DEEP LEARNING BASED CLASSIFICATION OF BONE TUMORS USING IMAGE SEGMENTATION

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ABSTRACT

Automated Cancer and tumor is a deadly circumstance that impacts human beings of all ages. With over one out of each three human beings will revel in most cancers and at a positive factor of their lives, biomedical area and pc science. The paper carries the look at of bone most cancers and functions to expect the sort of the same. Chondrosarcoma, Ewing sarcoma, Osteo sarcoma primarily based totally bone tumor detection scheme is carried out here. From the help of Histological Images, Osteo sarcoma, Ewing sarcoma are the styles of bone tumor images processed through deep learning algorithm is carried out for extracted the functions of images on this machine. In metastasis, the most cancers cells can break away from the original cell and spread by the blood or lymph system, and they could shape a some other tumor part. In this machine processed the metastasis images to locate the cells that are in preliminary stage. The preprocessed picture has, casting off the noise from it. This machine carried out through convolutional neural community to lessen the manner in addition to enhance the efficiency. The processed picture statistics labeled with the assist of classifiers. The classifiers classify the rims and educated into the machine. This proposed set of rules offer the higher accuracy and sensitivity and the computation time of the machine is improved.

KEY WORDS: *Deep CNN layers, Digital image processing, DNN model, Feature extraction, Classification, MATLAB.*

INTRODUCTION

Bone cancer is taken into consideration a critical health problem, and in lots of cases, it reasons affected person death. The X-ray, MRI or CT-scan image is utilized by medical doctors to become aware of bone cancer. The manual technique is time-ingesting and required knowledge in that field. Therefore, it's miles important to broaden an automatic device to categorize and become aware of the cancerous bone and the healthful bone. The texture of a cancer bone is one-of-a-kind as compared to a healthful bone with inside the affected region. Advanced malignant carcinomas,

 https://doi.org/10.37896/pd91.3/91326

along with breast tumors, prostate tumors and lung tumors regularly become bone metastasis. Thus the early detection of bone metastasis holds a precious gain for deciding on the remedy method to reap a higher universal survival period and progressed existence excellent of sufferers Bone scintigraphy (BS) with 99m-Tc-MDP is one of the maximum usually applied diagnostic strategies to become aware of bone metastasis in cancer sufferers because it has advantage for whole-frame detection and excessive The modern day countrywide survey has stated that extra than 1.15 million bone scans have been yearly carried out in India , which occupies a extremely good workload for nuclear physicians. However, the confined decision of BS pix makes the translation is time-ingesting and experience-based paintings and has the negative aspects of subjectivity, blunders distinctive, and unsatisfied efficiency. The improvement of synthetic intelligence (AI) is creeping into each side in cutting-edge existence through its advances in big-statistics retrieval and specific characteristic evaluation, which is good for clinical picture analysis. With the assist of deep neural networks (DNNs), the computational techniques permit an set of rules to application itself through getting to know from a massive set of examples that exhibit the preferred behavior, putting off the want to specify regulations explicitly Compared to conventional image processing strategies, deep getting to know is extra dependable and efficient, given that it can robotically extract image features as opposed to homemade features.

LITERATURE REVIEW

The variety of the latest instances every 12 months is anticipated to twelve million in 2020 to twenty million by 2030 with 60% of those instances going on in growing countries. In India, there are eight million new instances stated through ICMR and there might be an envisioned 12% upward thrust in subsequent five years. Maduri avula et al. [1] proposed a system to locate the bone tumors processed through the image segmentation through comparing the mean depth. They categorized the clinical images for deciding on pixel intensity values to discriminate tumors / no tumors for the images. Abhilash Shukla et al. [2] mentioned the desirable segmentation strategies that are expecting the tumor as it should be and efficiently. Finally, they concluded canny edge and k-means are great to find the edges with inside the clinical images.

 https://doi.org/10.37896/pd91.3/91326

Title	Objective	Drawbacks
Bone Cancer Detection From MRI Scan Imagery Using Mean Pixel Intensity	The segment image is processed for detect the bone cancer by evaluating the mean intensity. Threshold values are proposed for the classification of medical images for the presence or absence of the bone tumors.	It has more sub sets to detect the data. It will detect the tumors in middle stage of metastatis.
Bone Cancer Detection From X-Ray and MRI Images Through Image Segmentation Techniques	This paper covers the classification of image segmentation and mainly focused on best segmentation technique with different ages.	It has identify only X-ray and MRI images with few supported image fomates.
Screening and Identify The Bone Cancer / Tumor using Image Processing	To Implement the image processing to detect the Bone tumors easily.	Improve this concepts using some advanced technology to detect the tumors efficiently.

DIGITAL IMAGE PROCESSING

Digital photo processing is the usage of laptop algorithms to carry out photo processing on virtual images. The 2D non-stop photo is split into N rows and M columns. The pixel is defined as the intersection of a row and column. The photo also can be a characteristic different variable together with depth, color, and time. A photo given with inside the shape of a transparency, slide, photo or an X-ray is first digitized and saved as a matrix of binary digits in laptop memory. This digitized photo can then be processed and/or displayed on a high-decision TV reveal. For display, the photo is saved in a rapid-get entry to buffer memory, which refreshes the reveal at a price of 25 frames in line with 2d to provide a visually non-stop display.

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THE IMAGE PROCESSING SYSTEM

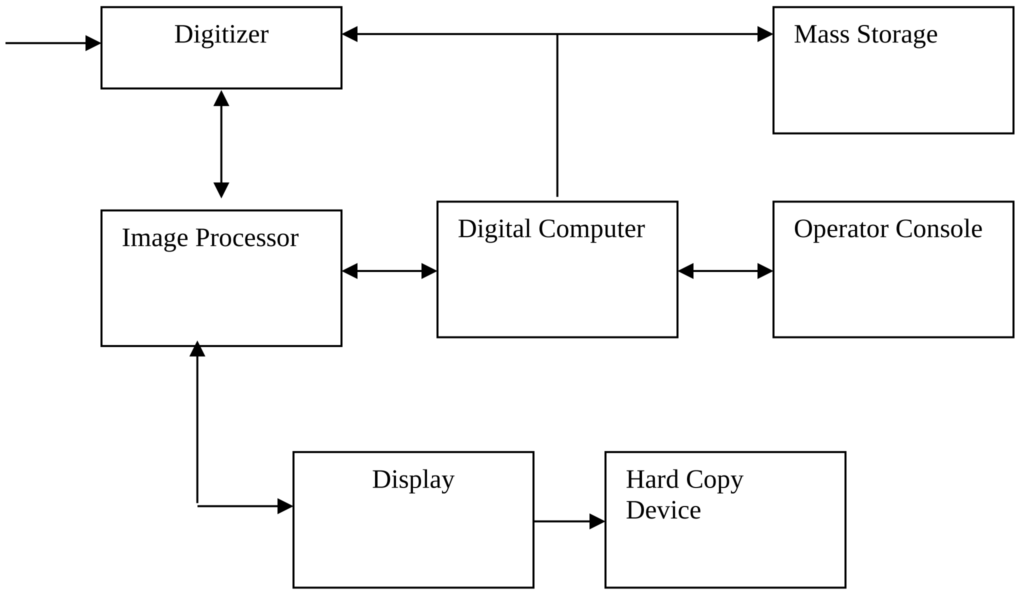

Fig 1.1 BLOCK DIAGRAM OF IMAGE PROCESSING SYSTEM

IMAGE PROCESSING GOALS

In virtually all image processing applications, however, the intention is to extract records from the image data. Obtaining the records favored may also require filtering, transforming, coloring, interactive analysis, or any variety of different methods. To be fairly extra specific, you could generalize maximum image processing obligations to be characterized with the aid of using one of the following categories.

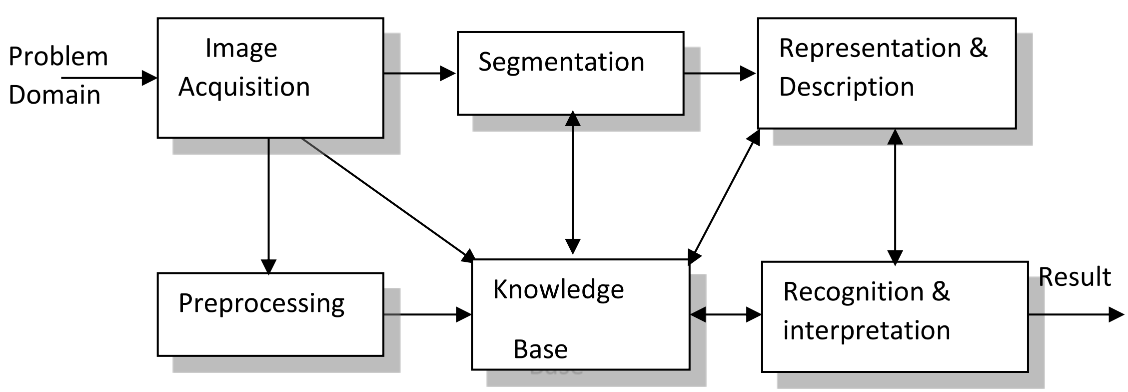

Fig 1.2 BLOCK DIAGRAM OF FUNDAMENTAL SEQUENCE INVOLVED IN AN IMAGE PROCESSING SYSTEM

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PROPOSED SYSTEM

The proposed system bone cancer detection is implemented using convolution neural network-based algorithm, bone sarcoma is cancer that starts in the bone. The primary bone sarcomas affects less than 0.2% of all cancers. However, it is much more common for bones to metastasize or spread from cancers that started elsewhere in the body. Osteosarcoma Based on Convolutional Neural Networks (CNNs) models is implemented for detect and classify the sarcoma images deep learning-based system is implemented for detect the bone sarcoma images. This section includes data collection, augmentation of data using image transformations and finally classification of healthy and cancerous bones using deep CNN. Convolutional Neural Networks (CNN) are typically used for automatic information extraction from image data. They consist of convolutional layers that extract neighborhood relationships and encode them to form neural outputs. In general, denser CNNs are able to learn more information. But increasing the density introduces problems like gradient smoothing. Therefore, many CNN architectures are proposed to handle these issues uniquely and hence can be used as needed.

CLASSIFICATION OF BONE TUMORS

Bone tumors generally classified into two types, primary bone cancer and secondary bone cancer. Primary bone tumors are formed in bone itself. But secondary tumors are started some other body parts and spread with blood system. Most of the children are affected by primary bone tumors and some of the adults affect them, too.

PRIMARY BONE TUMORS

1. Osteosarcoma
2. Ewing sarcoma
3. Chondrosarcoma
4. Soft tissue sarcoma
5. Fibrosarcoma

SECONDARY BONE TUMORS

This kind of tumors typically formed somewhere in the human body spread to the bone through the blood or nymph system. It referred as metastatis tumor.

OSTEOSARCOMA

Osteosarcoma is a type of primary bone cancer that mainly affects children and adults.It is a rare type of disease, there are less than 20,000 cases recorded each year in the United States. This disease always requires a medical diagnosis and treatment requires imaging or lab tests. Osteosarcoma mostly occurs in the long bones of legs and arms and it can occur in any bone. Bone pain and swelling are the basic symptoms and surgery and radiation are the treatment to cure the affected person.

Fig 2.1 Osteosarcoma bone

EWING SARCOMA

Ewing sarcoma is another type of primary tumor. mostly occurs in and around the bones. This disease always requires a medical diagnosis and treatment requires imaging or lab tests. Ewing's sarcoma mostly occurs in the bone joints of legs and arms and it can. Bone back pain, swelling sometimes it cause bone fracture. These are the basic symptoms and based on the stage of the tumor, surgery and radiation are the treatment to cure the affected person.

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Fig 2.2 Ewing sarcoma bone

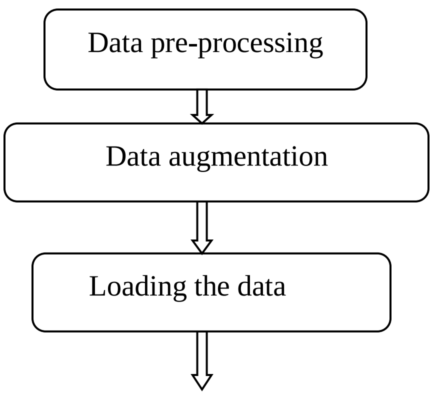
CHONDROSARCOMA

Chondrosarcoma has formed in the bones of the body. Adults between 20 and 60 ages are affected by this kind of tumor. It actually starts at the pelvis of the long bone of the arms and legs. It affects any body part contain cartilage. They have pain swelling are the symptoms and the only treatment is surgery to remove a tumor parts.

Fig 2.3 Chondro sarcoma bone

PROJECT PIPELINE

Pipeline consists of 7 steps, which are quite common in classification problems:



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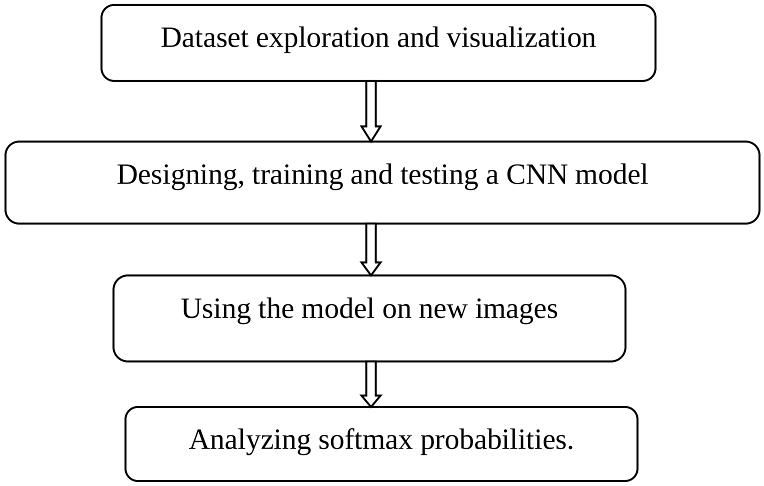

FEATURE EXTRACTION

The overall performance of any classifier relies upon at the fine of the capability it provides. Therefore, it's miles of maximum significance that enough and excessive fine features are extracted to the image maximum representative of the attributes of the unique image. Generally the features extracted from the images are HC however with the development of DLM, the usage of CNNs has won prominence, displaying tremendous enhancements over manual extraction of HCs. However, using HC features continues to be taken into consideration crucial because of the liberty to select attributes primarily based on image assets that professionals can study and does now no longer require any shape of education for the extraction process. In this research, an incorporated technique wherein capabilities are extracted the use of each HC techniques.

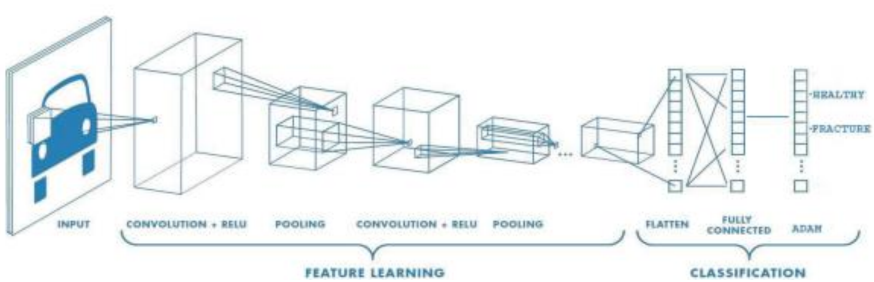

Fig 3.1 Bone cancer type classification

PROPOSED SYSTEM BLOCK DIAGRAM

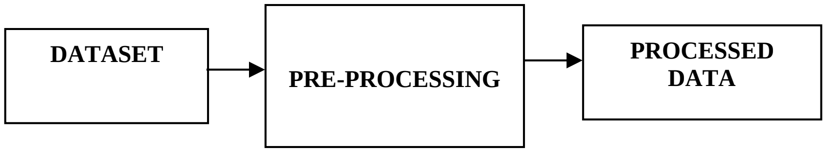

Fig 3.2 PRE - PROCESSING

DEEP CNN LAYERS

Deep neural networks include an input layer, an output layer, and at least two hidden layers. The feed forward network is a representative deep neural network, and the core of the feed forward network is the parametric feature approximation. For image classification, convolutional networks are extensively implemented among deep neural networks. Convolutional layers are the simple aspect of a convolutional network. In image processing, the filter flows over the complete image and stacks along the channel length with inside the convolutional layer. ImageNet Large Scale Visual Recognition Challenge (ISVR) has come to be the gold popular for huge scale visible recognition. It is an opposition wherein software program competes to effectively classify and discover objects and scenes. Different network structures with the excellent performance in the competition for the classification of images those final years had been tested on this challenge.

VGG

The first neural network tested on this project is VGG. VGG networks are characterized through their uniform architecture. The structure of VGG includes stacked convolutional layers, grouping layers, and absolutely related layers.VGG is just like Alex net however with greater filters and layers. VGG nets range intensive, and the 19 layer model is one of the great performing models. In this task, the VGG19 are implemented for the experiments. See segment A.3.2 in appendix for greater details.

INCEPTION

The startup architecture is likewise tested. Google net received the 2014 ISVR and performed a top five out of 6 blunders rate.67%, which is close to human level perception. It includes 22 convolutional layers with batch normalization, image distortions and Res pro. Applying boot blocks reduces the number of parameters from 60 million (Alex Net) to 4 million because of applying very small convolutions. The value of calculating the start is a great deal lower than VGG and Alex net, which makes it accessible with restricted recollections and calculation resources. There are numerous variations of the Inception architecture. After the primary advent of Google Net, the Inception architecture become delicate in various ways. Further, there are different factorization thoughts with inside the 1/3 generation, referred to as InceptionV3. 2.5 better than that of Googlebot and plenty greater efficient than that of VGG.

RESNET

It focuses on fixing the degradation problem with increasing intensity. A residual characteristic has been implemented to the residual network at the optimizing Assumption A residual mapping characteristic is less complicated to optimize the original, unrefined mapping. It seems that the network converges quicker and may achieve accuracy with a significantly extra depth of depth.

TRANSFER LEARNING

The pre-skilled network on Image net to train the CNNs is used. This approach is defined as transfer learning. Transfer learning is a way that applies recognized weights to train deep neural networks for better performance. In practice, transfer learning is not unusual place in training technique of convolutional neural networks due to the fact that the dataset is commonly not huge sufficient and it's miles too expensive to train from scratch with random initialization. Image net [13] is presently the most important publicly to be had dataset for item popularity and is widely implemented in transfer learning. Despite the considerable variations among natural and scientific images, Shin et al. discovered that transfer learning from Image net can still make medical image recognition responsibilities greater effective. The cross-modality imaging transferability makes

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transfer learning in CNN representation from Image net popular in various modality imaging recognition

AUTOMATIC AND INTERACTIVE PIPELINE

Two diagnostic pipelines have been constructed in the use of the scalable neuronal network (CNN) as a core classifier to look at the influence of user intervention on network performance. One is a fully computerized pipeline, in which the x-ray image is at once enter into the network with size and intensity normalization steps as described above. The transfer learning approach was used to pre-train those networks using images from Imagine. Another interactive pipeline requires user intervention for the dataset before the images are sent to the CNNs. In the X-ray images, the femur bones are in specific positions, and we assume the fracture to be in the center with vertical femur bones. Therefore, we wrote a script to move the fracture toward the center, with vertical femur bones above. Additionally, the circled images are cropped into the dimensions of 256×256 from the fracture middle. In this way, we can assume the networks to recognition more on the tumor features. The entire technique is accomplished in clicks from the user interface. Manual screening is performed once more afterwards to ensure the first-rate of those images. Several subjects are eliminated and there are 389 subjects with AFF and 388 with NFF. Figure 2.1 offers an instance of the described method Figure: forms of sarcoma images.

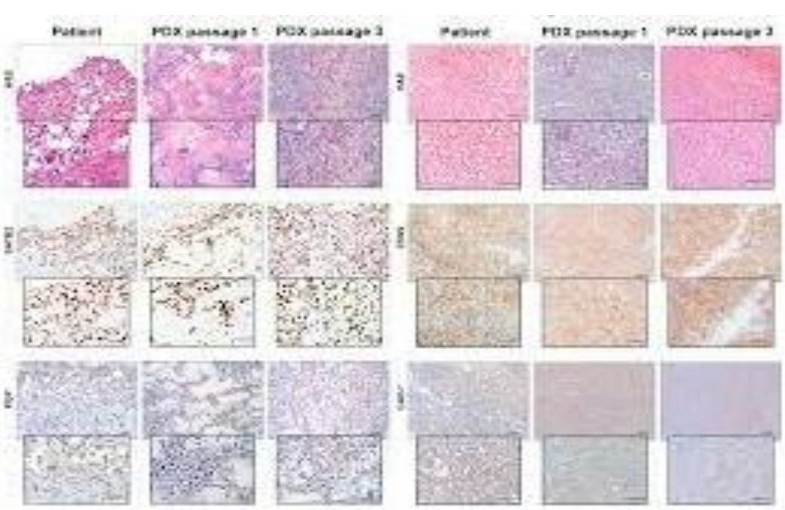

Figure: types of sarcoma images

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AUTOMATIC METHOD

In the primary stage, VGG19, InceptionV3 and ResNet50 are tested with the standardized pre-processed input information as defined in segment 2.1. The evaluated accuracy on validation dataset is 82.7%, 89.4%, 90.5% for VGG19, InceptionV3 and ResNet50 approximately. It takes around four hours to train one fold with one hundred epochs each. The accuracy plots of networks are proven in Figure 3.1. According to the accuracy plots, we are able to see that Reset has the pleasant overall performance among 3 networks. For similarly examination, cross validation is implemented for the three networks with five folds.

INTERACTIVE METHOD

In the second stage, the images are manipulated with restricted user intervention. Accuracy plots are for repeated experiments with same setups and the evaluation accuracy is progressed to 92.2%, 93.four and 94.4% for VGG19, Inception, ResNet50 respectively. Once again, with cross validation for 3 networks.

CNN LAYER

TRAINING PART

In the training part, a simple and iterative method was observed to find the fine architecture of the model. After converting one of the model parameters, I ran most effective 20 epochs of the training and determined the validation blunders seeking to set it on minimal level. It may be very crucial to remember specifically validation error at the same time as tuning the model. The corresponding validation accuracy after 20 training epochs. Sometimes the differences between certain tactics are considered huge, and it becomes difficult to make a wish between them. But keep in mind that for each training routine, there may be a random weight initialization affecting the last error. Especially when the number of epochs is small. That's why at some point in the final tuning of the model I used over 20 epochs around 100.

 https://doi.org/10.37896/pd91.3/91326

ISSN: 0369-8963
PERIODICO di MINERALOGIA Volume 91, No. 3, 2022

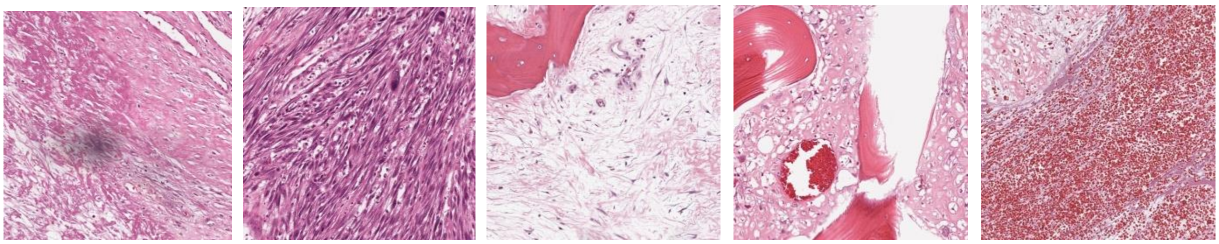

Fig 4.1 CT Histological Training set – data (Approximately 1000 training data)

TEST PART

Finally, we would like to test our road sign recognition system on absolutely invisible traffic sign images. Certainly, the accuracy acquired in the test set is also an excellent indication of the performance of the model. But let's check out some new images that aren't from our German road signs dataset. Below the images are model predictions, an indication of the accuracy of the prediction and the certainty of the model. Implementation of algorithm can be through the usage of MATLAB.

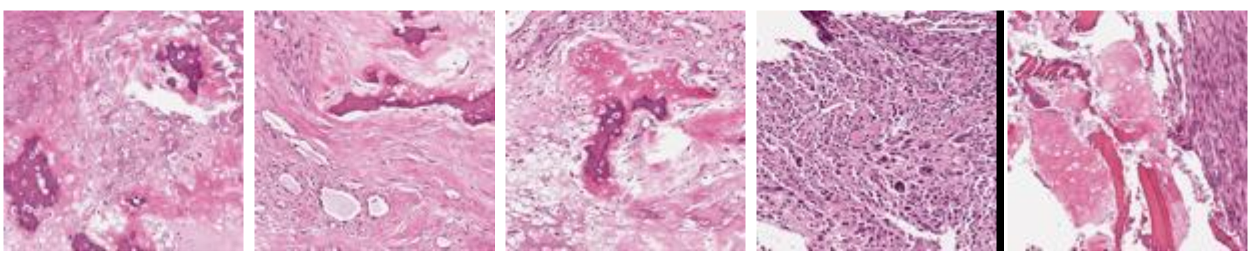

Fig 4.2 CT Histological Testing – data (Different from training data)

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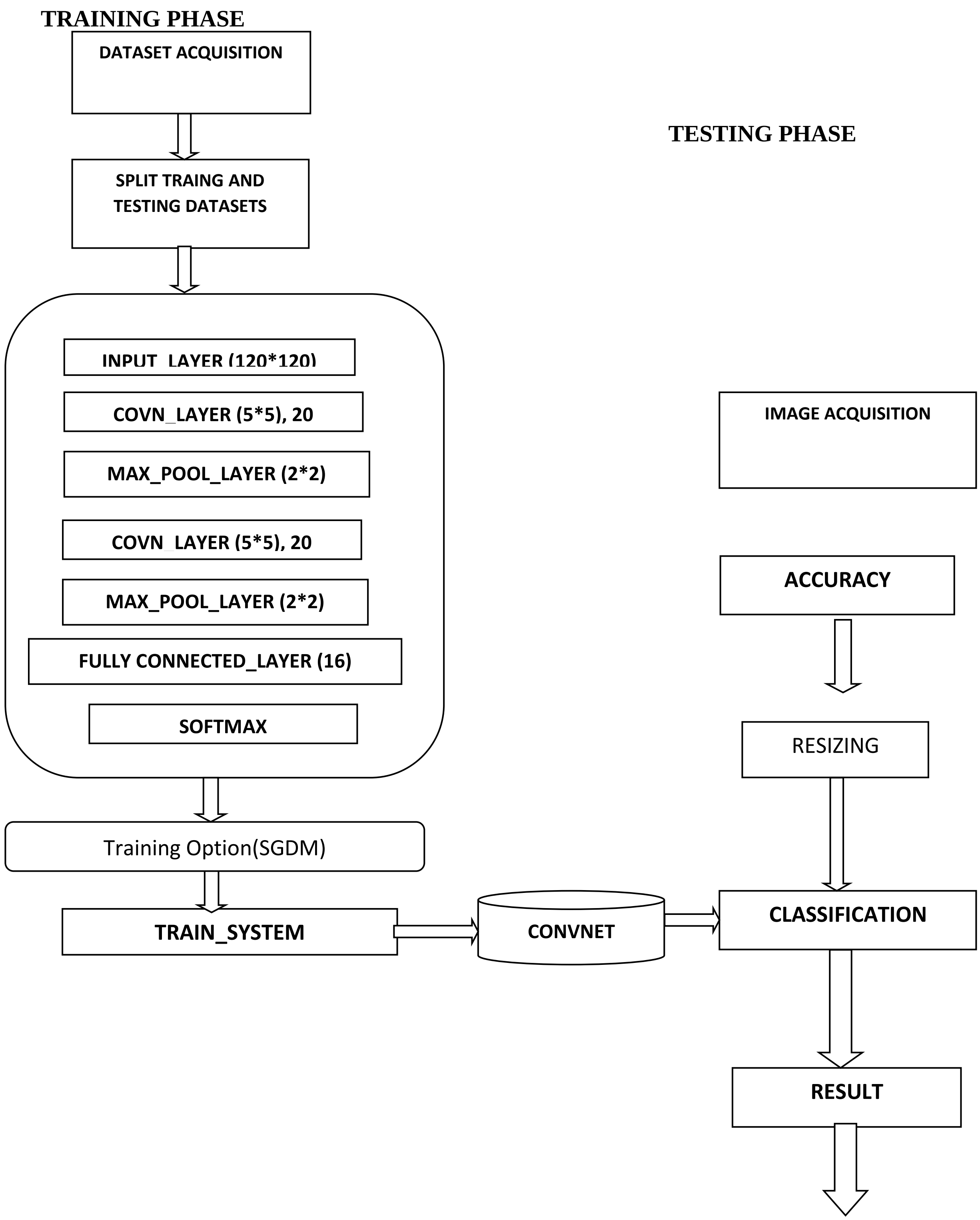

Fig 4.1 FLOW CHART OF TRAINING AND TESTING OF CNN MODEL

DATA FLOW DIAGRAM

A data flow diagram (DFD) is an illustration in a graphical form. This is an illustration of the "running" information throughout a sequence, which is part of the procedure. Frequently they are a beginning move employed towards building a general idea regarding the method that will be detailed later on. A DFD demonstrates the variety of input data in sequence to with output as of the method, in which the information will approach as of plus exit towards, in addition to in what the information will be accumulated. It doesn't demonstrate in sequence regarding the instance of procedures, or else in sequence regarding whether the procedures will work sequentially or else separately.

4.4 DATASET

The dataset is divided into training set and test set. Each sample represents a traffic sign labeled as one of 2 classes. The shape of a traffic sign image is scaled to 256×256 pixels in the 3-channel RGB representation.

4.5 DESIGNING A DEEP NEURAL NETWORK MODEL

It's finally time to send the data to the neural network. Choosing the network architecture, constantly adjusting different Each is probably the most difficult task. The are no clear rules for model optimization. Choosing addition to a few proven rules of thumb, our experience often plays an important role. Parameters, when it comes to deep neural networks, it takes a relatively long time to wait for the results of each model tested.

CONVOLUTIONAL NEURAL NETWORK

The concept of convolutional neural networks are very successful in image recognition. There key part to understand, which distinguishes CNN from traditional neuron In is the exploitation of convolution. Moreover an input image, CNN scans it multiple times to look for certain features. The sweep (convolution) can be configured with 2 main parameters: the stride and the type of padding. networks, we see in the image below, the first convolution process gives us a series of new images, shown here in the second column (layer). Having frame contains information about a feature and its presence in the scanned image. This resulting frame will have higher values when a feature is strongly visible and lower values when there are no or few such features. As the

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process is repeated for each of the obtained frames a specified number of times. Each this project, we have chosen a classic model that contains only two convolution layers.

In the last layer that we convey, the highest level characteristics are sought. It works like human perception. Then, during the training process, the weights between the neurons are adjusted. In slowly the CNN starts finding such features that achieve the predefined goal, i.e.to successfully recognize images from the training set. It the levels described, there are also grouping operations (down sampling) which reduce the size of the resulting frames. Then, after each convolution, we apply a nonlinear function to the resulting frame to introduce nonlinearity into the model., and, there are also fully connected layers at the end of the network. Among final set of frames obtained from convolutional operations are flattened to obtain a one-dimensional vector of neurons. down sampling this point we put a standard and fully connected neural network. Additionally, for classification problems, there is a Finally layer. The the model results into probabilities of a correct estimate of each class, here a road sign index. From is a summary of the model I chose and Finally with dimensions marked for each level.

10x1 Layer array with layers:

1 '' Image Input 120x120x3 images with 'zerocenter' normalization

2 '' Convolution 20 5x5 convolutions with stride [1 1] and padding [0 0]

3 '' ReLU ReLU

4 '' Max Pooling 2x2 max pooling with stride [2 2] and padding [0 0]

5 '' Convolution 20 5x5 convolutions with stride [1 1] and padding [0 0]

6 '' ReLU ReLU

7 '' Max Pooling 2x2 max pooling with stride [2 2] and padding [0 0]

8 '' Fully Connected 16 fully connected layer

9 '' Softmax softmax

10 '' Classification Output crossentropyex

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DATA ANALYSIS

MATLAB provides interactive tools and command-line functions for data analysis operations, including:

- Interpolating and decimating
- Extracting sections of data, scaling, and averaging
- Thresholding and smoothing
- Correlation, Fourier analysis, and filtering
- 1-D peak, valley, and zero finding
- Basic statistics and curve fitting
- Matrix analysis

DATA ACCESS

MATLAB is an effective platform for having access to records from files, different applications, databases, and external devices. You can read data from popular file formats, consisting of Microsoft Excel; ASCII textual content or binary files; photograph, sound, and video files; and medical files, consisting of HDF and HDF5. Low-stage binary file I/O features assist you to work with data files in any format. Additional features assist you to study records from Web pages and XML.

VISUALIZING DATA

All the graphics functions which might be required to visualize engineering and medical data are to be had in MATLAB. These consist of 2-D and three-D plotting features, three-D volume visualization features, gear for interactively developing plots, and the capacity to export consequences of all famous photos formats. You can personalize plots through including a couple of axes; converting line colors and markers; including annotation, Latex equations, and legends; and drawing shapes.

2-D PLOTTING

Visualizing vectors of data with 2-D plotting functions that create: ϖ Line, area, bar, and pie charts. ϖ Direction and velocity plots. ϖ Histograms.

- ❖ Polygons and surfaces.
- ❖ Scatter/bubble plots.
- ❖ Animations.

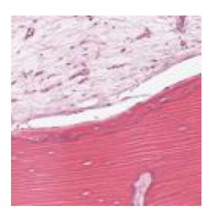
3-D PLOTTING AND VOLUME VISUALIZATION

MATLAB gives functions for visualizing 2-D matrices, 3-D scalar, and 3-D vector data. You can use those functions to visualize and recognize large, regularly complex, multidimensional data. Specifying plot characteristics, consisting of camera viewing angle, perspective, lighting fixtures effect, mild source locations, and transparency.

3-D plotting functions include:

- ❖ Surface, contour, and mesh.
- ❖ Image plots.
- ❖ Cone, slice, stream, and surface.

SAMPLE TESTED DATA

Name	Medical image file name	Body Part	Cancerous / Non Cancerous	Cancer Type	CT Histological Image
Pratik	Case 3 A7-18669-5101.jpg	Right Arm	YES	Osteosarcoma	

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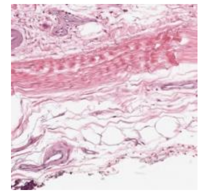
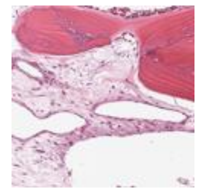
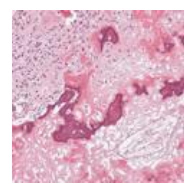
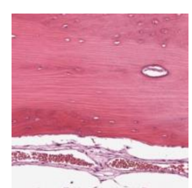
Krish	Case 3 A12-34294-35557.jpg	Left Leg	NO	-	
manjunath	Case 4 C21-11229-17093.jpg	Left L-bow	YES	ewingsarcoma	
Namya	Case 4 C21-14246-18799.jpg	Left	YES	chondrsarcom a	
Shyam	Case 3 A7-11686-7821.jpg	Left arm	YES	Osteosarcoma	
Ammirreddy	Case 3 A13-25714-32133.jpg	Sternum	NO	-	
Nusarath Banu	Case 3 A13-30465-16520.jpg	Gliding joint	YES	chondrsarcom a	

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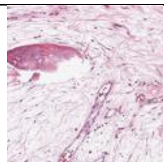
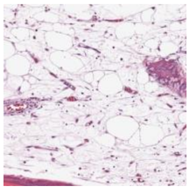
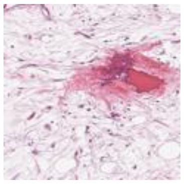
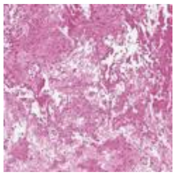
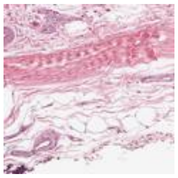
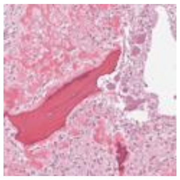
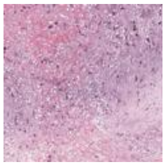
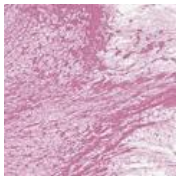
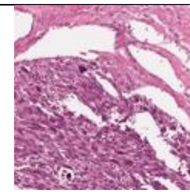
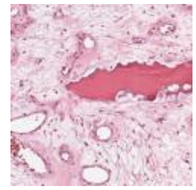
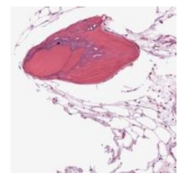
					
Reema	Case 3 A12-30696-5036.jpg	Left leg	YES	Osteosarcoma	
Stafina	Case 3 A12-29860-25889.jpg	Skull	YES	ewingsarcoma	
Aishuu	Case 3 A12-32477-34353.jpg	Right arm	NO	-	
Mi Cha	Case 3 A18-9709-20966.jpg	Pelvis	NO	-	
Naseer	Case 3 A12-32422-16245.jpg	Pivot joint	YES	chondrsarcoma	

Morgan	Case 48 - P5 C17-47230-17655.jpg	Right shoulder	YES	ewingsarcoma	
Alya	Case 48 - P5 C16-54563-21138.jpg	sternum	YES	Osteosarcoma	
Tharikath	Case 48 - P5 C16-50924-16162.jpg	Pelvis	YES	ewingsarcoma	
Shajitha Rehana	Case 48 - P5 C18-32717-16452.jpg	Left arm joint	YES	chondrsarcoma	
Chrisen	Case 4 C24-31203-32244.jpg	Pelvis	YES	Osteosarcoma	
Shivani	Case 4 C27-37658-29791.jpg	Right joint leg	YES	ewingsarcoma	

 https://doi.org/10.37896/pd91.3/91326

					
Aahana	Case 4 C24-32721-26127.jpg	Leg joint	YES	chondrsarcoma	
Kutty	Case 3 A18-3816-24060.jpg	Skull	NO	-	

There are more than 1000 set of data trained into this system and tested with different kind of 200 data for tuning the efficiency and accuracy.

RESULT AND DISCUSSION

Sampled testing image we have taken for image processing algorithm, the input image is the gray scale picture, this color image is transformed into gray scale image Grayscale images are monochrome images, method they have the handiest one color. Grayscale images do not include any information approximately color. Each pixel determines to be had one-of-a-kind gray levels. An ordinary grayscale image consists of eight bits/pixel data, which has 256 one-of-a-kind gray levels. The preprocessing step is implemented to convert the color image into gray scale image

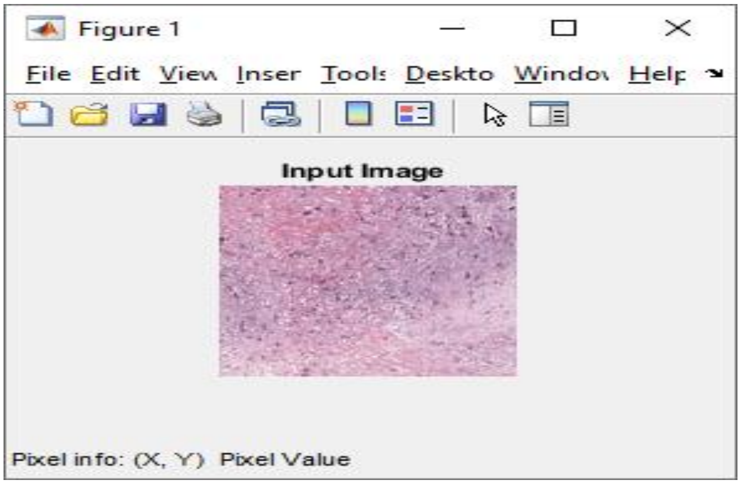


Fig 6.1 input image

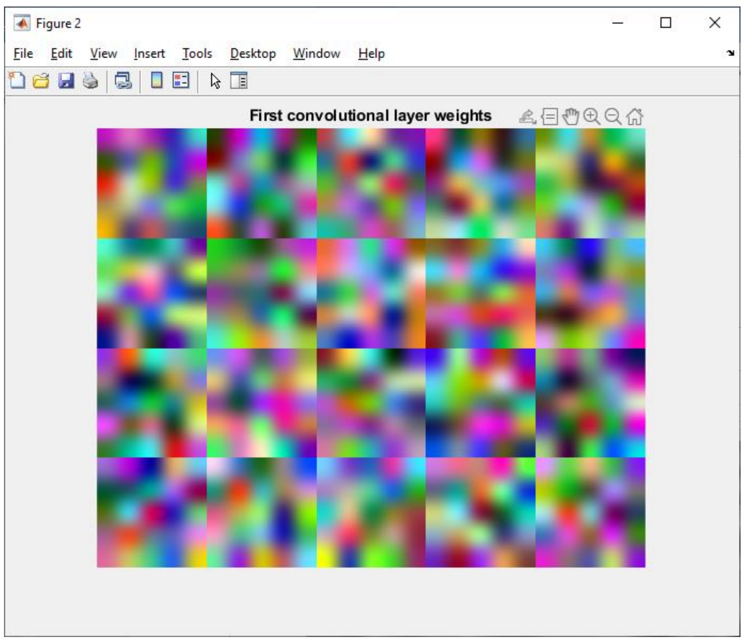


Fig 6.2 Convolution layers

Convolutional layers are the layers where filters are applied to the original image or other feature maps in a deep CNN. This is where most of the user-specified settings on the network are located. The most important parameters are the number of nuclei (kernals) and the size of the nuclei (kernals).

Fig 6.4 normal bone

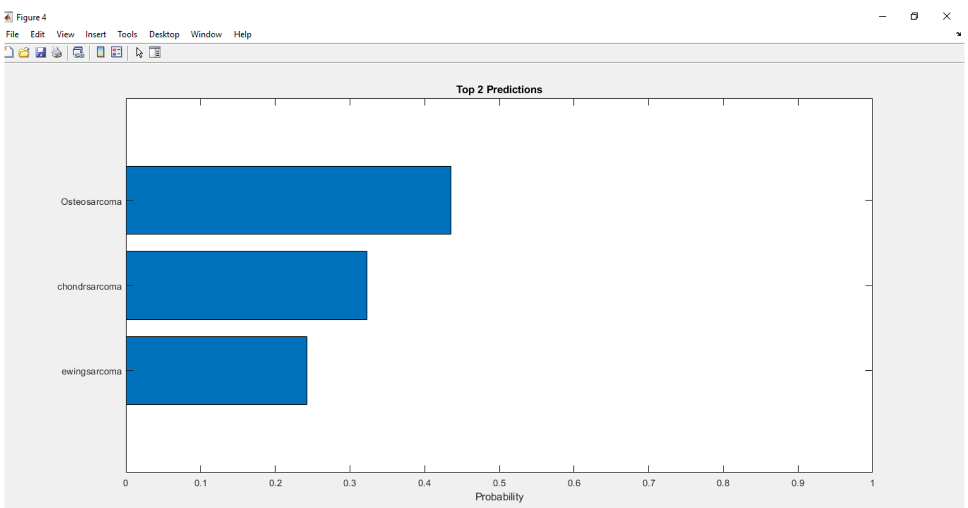


Fig 6.5 normal bone / cancer bone probability ratio

 https://doi.org/10.37896/pd91.3/91326

```
layers =

  10x1 Layer array with layers:

     1   ''   Image Input             120x120x1 images with 'zerocenter' normalization
     2   ''   Convolution             20 5x5 convolutions with stride [1  1] and padding [0  0  0  0]
     3   ''   ReLU                    ReLU
     4   ''   Max Pooling             2x2 max pooling with stride [2  2] and padding [0  0  0  0]
     5   ''   Convolution             20 5x5 convolutions with stride [1  1] and padding [0  0  0  0]
     6   ''   ReLU                    ReLU
     7   ''   Max Pooling             2x2 max pooling with stride [2  2] and padding [0  0  0  0]
     8   ''   Fully Connected         2 fully connected layer
     9   ''   Softmax                 softmax
    10   ''   Classification Output   crossentropyex
Training on single GPU.
Initializing input data normalization.
|======================================================================================|
|  Epoch  |  Iteration  |  Time Elapsed  |  Mini-batch  |  Mini-batch  |  Base Learning  |
|         |             |   (hh:mm:ss)   |   Accuracy   |     Loss     |      Rate       |
|======================================================================================|
|       1 |           1 |       00:00:00 |       55.56% |       2.5603 |      1.0000e-04 |
|      20 |          20 |       00:00:03 |      100.00% |   4.1988e-06 |      1.0000e-04 |
```

Fig 6.6 CNN layers

CONCLUSION

In the field of medical image processing, it is important to automate the classification of histological images using computerized systems, it is difficult and time-consuming to perform microscopic examination of histological images. Automatic histology diagnosis relieves the workload and allows pathologists to focus on critical cases. In this work, we used two pre-trained networks ,this proposed algorithm is provide the better accuracy and sensitivity and improved The deep CNN network we trained the different set images for training and different images for testing for improve the accuracy of the system.

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