM



HARDWARE & SOFTWARE SPECIFICATION

Hardware Specification

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. They are used by software engineers as the starting point for the system design.

Main Processor- 2GHz
Ram- 512 MB (min)
Hard Disk- 80 GB

Software Specification

The software requirements document is the specification of the system. It should include both a definition and a specification of requirements. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification. It is useful in estimating cost, planning team activities, performing tasks and tracking the teams and tracking the team's progress throughout the development activity.

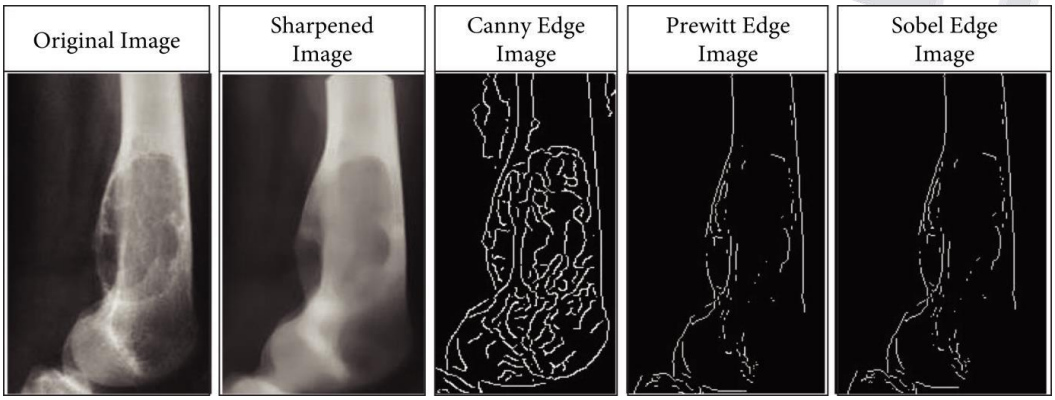
Language- Python
IDE- Google collab

MODULES AND ORGANIZATION

- Image Segmentation
- Feature Extraction
- Preprocessing
- Classification

Image Segmentation

The identification of an object from the image is done by segmentation. The segmentation technique's reliability is calculated based on the final precision rate. Therefore, it is rational and an effective technique for the identification of concern objects. The image is parted into pixel set to gather information from the item concerned utilizing the segmentation technique (Asuntha and Srinivasan, 2018). The Canny algorithm is used to segment the image in the present research. Since, the sharp edges responsible for better ROI are obtained through the Canny edge detection algorithm, compared to other edge detection techniques like Sobel and Prewitt. Also, the dataset used in the study is small. The performance of the Canny edge becomes excessive as the size of the dataset increases. Figure shows the different categories of images.



Feature Extraction

Feature extraction is a process of dimensionality reduction by which an initial set of raw data is reduced to more manageable groups for processing. A characteristic of these large data sets is a large number of variables that require a lot of computing resources to process. Feature extraction is the name for methods that select and /or combine variables into features, effectively reducing the amount of data that must be processed, while still accurately and completely describing the original data set.
The extraction function of the captured images can be carried out using the number of techniques available. In this article, we will use a machine learning algorithm to make the device more robust. There are many algorithms in the machine learning algorithm which are graded on the basis of their results. Specifically, supervised learning of the Random Forest and the nearest neighbor algorithm is useful, as these algorithms produce a function that maps inputs to the desired outputs.

Preprocessing

Pre-processing an image increases the precision of an optical inspection significantly. Pre-processing is the first step towards improving image quality. The filtering technique is used to start the image processing stage. Image filtering is useful to smoothen, sharpen and remove noise for many purposes. Filtering eliminates noise or other small image fluctuations. Such noises then have to be denoted. Gabor filter is used for noise removal and for the deficiency of the pictures in this methodology. The key advantage of this filter is, as compared with other filters, it achieves excellent noise reduction with less blurring. The gray conversion will be the next step after filtering. This is the process by which pixels with RGB level are converted to gray. The picture of colour has more meaning in the process. Therefore, it is appropriate to convert the gray picture. The main aim of this conversion is to remove the information on the colour and saturation by retaining the light.

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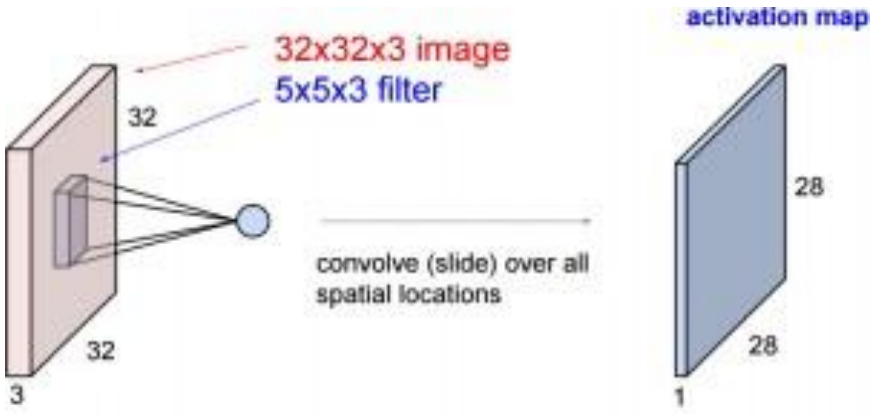
Classification

Classifier to perform classification of Bone disease the predictor is the system's final layer, and it determines the genuine likelihood of each activity. The process is divided into two sections: image processing and categorization. The image is enhanced by the material processing system, which removes cacophony and loud pieces. After the picture characteristics are cleared to check whether or not the Bone is compromised, the Bone and the image will be separated into various regions to segregate the Bone from operating the machine. Noise reducing unit eliminates undesired colors from the image. Image improvement component and optimization isolates the affected area from the usual scanned image by enhancing the area and splitting it into multiple aspects. Edge-Detection Component spotlight extraction is a crucial advancement in almost any gathering-cantered concern. For both organizational and inspection purposes, appearance is the most important factor. This aspect includes important visual data that will be needed to diagnose the condition. Unit of Cancer Disease Diagnosis determines whether the malignancy is harmless or dangerous. Input attributes such as notable qualities, such as asymmetries, edge, camouflage, distance, momentum, and so on. Classifier engine categorizes the photos by assigning them to one of the established diseases.

ALGORITHM

Convolution Neural Network(CNN)

A Convolution Neural Network (ConvNet/CNN) is a deep neural networks method that can accept an image as input, give priority to numerous perspectives in the image (learnable weights and biases), and differentiate between them. The amount of pre-processing required by a ConvNet is far less than that required by other classification methods. Despite the fact that filters are hand-engineered in rudimentary processes, ConvNets can learn these filters/characteristics with sufficient training. The Visual Cortex organization affected the layout of a ConvNet, which is akin to that of Neurons as in Human Cognitive connectivity pattern. Neural networks only send signals in a restricted area of the peripheral vision known as the Receptive Field. A group of such sectors spans to embrace the full visual zone. This layer entails scanning the entire image for similarities and converting the results into a 3x3 matrix. Kernel is the name given to the image's binarized feature vector. The weight vector is the name given to each element in the kernel.



The Pooling division is in charge of shrinking the Convolved Format's spatial size. This is done to lower the amount of processing power process data using dimension reduction. It can also be used to remove rotational and temporal affine dominant traits while keeping the model's training loop intact. There are two kinds of pooling: maximum and average. Max-Pooling returns the whole amount of the area of the image held by the Kernel. On the other hand, Average-Pooling delivers an aggregate of all the data from the picture portion sheltered by the Kernel. Max Pooling also functions as a noise reducer. It completely eliminates noisy events and even de-noises along with dimensionality improvements.

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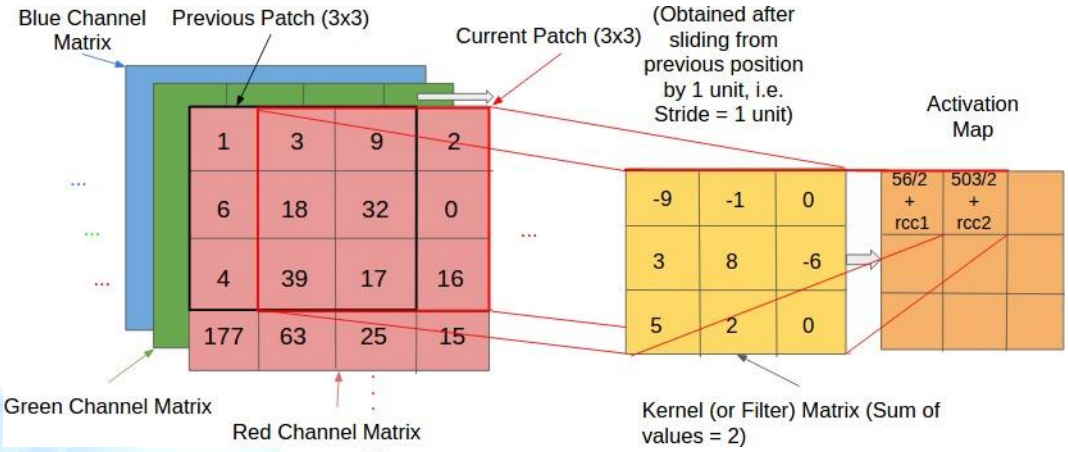
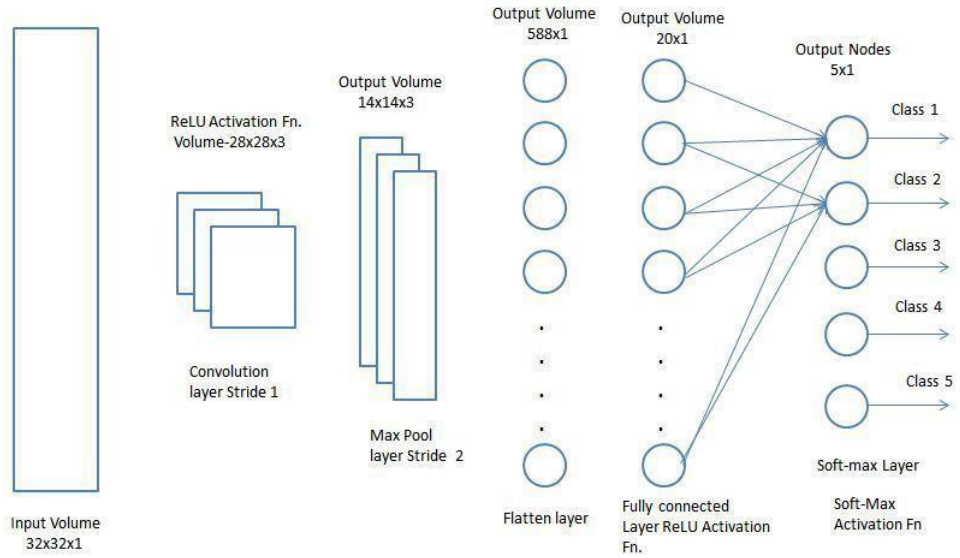


The Fully-Connected layer is a (typically) low-cost method of learning the high-level properties of non-linear topologies as expressed by the convolution kernel output. The Fully-Connected layer is acquiring a potentially non-linear variable in that space. Now that we've changed our image representation into a shape suitable for our Multi-Level Perceptron, we need to flatten it into a linear combination. The smoothed output appended to each training cycle is fed into a feed-forward neural net with back propagation.
Over a series of epochs, the model will distinguish between dominant and low-level features in images and categorize them by using soft-max classification method. The features are compared to test image's attributes, and relevant traits are correlated with the provided label. Labels are typically coded as figures for computational



WORKING METHOD FOR PROPOSED MODEL

Open the browser in your windows and open the google collab platform. Import the python file containing the code of the model. Run the Code by pressing the play button in the google collab. New window opens with the button connect to google drive. Connect to the google drive account that contains the datasets and input file x-ray images of bone . The input images are the X-ray images of the bone of the patient for whom the bone cancer should be detected. The proposed model perform analysis with the X-ray images of the bone , that has been affected with bone cancer.

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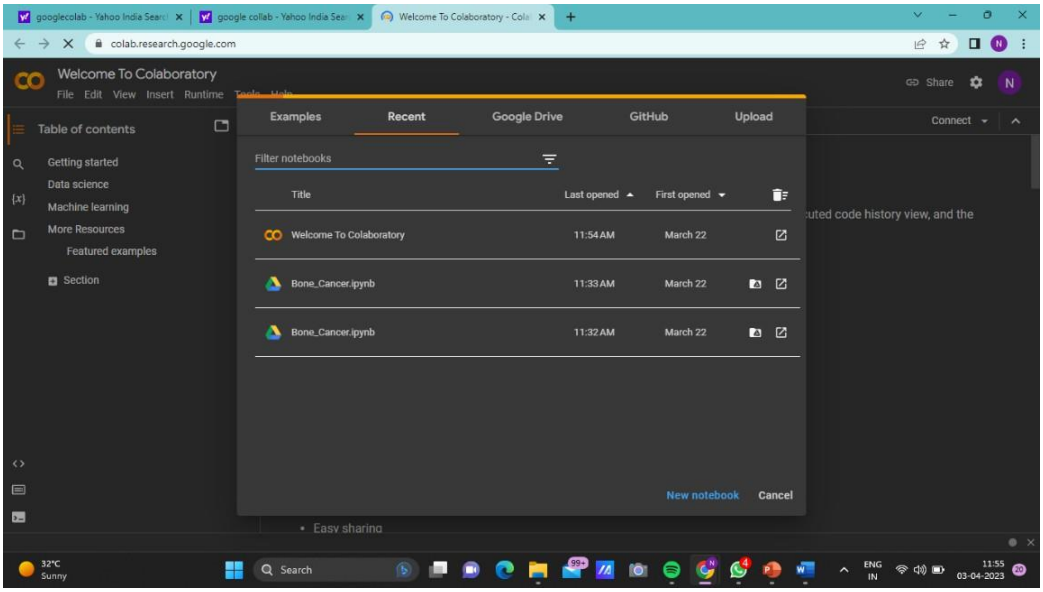
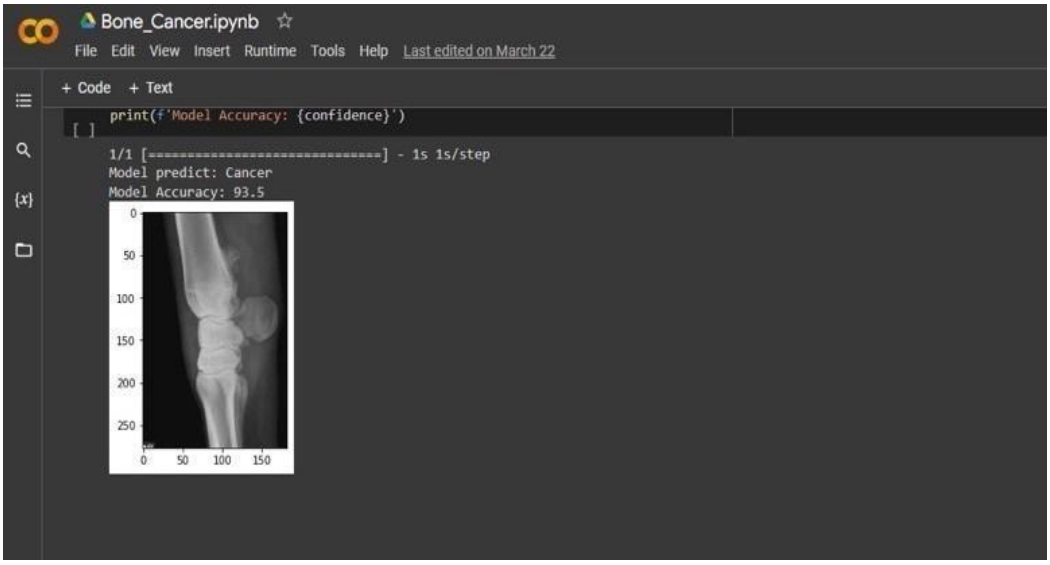


The image that has been uploaded using google drive will be analyzed using the dataset X-ray images of bone that has been affected for bone cancer. The analysis has been done using the CNN algorithm , the output of the code displays the model accuracy and the result of Osteosarcoma detection.



CONCLUSION AND FUTURE WORK

This paper may be used for a variety of diagnostic and therapeutic purposes, as well as computer-assisted surgeries and categorization tasks. This will assist healthcare practitioners in classifying and comprehending the stage of cancer in various bones, which may be a highly useful, timesaving, and life-saving element in medical treatments. This method is more cost-effective, classification-wise, and needs less human interactions. The same approach may be used to distinguish between various tumors and categories. The proposed method can be improved to recognize and forecast cancer stage in various images such as CT, X-Ray, and MRI. It could be enhanced to be more accurate in predicting phases. Because of the encouraging results achieved, our approach may be used in telemedicine, and the suggested technique could be implemented in smart phones or cloud computing, with the advantages of decreased computational burden, cheap cost, and very few parameters to setup.

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