Detection and Classification of Brain Tumor

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Abstract **- Brain and other nervous system cancer is the tenth leading reason of death for men and women. Brain tumors account for 85% to 90% of all number one nervous system (CNS) tumors. Detection of a brain tumor is always important specifically whilst affected person's survival depends upon correct time evaluation due to massive and diverse quantity of statistics manual detection of brain tumor may be very tedious and tough challenge. Moreover, computerized brain detection is always hard trouble due to the fact the structure of mind and distinct variations in MRIs. Image segmentation has usually been the essential task for the automatic detection of the brain tumor. This assignment proposes a technique wherein mind pix are preprocessed and segmented and additionally we employ CNN architecture algorithms to detect the type of tumor.**

Index Terms **- Brain Tumor, Machine Learning, Neural Networks, Segmentation.**

I.INTRODUCTION

The brain and spinal column make up the primary Nervous System (CNS), in which all vital abilities are controlled. These capabilities encompass idea, speech, and frame movements. This technique that once a tumor grows in the CNS, it is able to have an effect on someone's idea strategies or the manner they talk or float. The mind is crafted from 3 fundamental factors: the cerebrum, the cerebellum, the brain stem and meninges,

The cerebrum. This is the most important a part of the brain. It contains 2 cerebral hemispheres on either side of the brain that each control the opposite side of the body. It is divided into 4 lobes where specific functions occur:

- The frontal lobe controls reasoning, emotions, hassle-solving, expressive speech, and movement
- The parietal lobe controls the sensations of touch, along with pressure, ache, and temperature. It additionally controls components of speech, visual-spatial orientation, and calculation
- The temporal lobe controls reminiscence, unique senses such as listening to, and the ability to understand spoken or written phrases
- The occipital lobe controls imaginative and prescient.

The cerebellum. The cerebellum is placed on the back part of the brain under the cerebrum. It is responsible for coordination and stability and controls functions at the equal facet of the body.

The brain stem. This is the portion of the brain that connects to the spinal cord and the cerebellum. It controls involuntary features crucial for lifestyles, which incorporates the thrashing of the coronary heart and respiratory. Messages for the functions managed by way of manner of the cerebrum and cerebellum adventure through the mind stem to the frame.

The meninges. These are the membranes that surround and guard the brain and spinal twine. There are three meningeal layers, called the dura mater, arachnoid, and pia mater. The cerebrospinal fluid (CSF) is made near the middle of the brain, inside the lateral ventricles. CSF circulates throughout the brain and spinal cord between the arachnoid and pia layers.

A brain tumor is defined as extraordinary increase of cells within the mind or imperative spinal canal. Some tumors can be cancerous thus they want to be detected and cured in time. The specific motive of mind tumors isn't always clear and nor is actual set of symptoms described, hence, people can be tormented by it without realizing the danger. Primary brain tumors may be both malignant (include cancer cells) or benign (do now not include most cancers cells).Brain tumor passed off when the cells had been dividing and growing abnormally. It is appear like a strong mass while it identified with diagnostic medical imaging techniques. There are sorts of mind tumor that's primary mind tumor and metastatic mind tumor. Primary brain tumor is the condition when the tumor is formed within the mind and tended to stay there whilst the metastatic brain tumor is the tumor this is

fashioned some place else in the body and spread via the mind.

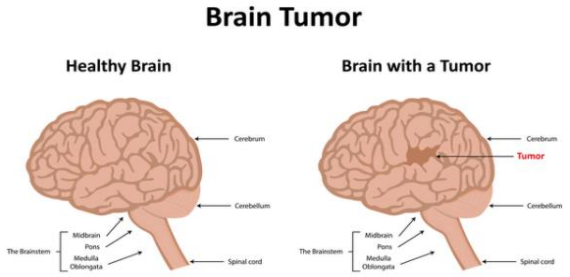

Fig. 1: Brain Tumor

The symptom having of brain tumor depends on the area, size and sort of the tumor. It takes place while the tumor compressing the encircling cells and gives out pressure. Besides, it's also takes place while the tumor block the fluid that flows all through the mind. The commonplace symptoms are having headache, nausea and vomiting, and having hassle in balancing and taking walks. Brain tumor may be detected by the diagnostic imaging modalities such as CT scan and MRI. Both of the modalities have benefits in detecting depending on the region kind and the cause of exam wanted. An MRI uses magnetic fields, no longer x-rays, to supply distinct pix of the body. MRI may be used to measure the tumor's length. A unique dye called a assessment medium is given before the experiment to create a clearer photograph. This dye can be injected right into a patient's vein or given as a pill or liquid to swallow. MRIs create more special photographs than CT scans (see beneath) and are the desired way to diagnose a brain tumor. The MRI can be of the mind, spinal wire, or both, depending on the sort of tumor suspected and the likelihood that it's going to spread in the CNS. There are special types of MRI. The results of a neuro-examination, accomplished by using the internist or neurologist, facilitates determin which sort of MRI to use.

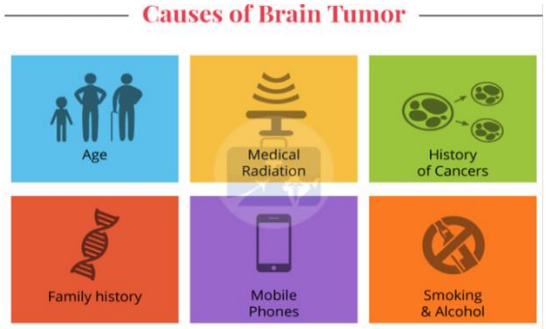

Fig. 2: Causes of brain tumor.

Symptoms of a brain tumor can be general or particular. A general symptom is resulting from the pressure of the tumor on the brain or spinal twine. Specific signs and symptoms are prompted while a particular a part of the brain isn't running well because of the tumor. For many humans with a brain tumor, they have been identified once they went to the health practitioner after experiencing a problem, inclusive of a headache or different adjustments.

II.RELATED WORK

Brain Cancer Detection from Mria Machine Learning Approach (Tensorflow) Dataset Acquisition is implemented by Data Augmentation and Model Creation approach which has the advantage of training and validation with the accuracy of 99% and 98.6% and main disadvantage of it is time consuming in model creation[1]. This paper proposes the following steps which are Image Filtering Image Classification for accurate brain tumor detection. This method is susceptible to adding unwanted information like noise in the image. And also it leads to blurring, weak boundaries, edges and reduced contrast [2]. By making use of CNN brain tumor is detected with the following steps Data collection, Data Augmentation and Image Pre-processing then the processed image is given to CNN model which resulted in accuracy of 93% and a loss value of 0.23264. More number of convolution layers affects the quality of classification and takes longer training time[3]. In this paper pre-processing techniques such as Histogram matching and Bounding box is used and feature such as Intensity, Intensity differences, neighborhood information and wavelet Features are extracted. Wavelet-based texture features with RF classifier has increased the classification accuracy. Larger data set Robustness is not achieved[4]. Machine Learning Approach-Based Gamma Distribution for Brain Tumor Detection and Data Sample Imbalance Analysis uses Edge based Image segmentation technique to detect brain tumor which detects brain abnormality and analysis without human intervention in the health care sector and accelerate realtime medical applications[8]. Optimized Edge Detection Technique for Brain Tumor Detection in MR Images is one of the approaches for brain tumor detection which include image processing techniques like Image Enhancement, Pre-processing, Contrast Enhancement,

Edge Detection which performs well compared to both classical and fractional-order edge detection methods, major disadvantage of this technique is the accuracy of the detections depends mainly on the selected training images [9]. Identification of Brain Tumor using Image Processing Techniques, image processing techniques like Pre-processing, Image segmentation, Feature extraction, Image classification are implemented which produces the contrast between foreground object and background object and it is comparatively high, major advantage is that it is easy to implement [10].

III. METHODOLOGY

The solution we proposed for this problem is not an entirely new one. With as light difference, we believe we have a better approach. We will be applying both generative and discriminative models. Generative models will be applied for the detection of a tumor while discriminative models will be used for the segmentation of MRI.

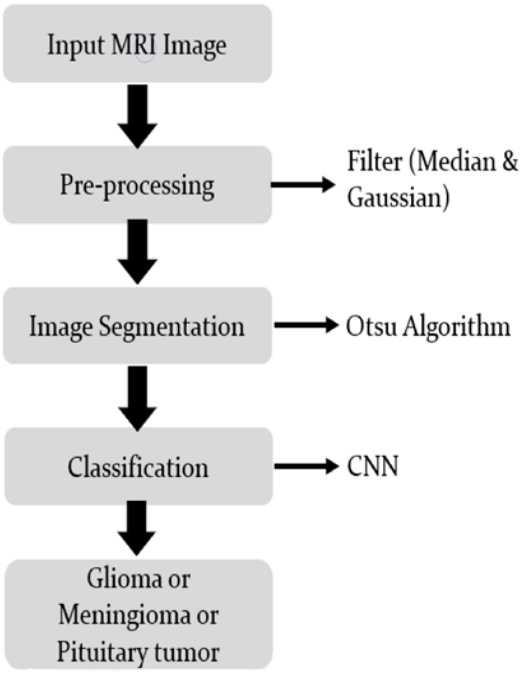

Fig 3: Proposed Methodology

Preprocessing

Before any image is processed, it's far very huge to dispose of unnecessary objects it can preserve. After putting off useless artifacts, the image can be processed effectively. The preliminary step of picture processing is Image Pre-Processing. Pre-Processing entails techniques like conversion to greyscale pix, noise elimination and image reconstruction. Conversion to greyscale image is the most common pre-processing practice. After the image is transformed to greyscale, then excess noise is removed by the usage of distinctive filtering techniques. We make use of median and Gaussian filter. Median filtering is a nonlinear procedure beneficial in decreasing impulsive, or salt-and-pepper noise. It is likewise beneficial in keeping edges in an image even as reducing random noise. Impulsive or salt-and pepper noise can occur due to a random bit errors in a communique channel. In a median filter out, a window slides alongside the image, and the median intensity fee of the pixels inside the window turns into the output intensity of the pixel being processed. Median filtering is a nonlinear technique useful in decreasing impulsive, or salt-and-pepper noise. It is likewise beneficial in preserving edges in an image at the same time as reducing random noise. Impulsive or salt-and pepper noise can occur because of a random bit blunders in a communication channel. In a median filter, a window slides alongside the picture, and the median depth price of the pixels in the window turns into the output intensity of the pixel being processed.

Image Segmentation

Image Segmentation' is the manner of dispensing an image into minor portions. It creates numerous sets of pixels within same picture. Assigns a tag to each pixel in an photo and the pixels with the same label share specific capabilities. Segmenting makes it less difficult to similarly examine and recognize critical facts form a digital picture. In computer vision and image processing, Otsu's technique, named after Nobuyuki Otsu is used to carry out automated image thresholding. In the best shape, the set of regulations returns a unmarried depth threshold that separate pixels into instructions, foreground and background. This threshold is decided by minimizing intra-elegance intensity variance, or equivalently, through maximizing inter-magnificence variance.

Convolutional Neural Network (CNN)

The advancements in Deep Learning and Computer Vision has been constructed and perfected with time, primarily over on algorithm; Convolutional Neural Networks. We will be using this deep learning algorithm in our segmentation procedure. It is a wide

structure that offers us will exceptional strategies to triumph over one of a kind problems. YOLO set of rules has been validated a sturdy algorithm in this architecture. An picture detection approach could be used for the segmentation of MR Images for purchasing the desired features. Furthermore, its non-max suppression technique modifications the pics into grids and offer us the desired grids with necrosis. An picture incorporates different pixels and channels on which convolved grid kernel is carried out to get a suppressed however complete result. Max pooling can be applied to get the maximum output.

IV. RESULT

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_2 (Conv2D)            (None, 148, 148, 32)      896
_________________________________________________________________
activation_4 (Activation)    (None, 148, 148, 32)      0
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 74, 74, 32)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 72, 72, 32)        9248
_________________________________________________________________
activation_5 (Activation)    (None, 72, 72, 32)        0
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 36, 36, 32)        0
_________________________________________________________________
flatten_1 (Flatten)          (None, 41472)             0
_________________________________________________________________
dense_2 (Dense)              (None, 32)                1327136
_________________________________________________________________
activation_6 (Activation)    (None, 32)                0
_________________________________________________________________
dropout_1 (Dropout)          (None, 32)                0
_________________________________________________________________
dense_3 (Dense)              (None, 4)                 132
_________________________________________________________________
activation_7 (Activation)    (None, 4)                 0
=================================================================
Total params: 1,337,412
Trainable params: 1,337,412
Non-trainable params: 0

Epoch 1/10
90/90 [==============================] - 81s 871ms/step - loss: 37.2030 - val_loss: 1.3876
Epoch 2/10
90/90 [==============================] - 77s 854ms/step - loss: 1.3749 - val_loss: 1.3911
Epoch 3/10
90/90 [==============================] - 77s 851ms/step - loss: 1.3684 - val_loss: 1.3953
Epoch 4/10
90/90 [==============================] - 76s 848ms/step - loss: 1.3639 - val_loss: 1.4001
Epoch 5/10
90/90 [==============================] - 77s 851ms/step - loss: 1.3602 - val_loss: 1.4052
Epoch 6/10
90/90 [==============================] - 76s 844ms/step - loss: 1.3575 - val_loss: 1.4102
Epoch 7/10
90/90 [==============================] - 77s 857ms/step - loss: 1.3508 - val_loss: 1.4149
Epoch 8/10
90/90 [==============================] - 76s 849ms/step - loss: 1.3447 - val_loss: 1.4186
Epoch 9/10
90/90 [==============================] - 75s 835ms/step - loss: 1.3576 - val_loss: 1.4223
Epoch 10/10
90/90 [==============================] - 76s 839ms/step - loss: 1.3435 - val_loss: 1.4258
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Fig. 4: Iterations

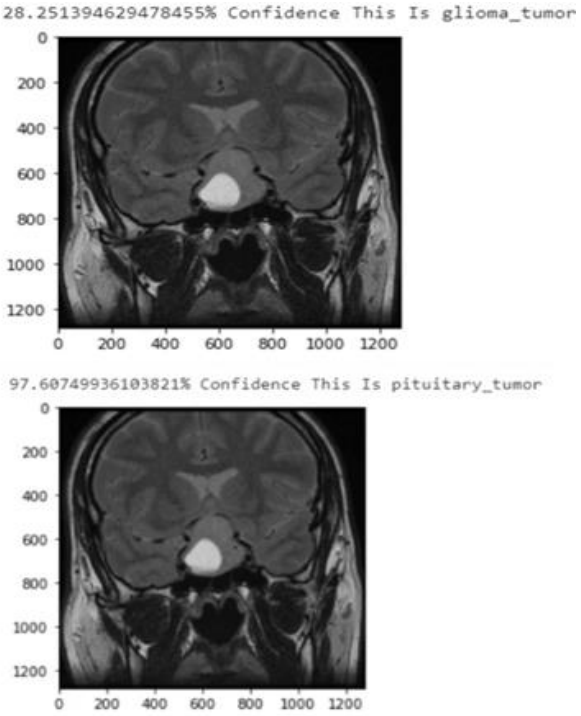

Fig. 5: Classification of tumor.

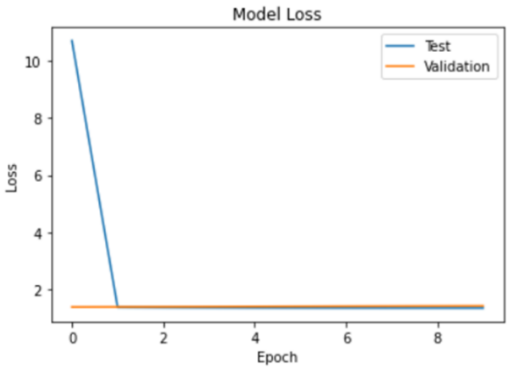

Fig. 6: Model loss graph.

V. CONCLUSION

The aim of this challenge was to detect the tumor from the given MRI scan after which classifies the tumor. This paper contributes its work in each segmentation and detection of a brain tumor with the use of CNN structure. Most of the papers studied in studies, they both contributed their work in MRI segmentation or in automation of brain tumor detection. We have proposed a method which works on CNN algorithms for the segmentation of the MRI for getting the favored outcomes and used generative version algorithms for the detection of the brain tumor. By implementing CNN, brain tumor is classified as glioma or

meningioma or pituitary tumor. Furthermore, Real time classification can be made possible by integrating Artificial Intelligence (AI) with the developed Brain Tumor Detection and Classification system.

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