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A REVIEW ON BONE CANCER DETECTION USING CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT

CNNs, or Convolutional Neural Networks, are an advanced type of neural network that processes data, specifically images, using deep learning algorithms. The use of CNNs is expanding rapidly, especially in the healthcare field, as research in deep learning advances. Cancer is a devastating disease that has claimed numerous lives worldwide, and early detection is crucial to determine whether the disease is curable or becomes critical. Bone cancer, which is characterized by abnormal tissue growth, can spread to other parts of the body. There are two types of bone cancer: cancerous and non-cancerous, with the latter being curable. Medical equipment such as CT scans, MRI scans, and X-rays are used to detect bone cancer. Early cancer detection is crucial in cases of metastasis, which is a non-curable disease. This paper aims to analyze and study the potential of Convolutional Neural Networks (CNN) in the early detection of bone cancer. By comparing various existing approaches and analyzing their effectiveness, this paper will highlight the potential of CNN algorithms in comparative analysis with their performance

Keywords: Bone Cancer Detection, CNN Algorithm, MRI images, Feature Extraction, Cancer Stage Classification

INTRODUCTION

The human body comprises 206 bones. Bone is a rigid body tissue that makes up our body's skeleton. Bone is a connective tissue made up of different types of cells internally, it has a honeycomb-like matrix that offers tension to bones. The primary function of bones is to provide structural support to the body and enable mobility. Bone cancer can occur in any part of the bone in our body.[1] The American Cancer Society (ACS) has published its 2023 report on cancer numbers in the United States. Here are the main findings: In 2023,

approximately 1.9 million new cancer cases (approximately 5,370 cases per day) and 609,820 cancer-related deaths (about 1,670 deaths per day) are projected to occur [2]. Bone tumors can be either benign or malignant growths of bone tissue. These tumors can either originate in the bone or come from other parts of the body and spread to the skeleton. Bone tumors are classified as either primary or secondary, depending on where they first develop. [3] When it comes to detecting bone cancer, there are a few different methods that doctors may use. These include CT, MRI, PET, X-rays, and bone biopsies. Each of these methods has its strengths and weaknesses, and doctors will often choose the one that is most appropriate for each patient. CT scans can tell whether cancer has spread to other parts of the body, whereas MRI scans produce detailed images of specific bones or parts of bones. PET scans use nuclear medication imaging to create 3D color images of the body's processes, and X-rays can detect damage to bones and new cells.[4] It is important to seek medical attention if you suspect that you may have a bone tumor because early detection and treatment can greatly improve your prognosis. It can be difficult to determine whether a tumor is cancerous or noncancerous, but AI techniques are being implemented in the medical field to help detect diseases earlier. With advancements in technology, it is becoming easier to detect and diagnose diseases. One such technique is the use of convolutional neural networks, which can help doctors detect and diagnose bone cancer with greater accuracy. This can save lives and improve the overall health of patients.

Cancer can occur when abnormal cells in the body begin to divide and grow uncontrollably. One of the most harmful and frequently occurring cancers in the world is bone cancer, which can be either invasive or non-invasive. Invasive bone cancer is malignant and can spread to other organs, while non-invasive bone cancer remains in its original organ but can eventually become invasive. This type of cancer has many different types, including Osteosarcoma, Chondrosarcoma, Ewing tumor, and Fibrosarcoma. Osteosarcoma is the most common type and often starts in bone cells in the arms, legs, or pelvis, while Chondrosarcoma forms in cartilage cells. Ewing tumor typically starts in the bones but can also form in other tissues and muscles, and Fibrosarcoma usually develops in the soft tissue around the bones, such as tendons, ligaments, fat, or muscles. Although bone cancer can occur anywhere in the world, it is most commonly found in the United States.

It is important to note that early detection and proper diagnosis of bone cancer are crucial for successful treatment. Several diagnosis tests, including Ultrasound, MRI, and Biopsy, can provide images for the classification of bone cancer. In addition, an x-ray of the bone is often the first test done if bone cancer is suspected. Magnetic resonance imaging (MRI) and computed tomography (CT) scans can also help in determining the extent of the tumor and whether it has spread to nearby tissues or other parts of the body. A bone scan can also help show whether cancer has spread to the bones. Machine learning, a sub-field of AI, plays an important role in the classification of bone cancer. Developers use machine learning to retrain existing models and improve their performance. Three main types of machine learning are used to train the model: supervised, unsupervised, and reinforcement. Deep learning, a sub-field of machine learning, is an unsupervised learning that learns from unstructured or unlabeled data. For the classification of the bone cancer dataset, a Convolution Neural Network (CNN) is used. CNN takes the images of the bone cancer dataset as input, associated with their corresponding weights. The weights are adjusted to minimize the error and enhance the performance. CNN contains many layers such as a convolution layer, pooling layer, ReLU

layer, and fully connected layer. In the convolution layer, a feature map is used to extract the features of the given image and make the original image more compact. The pooling layer is used to reduce the dimensions of the image. The ReLU layer is used as an activation function in which it checks whether the value of the activation function lies in a given range or not. The completely related layer is the very last layer of the model. It combines the results of all layers and applies the softmax function to give the probability to each class of the output. In conclusion, machine learning and deep learning are powerful tools that can aid in the diagnosis and classification of bone cancer. The review paper is divided into several sections, including an introduction and a related study, and concludes with important references for further reading.

Many diagnosis tests like Ultrasound, MRI, and Biopsy provided the images for the classification. An x-ray of the bone is frequently the primary check achieved if a few kind of bone tumor is suspected. Tumors might look like a dark spot on the x-ray, or the bone itself might look abnormal Magnetic resonance imaging (MRI) MRI scans create detailed images of the inside Of the frame the usage of radio waves and sturdy magnets. They can help show the extent of the tumor and whether it has spread to nearby tissues Computed tomography (CT) scan: A CT scan uses X-rays to create detailed cross-sectional images of the body. It can help show the size and location of the tumor and whether it has spread to other parts of the body Bone scan: A bone scan can help show whether cancer has spread to the bones. A small amount of radioactive material is injected into a vein, and then a special camera is used to create images of the bones Machine learning plays an important role in the classification of bone cancer. Many diagnosis processes have been discussed in the images. These types of diagnosis images are used for the classification using CN. Machine learning is a sub-field of AI. Many developers use machine learning to re-train the existing models and for better performance. Machine getting to know is used for the linear data. If the data is small then machine learning gives better results but when the data is too large then it doesn't give better results. Three main types of machine learning are used to train the model. Supervised machine learning works on the known data and with the help of the supervisor. Unsupervised gadget studying is taken with none supervision. Reinforcement machine learning is less in use. These algorithms catch the ideal information from past understanding to settle on the exact choices. Deep getting to know is a sub-subject of the device getting to know. Deep is an unmonitored study that learns from the data. The data may be unstructured or unlabeled. A deep neural network contains more than two hidden layers then it is called a deep network. The first layer is the enter layer and the second one is the output layer. The intermediate layer called the hidden layer has more layers as compared to the neural network. The node that contains the layer is called a neuron. The distinction among device gaining knowledge of and deep gaining knowledge of is that deep gaining knowledge of is in the direction of its intention compared to device gaining knowledge of. For the classification of the breast cancer dataset, a Convolution Neural Network is used. A convolutional Neural Network is used to categorise the images. It takes the images of the bone cancer dataset as input. CNN takes the images as an input associated with their corresponding weights. The weights are adjusted to minimize the error and enhance the performance. CNN contains many layers such as a convolution layer, pooling layer, ReLU layer, and fully connected layer. In the convolution, CNN contains many layers such as a convolution layer, pooling layer, ReLU layer, and fully connected layer. In the convolution layer, a characteristic map is used to extract the functions of the given image and make the original image more

compact. The pooling layer is used to reduce the dimensions of the image. The ReLU layer is used as an activation function in which it checks whether the value of the activation function lies in a given range or not. The completely related layer is the ultimate layer of the model. It combines the results of all layers and applies the softmax function to give the probability to each class of the output. The evaluation paper is split into a few components which can be given below. Section 1 contains the Introduction, section 2 contains the related study, and section 3 concludes conclusion and last references

Literature Review:

Bone cancer detection has been the subject of extensive research, and both machine learning and deep learning techniques have been utilized. However, machine learning has its limitations, which can be addressed through deep learning techniques. The research on bone cancer detection using both machine learning and deep learning is worth discussing

Ashish Sharma et al Paper [1] proposed to evaluate the performance using 5-fold verification Collect X-ray images from different sources in which you have to identify the cancerous and noncancerous bone. X-ray images contain noise which is removed by applying a suitable median filter of 3×3 sizes. Then the image is segmented by a canny edge algorithm. The capabilities are extracted from the cancerous and the healthful image. The education and type are accomplished the usage of SVM. The asymmetrical or symmetrical distribution of pixels in the image measures the skewness. The sample of skewness price withinside the cancerous and the healthful bone is similar in the test and training images. using GLCM-based texture features to identify the cancerous bone. The texture is represented through the depth of the pixels. The depth of the pixels withinside the healthful and the cancerous bone is different.

Maheep Singh, et al Paper[3] proposed that there are different methods used for cancer detection, including Artificial Neural Network, Decision trees and Support Vector Machines. After analyzing the data, it appears that the cancer cells can be classified into two groups: benign and malignant With the help of advanced technology like deep learning Convolutional Neural Networks. Collect the The Invasive Ductal Carcinoma Dataset is comprised of two different cancer cell types sepcified as Benign and Malignant resized dataset images. Normalize the images by dividing them by 255 to ensure that the values are between 0 and 1. The experimental results were obtained using Convolutional Neural Networks (ConvNets) to detect cancer cells. We will first explain the dataset used in the experiment, and then discuss the results. The implementation of this architecture was done in Pythons.

I Dabral et al., [4] proposed thatThe Invasive Ductal Carcinoma Dataset contains two different types of cancer cells - Benign and Malignant - in the form of resized dataset images. To ensure that the values of the images are between 0 and 1, they are normalized by dividing them by 255. In the experiment, Convolutional Neural Page 1 of 3 Page 1 of 3 Page 1 of 3 Networks (ConvNets) were utilized to detect cancer cells. The architecture was implemented using Python. The dataset used in the experiment will be explained first, followed by a discussion of the results.

Haruna Watanabe et al.,[5] suggests a way to find bone tumors using CT scans. The method uses a computer program that learns from pictures of non-spreading tumors and can find spreading tumors without being told where to look. The program gives each scan a score to show if it looks normal or not. Tests show that the scores for normal and spreading tumors are different. In this study, we used CT data from 29 patients, consisting of multiple axial-plane slice images. The images were adjusted to a window width of 250 and a window level of 990. Bone regions were removed and the images were resized to 128 × 128 pixels. Data augmentation was performed by varying the window level of the training images from -20 to 20 in increments of 10 to train the GAN. A total of 8,790 non-metastatic tumor images were used for training. For evaluation, we used ask as the test images. The anomaly detection technique can be powerful for the detection of bone metastatic tumors in CT images.

Muhammad Kashif Saeed et al., [6] proposed that based on a new technique called OSADL-BCDC which uses transfer learning and a hyperparameter tuning strategy for bone cancer detection. The proposed technique reduces diagnosis time and achieves faster convergence. The algorithm employs Inception v3 as a pre-trained model for feature extraction and uses the long short-term memory (LSTM) approach to identify bone cancer. The comparison study showed that the OSADL-BCDC model outperformed existing algorithms. OSADLBCDC technique outperformed recent state-of-the-art methods with a maximum accuracy of 95%. Future work can focus on using deep instance segmentation techniques to improve performance and designing explainable artificial intelligence models for bone cancer detection. Additionally, integrating multiple imaging modalities could provide a comprehensive view of bone cancer

S Gawade, et al.,[7] proposed that Osteosarcoma is a cancerous tumor that occurs in bones. Although it is able to arise in any bone, it often occurs in long bones such as arms and legs .Explore various supervised deep-learning methods to detect bone cancer and determine the optimal model by weighting user data This dataset is a set of microanatomy photos of Hematoxylin and Eosin (H and E) stained osteosarcoma. The proposed framework consists to apply supervised deep gaining knowledge of methods. And, for type hassle VGG16, VGG19, DenseNet201 and ResNet101 algorithms had been applied. It show the model selected meets the expectations with the highest accuracy 90.36% using the residual neural network(ResNet101) algorithm and 89.51% precision in the prediction tasks In the future, alternative models such as Xception, NASNetLarge, EfficientNetV2L, and ConvNeXtXLarge may be utilized for the purpose of detecting cancer, as they have the potential to provide more precise detection of the disease.

S. Purnima, et al., [8] proposed a model called fast and reliable fuzzy C means clustering (FRFCM) to detect tumors from MRI images The model also determines whether the tumor is non-cancerous or cancerous by comparing different segmentation techniques. According to the text, the Fast and Robust Fuzzy C means clustering-based Bone tumor detection and classification system has better noise immunity and less computational complexity compared to other clustering techniques. The results are highly reliable, and the processing time is 0.5 seconds or less.

Manjula Vasant Kiresur et al., [9] To identify bone cancer in its initial phase through a cost-effective and highly efficient tumor detection approach, the utilization of X-rays for the diagnosis of bone cancer is

employed. A simplified method to detect bone cancer involves converting the image to greyscale, using canny edge detection to segment the tumor, utilizing GLCM for feature extraction, and employing CNN for classification. This method helps enhance the resolution and efficiency of the input for extracting bone tumor features.. Provides a different way to detect the bone cancer in high accuracy

Madhuri Avula et al.,[10] proposed the model using a k-means clustering algorithm for bone image segmentation. The segmented photograph is in addition processed for bone cancer detection by evaluating the mean intensity of the identified area. Threshold values are proposed for the type of scientific pix for the presence or absence of bone cancer. This method uses jpeg images but is also applicable for the original format of DICOM (digital Imaging communique of medicine) scientific photographs if any modifications are done. To extract the tumor part from the MRI scan images using the K-means clustering algorithm. Based on the mean pixel intensity value thresholding, detection of the bone cancer is more accurately achieved (11) The proposed approach for tumor detection uses the gray level co-occurrence matrix (GLCM) to extract features for feature extraction and three different classifiers - XGBoost, support vector machine (SVM), and K-nearest neighbors. The system applies ensemble voting by combining the predictions from these classifiers to achieve an accuracy of 91.8%, indicating the effectiveness of the GLCM and ensemble voting techniques for tumor detection

S. Thoratet al.,[12] proposed a method to detect the tumor part present in the bone using Machine Learning. The method uses the K-Means clustering algorithm and the Fuzzy C-Means algorithm. To identify the bone tumor, the mean pixel intensity of the segmented image is calculated. The last step of the tumor detection process involves using the MATLAB function

Dr. Anjana S Chandran et al.,[13] proposed the model To Detect the tumor and classification using Machine Learning in TensorFlow and the data set used for this purpose in Osteosarcoma histology images. TensorFlow is a Machine Learning software developed by Google. It Page 1 of 4 Page 1 of 4 Page 1 of 4 uses an Inception algorithm which uses the techniques of a convolutional neural network to create an image classification model.

VDA Kumar et al.,[15] proposed approach consists of two phases:Feature Extraction: In this stage, features are extracted from segmented bone images using the Gray-Level Cooccurrence Matrix (GLCM) method. These features capture statistical texture-based information.Classification: The extracted features are then classified using a combination of K-Nearest Neighbor (K-NN) and Decision Tree algorithms.The goal is to achieve higher accuracy in predicting bone cancer disorders.The accuracy obtained by the proposed technique is enhanced and improved Page 1 of 3 [16]The researchers collected scanned images from various locations of the human body, obtained from different diagnostic labs.They employed the Region Growing Algorithm for segmentation, enabling analysis of the tumor region.Based on the segmented tumor part, they empirically calculated both the size of the tumor and the stage of cancer

F.J. Shaikh, D.S. Rao et al.,[17] proposed the model may outperform DV-Hop in certain scenarios, in particular when there exist large, well-spaced obstacles in the deployment field, or when the deployment area

is free of obstacles but the number of anchors is very limited. It provides accurate position information even in topologies withwalls and other concave structures, as long as the granularity of the obstacle features is in the same order as the separation between cluster heads

S. M. Hasan Mahmud et al.,[18] 2023 proposes a hybrid DL and ML model for classifying osteosarcoma malignancy. We used DenseNet-121 and DT-RFE for feature extraction and selection, and MLP for classification. Our mode existing state-of-the-art models, and we Page 2 of 4 developed a web application for early diagnosis of osteosarcoma. In Page 2 of 4 the future, we plan to integrate uncertainty mining and pLOF techniques to improve our predicted results

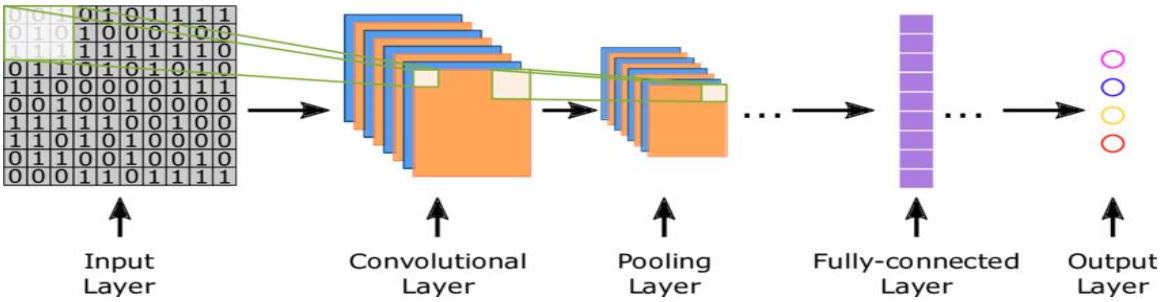
D. Anand, et al.,[19] proposed that the Detection of Bone Tumor from Histopathological Images Using Aquila optimizer-based feature extraction and VGG-19+RESNET50 Classifier 2023 histograms Page 2 of 4 were used to decrease image noise in the preprocessing step. The Aquila optimizer architecture was used to retrieve preparatory images to improve accuracy. VGG19+RESNET50 was used to classify bone tissue as normal or pathological. The model showed state-of-the-art performance in identifying Osteosarcoma malignancy, achieving 99.7accuracy, 98.9% precision, 99.2% recall, and 99.3-score.

Xiaoming Bai et al.,[20] suggested a method that uses an improved FCNN-4s for bone tumor image segmentation. Batch normalization layers were added to accelerate convergence and a fully connected CRF was used for fine segmentation. The algorithm outperformed traditional convolutional neural networks in segmentation accuracy and stability, achieving an average Dice of 91.56%. The algorithm has a more refined structure and better realtime performance, solving over- and under-segmentation Page 1 of 2 problems and achieving higher accuracy

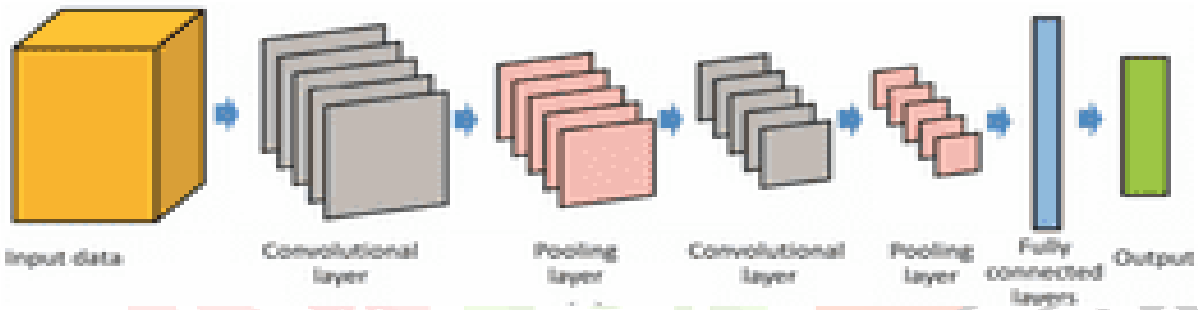
R. Balakumar et al.,[21] proposed that DTBV: A Deep Transfer-Based Bone Cancer Diagnosis System Using VGG16 Feature Extraction G. Suganeshwari 1,*, R. Balakumar 2, Kalimuthu Karuppanan 3, Sahaya Beni Prathiba 2,4, Sudha Anbalagan 4 and Gunasekaran Raja et al proposed that the DTBV system utilizes a transfer learning approach that involves a pretrained CNN model to extract features from pre-processed input images. These features are then used by an SVM model to distinguish between healthy and cancerous bone. In the proposed DTBV system, the VGG16 model extracts the features from the input X-ray image. According to a comprehensive performance evaluation, the DTBV system is highly efficient in detecting bone cancer with an accuracy of 93.9%. This accuracy rate is much higher than other existing systems, making it an excellent option for those in need of bone cancer detection. In the future DTBV system can be improved by training it on larger datasets and considering various imaging modalities for enhanced diagnostic systems. The proposed system uses the k-means algorithm to determine the stages of bone cancer based on computations of mean intensity and tumor size. The resulting images produced by the system are clear and highlight the affected area of the ailment, without any unwanted spatial or spectral distortions.The results were obtained based on their performance metrics like sensitivity, specificity, etc. The performance was calculated according to their true positive and true negative parameters.

Convolutional Layer Neural Network

CNNs are also known as Shift Invariant or Space Invariant Artificial Neural Networks (SIANN) re usually fully connected networks, that is, each neuron in one layer is connected to all neurons in the next layer. A convolutional neural network consists of an input layer and an output layer After passing through a convolutional layer, the image becomes abstracted to a feature map, also called an activation map, with shape: (number of inputs) × (feature map height) × (feature map width) × (feature map).

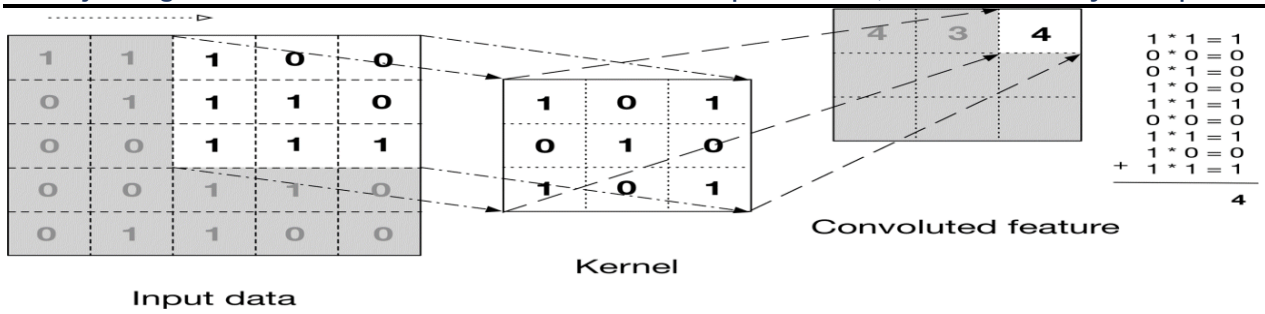


Pooling Layer: This layer is periodically inserted in the converts and its main function is to reduce the size of volume which makes the computation fast reduces memory and also prevents overfitting



Pooling layers

Pooling layers play an important role in reducing the dimensions of data by combining the outputs of neuron clusters at one layer into a single neuron in the next layer. Local pooling typically combines small clusters using tiling sizes such as 2 × 2. On the other hand, global pooling acts on all the neurons of the feature map.



Fully Connected Layers:

It takes the input from the previous layer and computes the final classification or regression task.

OBJECTIVE

The main objective of this paper is to detect cancer in its earlier stages, which could be extremely beneficial for cancer patients and increase their chances of survival. By implementing advanced techniques like the Convolutional Neural Network (CNN) and applying novel algorithms to extract relevant features from MRI scanned images, to find out the stages of cancer we can improve the accuracy of medical imaging systems and potentially save lives. It is important to focus our efforts on

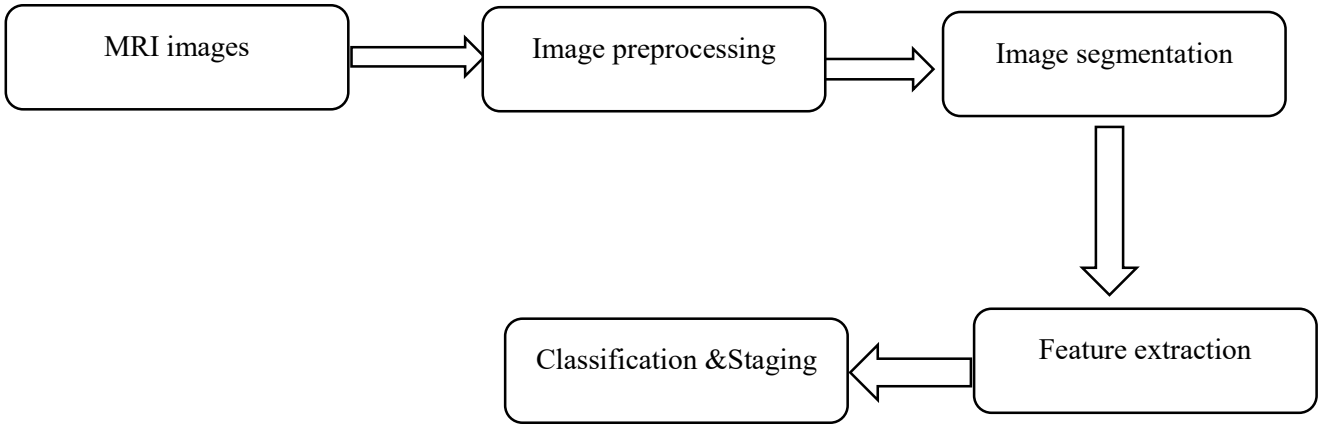
early detection in order to provide patients with the best possible outcomes.

- Problem statement
- Collection of MRI scanned images
- Image preprocessing-
- Image segmentation
- Feature Extraction

Problem statement

The early detection of cancer, specifically in stage 1, is crucial for the survival of cancer patients. Identifying the disease in its localized category can prevent the need for surgical methods and ensure a fast recovery. To achieve this, we propose a system that utilizes MRI scanned images and a novel algorithm of convolutional neural network technology for the early detection of cancer.

We have developed a system that aims to improve the quality and effectiveness of bone tumor analysis by extracting their characteristics. Our system utilizes MRI scanned images as input and is capable of detecting stage 1 bone tumors, which are highly treatable as they have not spread to other parts of the body.



Architecture of the Suggested system

Data gathering:

The first step is to collect a large amount of data. . Once you have collected the data, you need to clean it by removing any duplicates, resizing the images, and converting them to a standard format. Next, you need to label the data by assigning a class to each image. After labeling the data, you need to split it into training and testing sets. The training set is used to train the model, while the testing set is used to evaluate the model's performance.

Data augmentation

To increase the size of your dataset, you can use data augmentation techniques such as flipping, rotating, or cropping the images. This process of artificially increasing the size of your dataset is known as data augmentation. By following these steps, you can prepare your data for training a CNN for image classification.

Feature selection

Feature selection in Convolutional Neural Networks (CNNs) is a process that involves identifying and selecting the most important features from the input data that contribute to the accuracy of the network.

Feature extraction in Convolutional Neural Networks (CNNs) is the process of automatically extracting meaningful and relevant features from the input data. This is usually done by applying a series of convolutional and pooling layers to the input data, which helps to identify and extract important features. The extracted features are then used by the network to make accurate predictions on new, unseen data. Feature extraction is a critical part of CNNs, as it allows the network to learn and generalize from the input data, making it more robust and accurate.

Classification in Convolutional Neural Networks (CNNs) is the process of assigning a label or category to an input image or data. This is typically done by passing the input data through a series of convolutional, pooling, and fully connected layers, which learn to identify and extract relevant features from the input data. The final layer of the network is usually a softmax layer, which takes the output of the previous layers and produces a probability distribution over the possible classes or labels. The class with the highest probability is then

selected as the predicted class for the input data. Classification is a common use case for CNNs and has been successfully applied to a wide range of tasks, such as object recognition, image and video classification, and natural language processing.

Discussion of Findings from Literature

From the table 1, it is concluded that the deep learning technique gives better results as compared to machine learning. The outcomes are calculated withinside the specific dataset which have specific outputs. For the tabular dataset, the machine learning techniques gives the better results but in the images dataset it don't give better results. The research work is conducted using some enhancement that is a way for better performance. Some augmentation withinside the dataset , is likewise lead for the higher performance. In this section, the research work is conducted using enhancement and augmentation in dataset. It concluded from the [1] that SVM was a good classifier and compared with the hybrid techniques. It concluded from [3] that extreme learning machine performed better in among of all used. From [6], it showed that OSDAL-BCDC give better results on multiple data. .. In the paper [7], the author worked on Deep Learning learning and found residual network was a good classifier in terms of performance. From [8], the author worked on many machine learning techniques and found that the Random fat and robus fuzzy C technique gave the better result. It achieved the high accuracy. From [11], the author worked on two techniques K-nearest neighbours and SVM, and found that gave better results the research work was conducted on SVM and SVM with grid search and achieved better results through the grid search approach. In the paper [11], the writer proposed the version on CNN and determined the higher end result via the function extraction method. In the paper [13], the writer proposed the version on CNN and as compared it with the device mastering strategies and executed higher overall performance thru CNN. In the paper [14], the author worked on the Edge detection method and achieved the better performance

Conclusion

Bone cancer detection is a very challenging problem and it's a harmful disease that's growing every year, making it even more concerning. To detect bone cancer, scientists and researchers have been using machine learning and deep learning techniques. From previous research, it has been concluded that machine learning techniques have provided better results in their field. However, it has been observed that machine learning techniques work better on linear data and tend to fail when it comes to image data. To address this issue, researchers have started using innovative techniques like deep learning, which is a recently developed technique that is frequently used in data science. For the classification of bone cancer image data, a deep learning-based technique called CNN is used, which mostly works on the image dataset. It has been observed from previous research that CNN provides better results as compared to machine learning technique

Table 1 Existing Related Work

Author & Ref.	Title	Method	Findings	Dataset
Ashish Sharmaet al., [1] 2021	Bone Cancer Detection Using Feature Extraction Based Machine Learning Model	support vector machine (SVM) and the Random forest,	It achieved o, the SVM model trained with hog feature set provides an F1-score of 0.92 better than Random forest F1-score 0.77	X-ray images
I Dabral et al ., [4] 2021	Cancer detection using convolutional neural network	Decision Trees, Artificial Neural Network, and Support Vector Machines	The experimental results were obtained using Convolutional Neural Networks (ConvNets) to detect cancer cells	The Invasive Ductal Carcinoma Dataset
Eatedal Alabdulkreem et al., [6] 2023	Bone Cancer Detection and Classification Using Owl Search Algorithm With Deep Learning on X-Ray Images	OSADL-BCDC algorithm	It achieved the 95% of accuracy	X-Ray images
Sushopti Gawade et al .,[7] 2023	Application of the convolutional neural networks and supervised deep-learning methods for osteosarcoma bone cancer detection	Deep Learning Methods	highest accuracy 90.36% using the residual neural network(ResNet101) algorithm and 89.51% precision in the prediction tasks.	X-ray images
S. Purnima 1 et al. , [8] 2021	An Approach to Detect and Classify Bone tumour using	Machine Learning- fast and robust fuzzy C means	Highly reliable and processing time is observed to be 0.5 seconds or less.	MRI images

	fast andRobust Fuzzy C Means Clustering technique	clustering (FRFCM) to detect bone tumor		
Manjula Vasant Kiresur et al.,[9]2021	Bone Cancer Detection Using Convolution Neural Network – An overview	using greyscale conversion, Canny edge detection for segmentation, GLCM for feature extraction and CNN for classification	To increases efficiency of detecting tumor in early stage with less cost	X-Ray Images,
Madhuri Avul et al.,[10] 2014	Bone Cancer Detection from MRI Scan Imagery Using Mean Pixel Intensity	K-means clustering algorithm for bone image segmentation.	It achieved 95% accuracy with less computational time	DICOM (digital imaging communication of medicine) medical images
Ahmed Salama Abdellatif2 et al., [11], 2023	]. Bone osteosarcoma tumor classification	(GLCM) to extract features and three different classifiers for tumor detection. The used classifier are XG-Boost, support vector machine (SVM), and K-nearest neighbors..	It achieved 91.8%accuracy	WSI image
Sailus Michael1et al.,[13] 2020	Bone Tumor Detection from Oestosarcoma Histology	machine learning in Tensorflow platform	This study revealed that to classify the cancer into four classifier	osteosarcoma histology images

	Images using Machine Learning			
Dr. G Manjula et al.,[14] 2021	Bone Cancer Detection at Earlier Stage Using Convolutional Neural Network	Edge Detection Method	It achieved 95% - 98%accuracy	X-ray, CT, PET scan
Satheesh Kumar, Ba,[15]2021	Bone Cancer Detection Using Feature Extraction with Classification Using K-Nearest Neighbor and Decision Tree Algorithm	K -Nearest Neighbor Algorithm and Decision Tree Algorithm.	simulation results show the enhanced classification results and extracted output with higher accuracy	MRI Images
PRATHYUSHA et al.,[22] 2023	”Bone Cancer Detection Using Convolutional Neural Network	Deep Learning	Improved Accuracy using ANN	MRI Images

REFERENCES:

[1] “Bone Cancer Detection Using Feature Extraction Based Machine Learning Model” Ashish Sharma , 1 Dhirendra P. Yadav , 1 Hitendra Garg , 1 Mukesh Kumar , 2 Bhisham Sharma , 2 and Deepika Koundal 2021

[2]. American Cancer Society MB Amin - AJCC cancer staging manual. Eight edition/editor- in …, 2017

[3].Maheep Singh, Krishna Kumar “Cancer Detection Using Convolutional Neural Network” 2021

[4]. Cancer detection using convolutional neural network I Dabral, M Singh, K Kumar Conference Proceedings of ICDLAIR2019, 2021•Springer

[5]Bone Metastatic Tumor Detection Based on AnoGAN Using CT Images
Haruna Watanabe, Ren Togo, Takahiro Ogawa and Miki Haseyama 2019

[6]. Bone Cancer Detection and Classification Using Owl Search Algorithm with Deep Learning on X-Ray ImagesE Alabdulkreem, MK Saeed, SS Alotaibi, R Allafi, A Mohamed, MA HamzaIEEE Access, 2023•ieeexplore.ieee.org

[7]. Application of the convolutional neural networks and supervised deep-learning methods for osteosarcoma bone cancer detection S Gawade, A Bhansali, K Patil, D Shaikh - Healthcare Analytics, 2023 – Elsevier

[8].An Approach to Detect and Classify Bone tumour using fast and Robust Fuzzy C Means Clustering technique S Purnima, V Lashna, R Mahalakshmi, P Sushmika, A Tharani Annals of the Romanian Society for Cell Biology, 2021•annalsofrscb.ro

[9]. Bone Cancer Detection Using Convolution Neural Network – An overview Manjula Vasant Kiresur 2021

[10]Bone cancer detection from mri scan imagery using mean pixel intensityM Avula, NP Lakkakula, MP Raja 2014 8th Asia Modelling Symposium, 2014•ieeexplore.ieee.org

[11]. Bone osteosarcoma tumor classification Kamel Hussien Rahouma1 , Ahmed Salama Abdellatif2 2023

[12] Bone Tumor Detection from MRI Images Using Machine Learning

Sonal S. Ambalkar, S. Thorat

[13]. Bone Tumor Detection from Oestosarcoma Histology Images using Machine Learning Sailus Michael1, Dr. Anjana S Chandran2 2020

[14]. Bone Cancer Detection at Earlier Stage Using Convolutional Neural Network [1] Dr. G Manjula [2] 2021

[15] Bone Cancer Detection Using Feature Extraction with Classification Using K-Nearest Neighbor and Decision Tree Algorithm VDA Kumar Smart Intelligent Computing and Communication Technology, 2021

[16] Kishor Kumar Reddy, Anisha P R, Raju G V S, "A novel approach for detecting the tumor size and bone cancer stage using region growing algorithm", International Conference on Computational Intelligence and Communication Networks, 2015

[17]Prediction of Cancer Disease using Machine learning Approach "F.J. Shaikh , D.S. Rao 2021

[18]A Novel Hybrid Approach for Classifying Osteosarcoma Using Deep Feature Extraction and Multilayer Perceptron Md. Tarek Aziz 1 , S. M. Hasan Mahmud 1,2,*, Md. Fazla Elahe 1,3, Hosney Jahan 1,4, Md Habibur Rahman 1,5, Dip Nandi 2, Lassaad K. Smirani 6, Kawsar Ahmed 7,8,*, Francis M. Bui 7 and Mohammad Ali Moni 9 2023

[19] Detection of Bone Tumor from Histopatholgial Images Using Aquila optimizer based feature extraction and VGG-19+RESNET50 Classifier 1 D. Anand, 2 G. Arulselvi, 3G.N. Balaji

[20] Bone tumor examination based on FCNN-4s and CRF fine segmentation fusion algorithm Shiqiang Wu a,b,1,*, Xiaoming Bai b,1, Liquan Cai a, Liangming Wang a, XiaoLu Zhang a, Qingfeng Ke a, Jianlong Huang c,d,e,* 2023

[21]A Deep Transfer-Based Bone Cancer Diagnosis System Using VGG16 Feature Extraction G. Suganeshwari 1,*, R. Balakumar 2, Kalimuthu Karuppanan 3, Sahaya Beni Prathiba 2,4, Sudha Anbalagan 4 and Gunasekaran Raja

[22] ”Bone Cancer Detection Using Convolutional Neural Network “1d.Prathyusha, 2d.Gowri Sankar Reddy 2023

[23]A. Torki, “Fuzzy rank correlation-based segmentation method and deep neural network for bone cancer identification,” Neuural Computing and Applications, vol. 32, no. 3, pp. 805–815, 2020.

[24] P. Nisthula and R. B. Yadhu, “A novel method to detect bone cancer using image fusion and edge detection,” International Journal of Engineering and Computer Science, vol. 2, no. 6, pp. 2012–2201, 2013.

[25]D. P. Yadav and S. Rathor, “Bone fracture detection and classification using deep learning approach,” in 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), pp. 282–285, Mathura, India, 2020

[26] Kishor Kumar Reddy, Anisha P R, Raju G V S, “A novel approach for detecting the tumor size and bone cancer stage using region growing algorithm”, International Conference on Computational Intelligence and Communication Networks, 2015

[27] Amit Verma and Gayatri Khanna, “A Survey on Digital Image Processing Techniques for Tumor Detection”, Indian journal of science and technology, 9(14), 2016

[28]”Deep Learning Based Bone Tumor Detection With Real Time Datasets “Santhanalakshmi .S.T 1, Abinaya.R 2, Affina sel. T.V 2, Dimple .P

[29]Prediction of Cancer Disease using Machine learning Approach “F.J. Shaikh , D.S. Rao 2021

[30]Medical image diagnosis based on adaptive Hybrid Quantum CNN” Naim Ajlouni1,2,3,4*, Adem Özyavaş1 , Mustafa Takaoğlu5 , Faruk Takaoğlu5 and Firas Ajlouni

[31]A. Torki, “Fuzzy rank correlation-based segmentation method and deep neural network for bone cancer identification,” Neuural Computing and Applications, vol. 32, no. 3, pp. 805–815, 2020.

[32]] P. Nisthula and R. B. Yadhu, “A novel method to detect bone cancer using image fusion and edge detection,” International Journal of Engineering and Computer Science, vol. 2, no. 6, pp. 2012–2201, 2013.

[33]D. P. Yadav and S. Rathor, “Bone fracture detection and classification using deep learning approach