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BRAIN TUMOR DETECTION AND SEGMENTATION USING DEEP LEARNING

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***Abstract* — In modern days Artificial intelligence is becoming an essential part of our life from which Machine Learning and Deep Learning are the two subsets of Artificial Intelligence and Machine Learning is the emerging field of the current era. As we know Machine Learning plays an important role in the field of Medical Science in terms of diagnosis. We can now save many lives if we were able to diagnose a disease even before it appeared in an individual's body. Most of the current techniques failed to localize the tumor area, so we used mask r-CNN and successfully detected the brain tumor and localizing the tumor using image segmentation technique.**

***Keywords* —Convolution Neural Network, Deep Learning,**

I. INTRODUCTION

Medical diagnostics are a category of medical tests designed to detect disease. Nowadays machine learning algorithms are used for data analysis and to produce the most effective results. Currently, medical clinics are very well furnished with fully automatic machines and those machines are generating a huge amount of data, then those data are collected and shared with information systems or with a doctor to take required steps. Machine learning techniques can be used for the analysis of medical data, and it is very helpful in medical or any diagnostic system. But the major problem with medical data is that most of the medical data have a huge number of dimensionalities as the data changes frequently. But the major problem with medical data is that most medical data have a huge number of dimensionalities as the data changes frequently. In this paper, we tried to resolve the issue of the current system. Thus, we proposed a new approach that can detect brain tumors. In addition, we also tried localizing the brain tumor using image segmentation techniques to highlight the tumor area.

II. RELATED WORK

Several studies and projects have already been completed to ensure a comfortable ride. And getting information from a human has improved the experience.

Applications of radionics and machine learning for radiotherapy of malignant brain tumors [1]: Comprehensive literature research analyses neuroimaging and its potential application for radiotherapy in patients.
Automatic evaluation of traumatic brain injury based on terahertz imaging with machine learning [2]: Demonstrate an automatic evaluation method of different degrees of TBI in a rat model based on THz transmission CW imaging with machine learning (ML).
Brain Tumor Detection Analysis Using CNN: A Review [3]: It examines the quantitative characteristics of brain tumors, such as shape, texture, and signal intensity, to predict high accuracy with a low error rate.
Brain Tumor Detection and Classification by MRI Using Biologically Inspired Orthogonal Wavelet Transform and Deep Learning Techniques [4]: It has improved the performance and simplification process of medical image segmented tissue using the gray-levels-occurrence matrix (GLCM) method.
Brain tumor segmentation with Deep Neural Networks [5]: Automatic brain tumor segmentation method based on Deep Neural Networks (DNNs) that are tailored to glioblastomas (both low and high grade) pictured in MR images.
Application of Edge Detection for Brain Tumor Detection [6]: For edge detection there are various classical methods but in this algorithm edge detection using 2D Cellular Automata concept was used because the detection of edges depends on neighborhood pixels. The Cellular Automata rule number 252 provides strong edge detection. The algorithm was applied on numerous images and the results obtained were very good and efficient.
Brain Tumor Detection Using Color-Based K-Means Clustering Segmentation [7]: It is a color-based segmentation algorithm with K-means is to convert a given gray-level MR image into a color space image and then separate the position of tumor objects from other items of an MR image by using K-means clustering and histogram-clustering. Experiments demonstrate that the method can successfully achieve segmentation for MR brain images to help pathologists distinguish exactly lesion size and region.
Image Processing Techniques for Brain Tumor Detection: A Review [8]: In this study methods like Filtering, Contrast enhancement, Edge detection is used for image smoothing. The preprocessed images are used for post processing operations like; threshold, histogram, segmentation and morphological, which is used to enhance the images.

III. METHODOLOGY

The purpose of this system is to detect and classify brain tumors. The main aim is to ease the life of people and help make efficient use of their time. Here deep learning techniques are used for the Classification of the brain tumor which is developed using the TensorFlow Keras library with two Convolution Neural networks along with the two dense layers. After successful classification, it uses mask r-CNN techniques for image segmentation to locate the tumors.

In Brain Tumors, Detection and Localization are done in multiple steps whereas the first step is the image dataset which consists of all the images with their different classes grouped. Then those images and labels are passed to obtain the region of interest from the image which is done by tools such as VGG Annotator allows manually creating the ROI from the image along with the labels. After separating the ROI

from all the images, we will send it to the conventual network layer along with the label that is class. After passing through the layers, we will reach the output where we can the selected ROI in an image. They are then checked with the test dataset. And if we get the ROI area then our model works perfectly well else, we change the weight or add more hidden layers based on the requirements. The below figure (1) represents the architecture of the system.

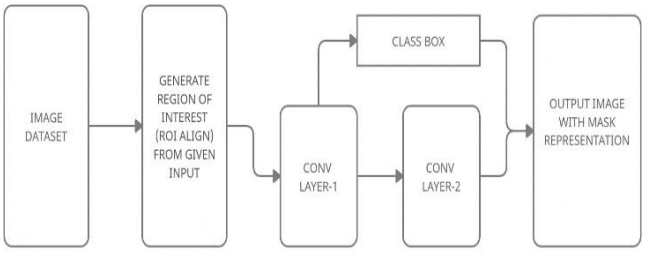

Figure (1): System Architecture Diagram for Brain Tumor Detection.

The Block diagram for image classification has two different phases. On the left-hand side, we work with marking the brain and on the right-hand side, we mark the tumors inside the brain. Starting with the dataset in which we will have both the image and tumor mask data generated from the VGG annotator, then these data are passed. After the dataset, we separate the data and its labels. From the brain image dataset, using mask r-CNN we try to detect the brain and mask them. Similarly, with the tumor area using the same mask r-CNN, we figure out the tumor. After this, we create a model for both the brain and the tumor. Then finally sending both trained models we try to find the model accuracy and then we check this model with the test dataset. If we didn't get the desired accuracy, we roll back and try to fix it with manual weights until we achieve our target. The below figure (2) represents the block diagram.

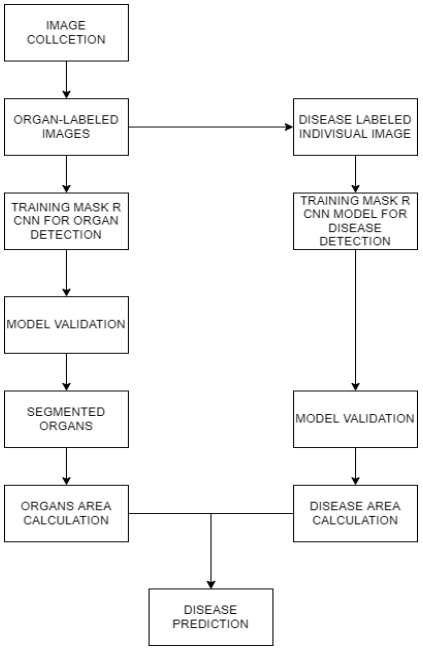

Figure (2): System data flow Diagram.

The Dataflow diagram for Machine Learning Model has six different steps. These Steps are:

Data ingestion − It is the process of importing the data for use in Machine Learning project. The data can be extracted in real time or batches from single or multiple systems. It is one of the most challenging steps because the quality of data can affect the whole Machine Learning model. For this project we had two categories of image data out of which 2800 images for the train set, 200 images for the validation and 50 images for the test set.

Data Preparation − After importing the data, we need to prepare data to be used for our ML model. Data pre-processing is one of the most important technique of data preparation. For preprocessing we had image rescale and rotation techniques.

Machine Learning Model Training − Next step is to train our ML model. We have various Machine Learning algorithms like supervised, unsupervised, reinforcement to extract the features from data, and make predictions apart from this we used deep learning convolution neural network for the classification and mask r-CNN for image segmentation.

Trained Model Evaluation − Next, we need to evaluate the ML model. In case of Auto ML pipeline, ML model can be evaluated with the help of various statistical methods and business rules. For evaluation of our model, we had separate validation dataset.

Machine Learning Model retraining − In case of Auto ML pipeline, it is not necessary that the first model is best one. The first model is considered as a baseline model, and we can also train the model repeatably by changing the attributes so to increase model's accuracy.

Deployment of the Model − At last, we need to deploy the model. This step involves applying and migrating the model to business operations for their use. For the deployment purpose we linked our model with the flask to provide graphical user interface to the users. It makes easier to use.

IV. RESULT

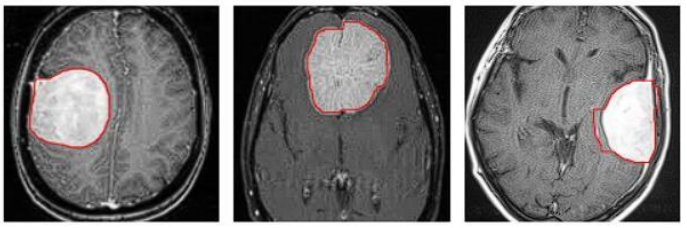

Figure (3): Image Data with Tumor Present.

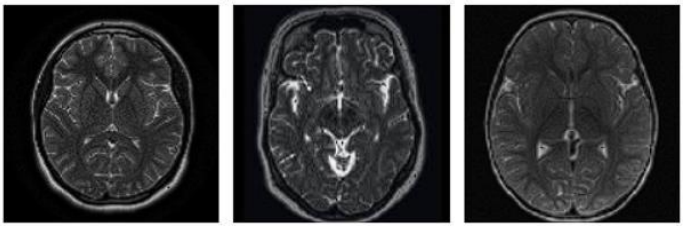

Figure (4) Image Data with Brain Tumor Absent.

In this paper, the above figure (3) shows the Brain Tumor classification and image segmentation using mask r-CNN. The Image displayed tells that it has tumor and red areas shows the tumor location in the brain and In the Figure (4) the image displayed tells that there is no presence of tumor in the brain. We also achieved the accuracy of 98.7% from the validation data which have 200 images for both the positive and negative outcome.

V. CONCLUSION

Brain Tumor is a very common problem for most of the deaths in the world and detecting these problems in their early stages can save a lot of lives. Therefore, Machine Learning approaches can extract a substantial amount of information from images and classify them to make a judgment based on that information, such as cancer detection. It is found to be useful for fast diagnosis and locating the brain tumor. The

project is extremely user-friendly and easy to use.

VI. REFERENCES

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