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DEEP LEARNING BASED BONE TUMOR DETECTION WITH REAL TIME DATASETS

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Abstract-*Digital image processing is the use of a digital computer to process digital images through an algorithm. Image Processing can be used to improve the pictorial information for human interpretation. Since the cancerous bone tumor is malignant which will destroy the cortex and spread to other tissues of the body. Hence it is significant to detect the bone tumor in earlier stage with more accuracy. Medical Imaging has achieved a benchmark in tumor detection by resolving various complexities. There are different techniques in medical imaging like X-ray, CT(Computerized Tomography), MRI(Magnetic Resonance Imaging),Ultra sound. Among these various techniques MRI gives with high accuracy rate and also MRI delivers the best images as it has higher resolution. In this paper the tumor detection has been proposed using deep learning.*

Keywords: Medical Imaging, Magnetic Resonance Imaging, Recurrent Neural Network, Long Short Term Memory.

1. INTRODUCTION

Bone tumor develops in skeletal system which destroys tissues and spread to other parts of the body. There are two types of bone cancer namely Primary and Secondary bone cancer. Primary bone tumor either be benign (non-cancerous) or malignant (cancerous).Non-cancerous tumor do not spread beyond their original site whereas cancerous tumors are more aggressive and have a higher risk on growing and spreading. Secondary bone tumor spreads to the bone from elsewhere in the body. Most cancers can be spread to the bones of the body .Moreover people with breast and prostate cancer have high risk of developing secondary bone cancer. These are the most common bone cancers in adults. Secondary bone tumor is also known as bone metastases. For this image processing plays a significant role in detecting bone tumor. In the previous paper, to represent the local structure of 3D patches in the vicinity of particular location across the entire collection, Gaussian Mixture Model(GMM) is used. Since in many clinical datasets the thickness is unknown or varies by site, the existing system could not explicitly model slice thickness.

In this paper, we propose bone tumor detection method using Recurrent Neural Network(RNN) algorithm . In medical examination data there often exist missing parts due to various human factors because human subjects occassionally miss their annual examinations. Thus missing information need to get imputed for accurate prediction of medical examination data. In our proposed method, the trained RNNs are used both for missing data imputation and target data prediction.

2. LITERATURE REVIEW

Haruna Watanabe *et al* [1] has proposed an Bone Metastatic Tumor Detection Based on AnoGAN Using CT Images. In this paper, Generative Adversarial Network(GAN) based anomaly detection is done. The proposed method uses only non-metastatic bone tumor images and learns the distribution of normal images based on adversarial learning. They define the anomaly scores by comparing a test image with a generated image .Metastatic tumor images can be automatically detected based on calculated anomaly scores, but Still missing-features problem exists and Computational analysis are impractical .

Akash Pandey *et al* [3] has done a paper on A Survey Paper on Calcaneus Bone Tumor Detection Using different Improved Canny Edge Detector. In this paper Computer Aided Diagnosing(CAD) is used to analyze Computed Tomography images..And canny edge detector is used for edge detection in image. But canny edge detector has some limitations like it is not able to distinguish edges occurring around objects but still it is beneficial than other traditional edge detector method since it improves the performance of image analysis algorithms.

Eftekhar Hossain *et al* [4] has proposed an Comparative Evaluation of Segmentation Algorithms for Tumor Cells Detection from Bone MR Scan Imagery. This study proposed an object labeling algorithm for the segmentation of bone tumor from magnetic resonance images (MRI) and also provides a comparative analysis of the existing bone cancer segmentation methods . This segmentation algorithms with the proposed one has been compared on the basis of quantitative methods like the dice similarity coefficient (DSC) and the 8structural similarity index measurement (SSIM).Since it is comparatively easier and provide greater noise

immunity over the edge detection method, the bone images contain granny portions of tissues and low volume tumor which make problems of over or under segmentation

Eftekhar Hossain[2] has proposed an Detection & Classification of Tumor Cells from Bone MR Imagery Using Connected Component Analysis & Neural Network. The bone tumor can be detected by using connected component labeling algorithm . In this work, for classifying the bone tumor Artificial Neural Network (ANN) is used. Here bone MR images of previously verified patients are collected and the texture features of this images are used for the training and testing of the neural network. Although ADF conserves the main edges of the objects by removing the high- frequency noise and thus, enhance the low volume region of the images. The tumor portion will become shaded and thus difficult to find out.

Krupali D *et al* [6] has done a paper on Integrated Approach for Bone Tumor Detection from MRI Scan Imagery. The paper proposes an approach of detecting Enchondroma bone tumor from MRI images by using image processing, segmentation clustering techniques, i.e .K-means integrated with Fuzzy C-means clustering. Detected manually by doctors, but because of noise and low quality images of infected body parts, the tumor is not detected easily and is time consuming.

NGOC-HUYNH HO *et al* [5] has proposed on Regenarative Semi-Supervised Bidirectional W-Network-Based Knee Bone Tumor Classification on Radiographs Guided by Three-Region Bone Segmentation. This paper develops and evaluate a new deep learning architecture, namely regenerative semi-supervised bidirectional W-network (RSS-BW), to predict the tumor state of theknee bone from radiographic images. First, we constructed an autoencoder model, called Bidirectional W-network (BW), for segmenting three-region (i.e., femur, tibia, and fibula) of knee bone. Using these regions as input data, RSS-BW architecture consisting of the autoencoding model for regenerating the bone structures, the backbone model for extracting features with pretrained Image Net, and the predicting model for knee bone tumor classification are established.

3. PROPOSED SYSTEM

In our proposed system , in order to predict medical examination data with missing parts Recurrent Neural Network (RNN) is used. Among various types of RNNs. we use simple recurrent network (SRN) and long short-term memory (LSTM) in order to predict the missing information along with the future medical examination data, since these algorithm will show good performance in many relevant applications. Basic RNNs are a network of neuron-like nodes organized into successive layers. In this algorithm each node in a given layer is connected directly (one-way connection) to every other node in the next successive layer. Due to this functionality the output from the previous step are fed as input to the current step. The important feature of Recurrent Neural Network is Hidden state which remembers some previous information about the sequence.

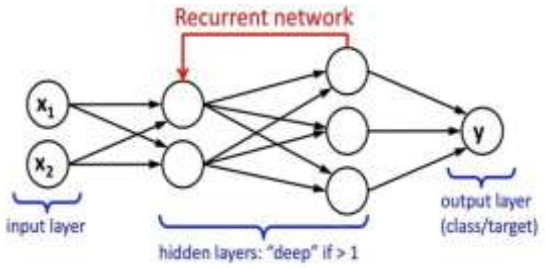

Fig-1:Implementation of RecurrenNeuralNetworks(RNN)

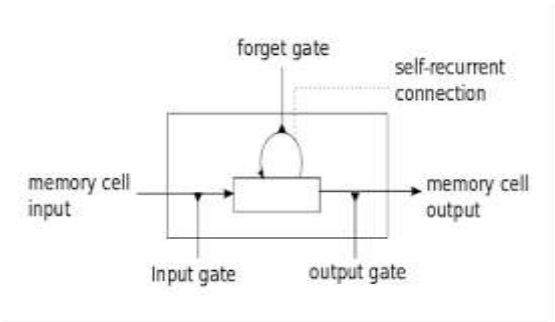

Fig-2:Long Short Term Memory(LSTM) Networks

Long short-term memory (LSTM) is an artificial recurrent neural network (RNN) capable of learning long-term dependencies used in the field of deep learning .Their default behaviour is to remember information for long periods of time and it not only process single data points (such as images), but also entire sequences of data (such as speech or video). LSTMs were developed to deal with the exploding and vanishing gradient problems that can be encountered when training traditional RNNs. The purpose of using RNN and LSTM in our is to impute the missing data in order to handle data with missing parts without extra training data composed of missing examples. In our proposed method, the trained RNNs are used both for missing data imputation and target data prediction .In the proposed system, when there are no missing data, the RNN is processed normally;
when there appears missing data, the output of the RNN in the previous time step is used as the input of the current time step. With such missing data imputation method, the target data with missing parts may be predicted by our proposed RNNs.

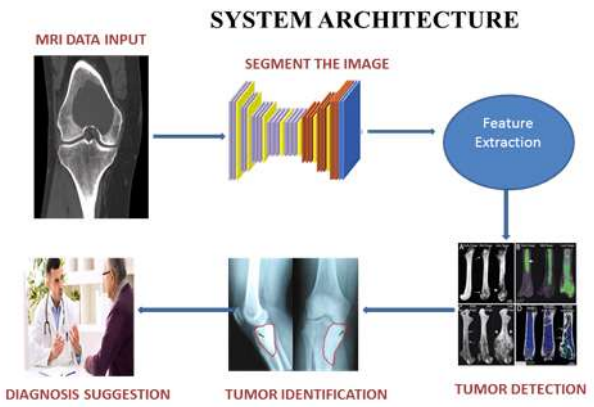

Fig -3: System Architecture

3.1 MRI

Magnetic resonance imaging (MRI) scan uses radio waves to look at organs and structures inside the body. To diagnose various condition Health care professionals use MRI scans from torn ligaments to tumors. There are no risk or side effects of an MRI scan. The benefits of an MRI relate to its precise accuracy in detecting structural abnormalities of the body. Hence in our proposed system we are using MRI images as datasets.

3.2 Image segmentation:

Multiple segments are formed using partition process which is said to be image segmentation. The goal of segmentation is that the resultant formed is something meaningful to examine. The image has more pixel and each pixel is assigned by a label. It shares some common characteristics like same label etc... so segmentation means contours extracted from an image.

3.3 Feature extraction:

Feature extraction reduces initial set of raw data into more manageable groups for processing. Image processing is a vast area to work with in which behaviour of the image has been clearly extracted through feature extraction techniques where some of feature extraction technique are Histogram of oriented gradients (HOG), Speeded-up robust features (SURF), Local binary patterns (LBP), Haar wavelets, Color histograms. Once the behaviour of the image can be drawn then it is feasible to find the tumor in bones.

3.4 Tumor detection

Once the image features are extracted the detection of bone tumor can be easily done since we are using MRI images .Because MRI images gives more accurate detection of tumor cells and we are using this image in our system.

3.5 Tumor identification

The identification of tumor can be done by calculating each pixels in the image and compare it with the trained datasets. Once the comparison has been done it pin points the particular point of affected area which gives an accurate answer for identifying the bone tumor.

3.6 Diagnosis suggestion

Finally the diagnosis suggestion has been given to the patient by analysing the MRI images which is the test datasets that gives more accurate point of attack.

4. PERFORMANCE ANALYSIS

In our proposed system, we choose RNN for increasing the accuracy of the bone tumor detection. In this user just need to select the images and the rest of the process can be handled by the algorithm. Since the missing parts can be imputed in Recurrent Neural Network algorithm, the accuracy can be increased when compare with the Convolutional Neural Networks. The system result is in the form of suggestion which increases the reliability of the concept.

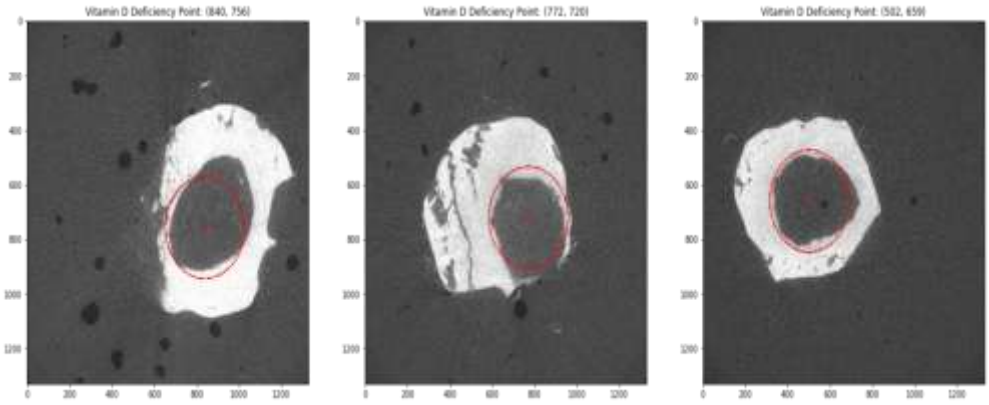

Fig-4: Vitamin D deficiency points

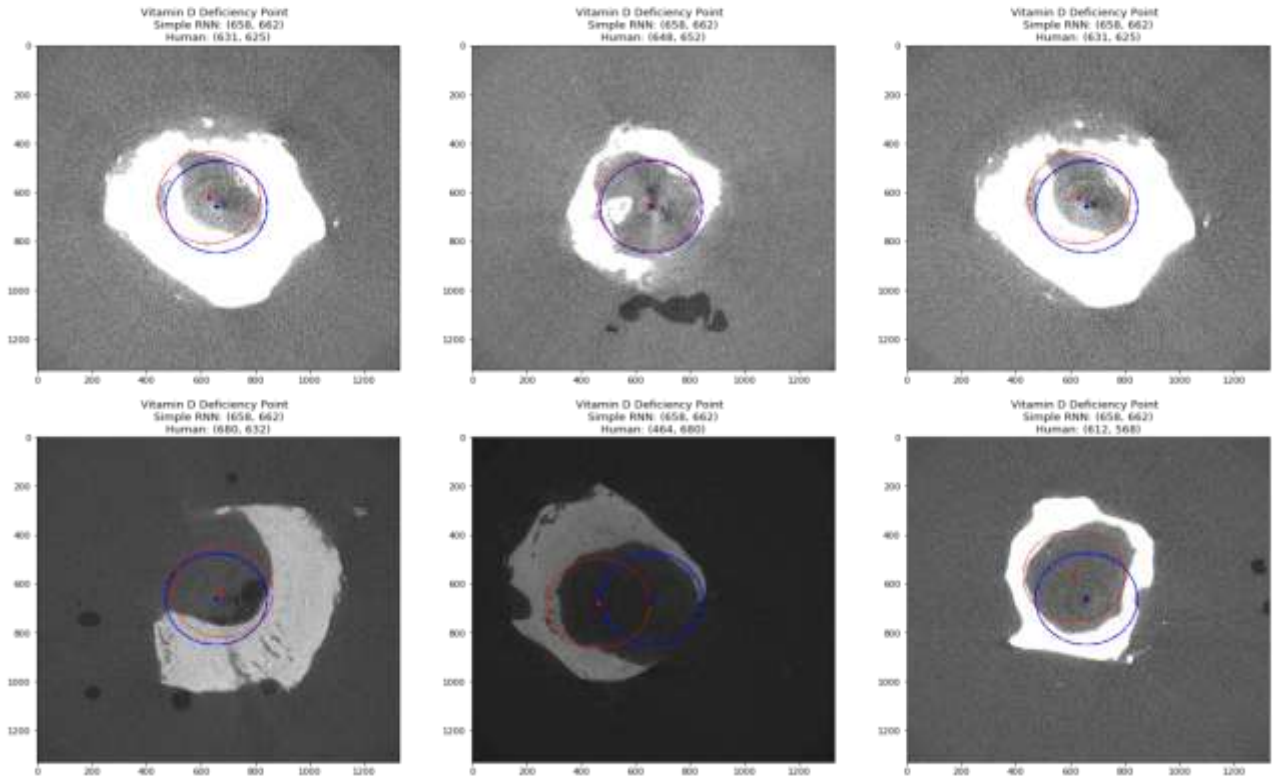

Fig -5: Vitamin D deficieny points[Sample between RNN and human]

5. CONCLUSION

We propose a bone tumor detection method by using Recurrent Neural Network algorithm. Among several types of RNNs, we choose Simple Recurrent Network and Long Short Term Memory in order to impute the missing parts in medical examination data .By using these algorithm we can increase the accuracy of detecting the bone tumor when compare with the existing system. Thus our proposed system provides a different way for detecting the bone tumor with high accuracy.

6. REFERENCES

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