iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.53922

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Brain Tumor Diagnosis Using CNN & Image Processing

Gaurav G. Khochare[1], Shantanu S. Khopade[2], Pratik N. Khinde[3], Sachi D. Khobragade[4], Sampada R. Khopade[5]
[1, 2, 3, 4, 5]*Department of Engineering, Sciences and Humanities (DESH) Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India*

Abstract: Among the most tedious and time-consuming tasks in medical image processing is brain tumor identification and segmentation. Magnetic resonance imaging, or MRI, is a medical procedure that radiologists primarily utilize to examine the human body without having to do surgery. The substantial information that MRI provides on human soft tissue aids in the diagnosis of brain tumors. It is crucial to accurately segment MRI images in order to detect a brain tumour utilizing computer-aided clinical techniques. Brain tumor identification facilitates determining the precise size and location of the tumor. Initially, the scanned image's quality is upgraded, and tumors are located in the image using morphological operators.
Keywords: Brain Tumor, Magnetic Resonance Imaging, Thresholding , Segmentation

I. INTRODUCTION

There are numerous different types of cells present in the human body. Every cell serves an unique function. The body's cells develop, divide, and create new cells in an organized way. These new cells aid in maintaining the body's functionality and overall health. Some cells develop abnormally when they lose the ability to regulate their own growth. Tumors are created when redundant cells combine to form a mass of tissue. Tumors may be benign or cancerous. While benign tumors don't cause cancer, malignant tumors do. The medical image data obtained from various biomedical devices that use various imaging methods such as X-rays, CT scans, and MRI are a significant factor in the medical diagnosis.The traditional method for finding tumors in an MRI scan involves human analysis. Using this method takes a long time. With vast amounts of data, it is not applicable. Additionally, inaccurate categorization may be caused by noisein the MRI caused by operator interaction. Automated solutions are required since they are also cost-effective, and there will be a lot of MRI data to analyze. Automated tumor diagnosis in MRI scans is necessary since dealing with human life demands for extreme precision.

A form of machine learning technique called ANN (Artificial Neural Networks) is used for classification, clustering, and regression. It needs labelled data to learn because it is a supervised learning algorithm. There are several uses for ANNs, including the identification of brain tumors. Another sort of machine learning technique used for object and image recognition is CNN (Convolutional Neural Networks). CNNs are unsupervised learning algorithms, which means they can learn without labelled input, in contrast to ANNs. CNNs are frequently employed in medical imaging applications, such as the identification of brain tumors. CNNs are better than other techniques for brain tumor detection because they are able to learn from large amounts of data and create models that are more accurate than traditional machine learning techniques. Since they can learn from massive amounts of data and produce models that are more accurate than conventional machine learning techniques, CNNs are superior to existing methods for detecting brain tumors. Also, CNNs are more adept in identifying normal from abnormal brain tissue, which is crucial for spotting brain cancers. CNNs are more precise than previous methods at classifying tumor types, and they can even classify tumor subtypes with greater accuracy. High resolution scans can be used to identify cancers using CNNs, which is crucial for early identification and diagnosis. MATLAB is a programming language and computing environment created for numerical computing, data analysis, and visualization. In the disciplines of engineering, science, and economics, it is extensively employed. By using image processing methods to pictures generated by MRI, CT, and PET scans, MATLAB can be used in the detection of brain tumors. Tumors can be found and categorized using image processing based on their size, shape, and contrast. Moreover, models for calculating the probability that a tumor is benign or malignant can be developed using MATLAB. MATLAB can be used to interpret the scan data in order to produce visual representations of the brain and find any potential anomalies.

Modifying digital images is part of the process of using computer algorithms for digital image processing.It can be applied to enhance an image's quality or to draw out important information from an image. Because it may be used to recognize tumors, analyze their size and shape, and track their growth over time, digital image processing is helpful in the detection of brain tumors. In order to choose the most effective course of treatment, the type of tumor can also be identified via digital image processing.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

II. LITERATURE REVIEW

Three different kinds of algorithms are used by experts when they examine tumor images. Some of the strategies are pixel-based, while others are based on the texture and structure of the images.

1) For the purpose of detecting brain tumors, p a fuzzy c- mean algorithm multi-scale, image segmentation technique was proposed.
2) A technique using MRI brain scans to detect brain tumors. The MRI brain images are first preprocessed using a median filter, after which threshold segmentation and morphological procedures are used to separate the image into its component parts, and finally image subtraction technique is used to isolate the tumor location. This method reveals the precise shape of the tumor in the brain's MRI.
3) This algorithm uses the neuro fuzzy method. The MRI brain images are initially preprocessed using a standard filter, followed by threshold segmentation, morphological operations, and finally, image deduction technique to determine the tumor region. In the segmentation of an MRI brain image for tumor detection, this method provides the precise shape of the tumour.
4) In order to automatically detect the tumour in brain MRI images, a neural network and segmentation base system was suggested.
5) Using fuzzy clustering to identify malignancies in MR images. This approach makes use of fuzzy C-means; however its main flaw is that it takes a long time to compute.
6) For the classification of brain MRI images, An unsupervised neural network learning technique was proposed.
7) Automated tumour segmentation was accomplished using artificial intelligence.

Please note that the first paragraph of a section or subsection is not indented. The first paragraphs that follows a table, figure, equation etc. does not have an indent, either. Subsequent paragraphs, however, are indented.

III. METHODOLOGY /EXPERIMENTAL

A. Algorithm

1) Step 1. Convert the image to grayscale.
2) Step 2. Apply noise reduction filters:Gaussian low-pass filter to smooth the image. Butter worth high-pass filter for sharpening.
3) Step 3. Apply median filter to remove salt-and- pepper noise resulted from previous step.
4) Step 4.Perform histogram thresholding with single threshold.
5) Step 5. Perform morphological operations:
a) Create morphological, disk-shaped element.
b) Erode the image, to separate the tumor.
c) Area dilates the image, to smooth the edges.

B. CNN Algorithm

1) Step 1: Acquire the labeled dataset.
2) Step 2:Prepare the Dataset for training CNN.
3) Step 3:Define the image classifier.
4) Step 4:Perform CNN on test image.
5) Step 5:Display the result.

IV. RESULTS AND DISCUSSIONS

A. Image Acquisition

The image acquisition step is the first phase of any vision system. After acquiring the image, multiple processing techniques can be used to carry out the numerous critical vision tasks.

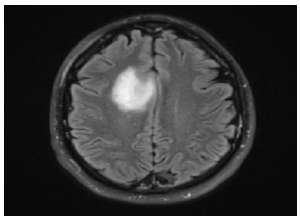


Figure 1 Image Acquisition

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

B. Maximum Intensity Value

With a grayscale image, each pixel's intensity value is a single value, but for a color image, it is a collection of three values. In this case, we utilized this criterion to get rid of extra text from the image, such as the date, the patient's name, the lab results, etc.

C. Image Conversion

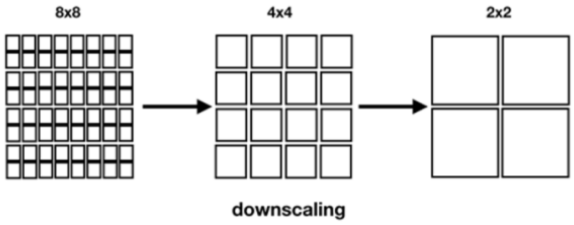
The image must be changed into a grayscale version. The following procedure is used to do this:

Average method-The easiest method is the average one. All we need to do is average the three hues. As it is an RGB image, we must add r, g, and b and then divide the result by 3 to obtain the desired grayscale image.

Grayscale = (R + G + B / 3)

D. *Resizing the Image*

The image is scaled into a format where the highest brightness value or pixel intensity value, which denotes pure white color, is 256.



$$Y = y_1 + (x - x_1) \{ (y_2 - y_1) / (x_2 - x_1) \}$$

E. Smoothening the Image

Smoothing is frequently used to produce images that are less pixilated or noisy. Low pass filters are the foundation for most smoothing techniques. The median or average values, for example, are typically used as the basis for smoothing.

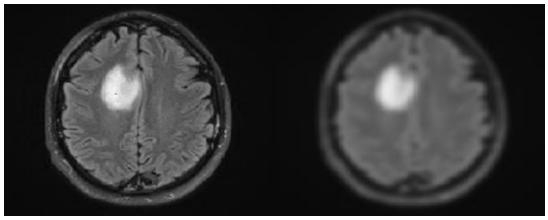


Figure 2 Original Image (Left) Vs. Gaussian filtered image (Right)

F. Contrast Stretching

Contrast stretching, as the name suggests, is a technique for improving contrast by stretching an image's intensity values to cover its whole dynamic range. The transformation function being utilized is linear and always grows monotonically.

G. Image Filtering

An procedure known as convolution is used to linearly filter an image. Each output pixel in a neighborhood operation called convolution is the weighted sum of adjacent input pixels. The convolution kernel, commonly known as the filter, is the weights matrix. A correlation kernel that has been 180 degrees rotated is a convolution kernel.

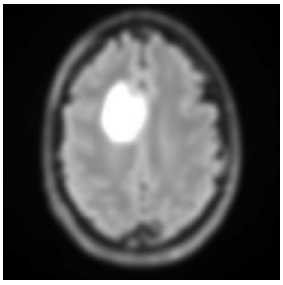


Figure 3 Filtered image.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

H. Median Filtering

Occasionally, photographs will exhibit salt-and-pepper noise, a type of noise. In the visual signal, this noise may be brought on by abrupt, acute disturbances. White and black pixels that are irregular in appearance are what appears to be. For this kind of noise, a median filter is a useful noise reduction technique.

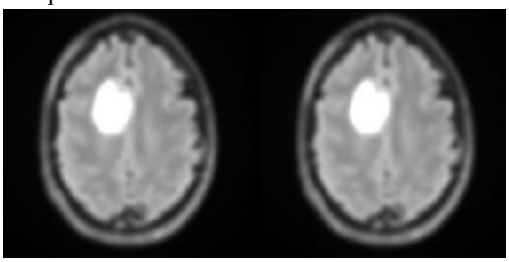


Figure 4 Median filtering

I. Segmentation

The division of an image into various segments is known as image segmentation. Image segmentation is frequently used to identify boundaries and objects in images.

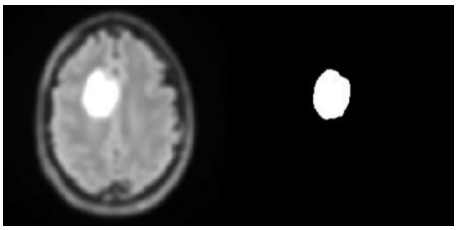


Figure 5 Segmentation

J. Thresholding

We convert a colour or grayscale image into a binary image—one that is solely black and white—through the thresholding procedure. Most typically, thresholding is used to pick out specific portions of an image that are of interest while ignoring the rest.

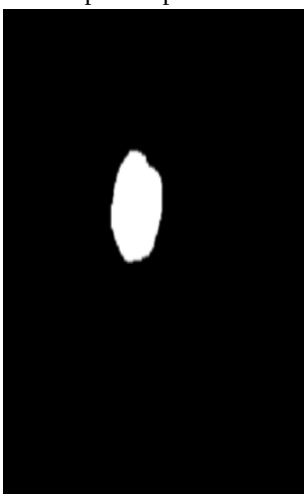


Figure 6 Thresholding

K. Erosion

Erosion mainly decreases the sizes of objects and eliminates minor anomalies by eliminating things whose radius is smaller than the structuring element. Any items bigger than the structuring element and the perimeter pixels are removed by erosion in binary pictures from larger image objects.

L. Dilation

In general, dilation enlarges objects, fills in gaps and broken sections, and connects regions that were previously divided by spaces smaller than the size of the structural element. Dilation in binary images adds pixels to the perimeter of each image object and joins regions that are separated by spaces smaller than the structuring element.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

M. Final output

Here we are displaying the final image with the detected tumor being highlighted on the original image.

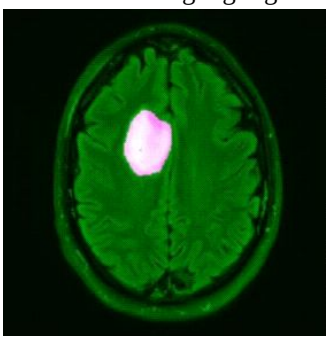


Figure 7 Final image

N. Testing and training

We have used Kaggle Dataset for this project. This dataset consists of MRI images of brain tumor patients and provides pixel-wise segmentation of the tumor, allowing for machine learning algorithms to be used for tumor detection. Many machine learning algorithms, including convolution neural networks and support vector machines have been used with this dataset in the past to detect brain tumors. There are 95 images in dataset of each category (yes and no) out of which 70 % are used for training and 30% are used for testing in CNN model.

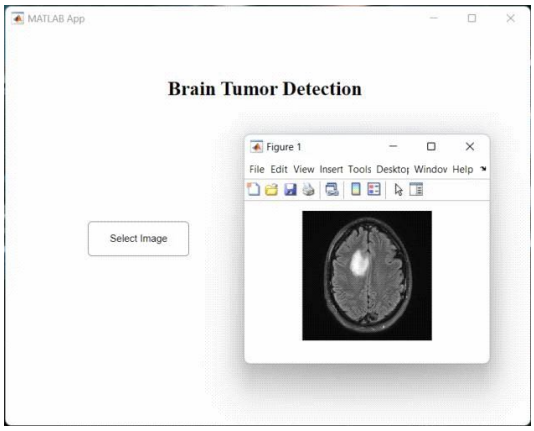


Fig 1 Input MRI scan

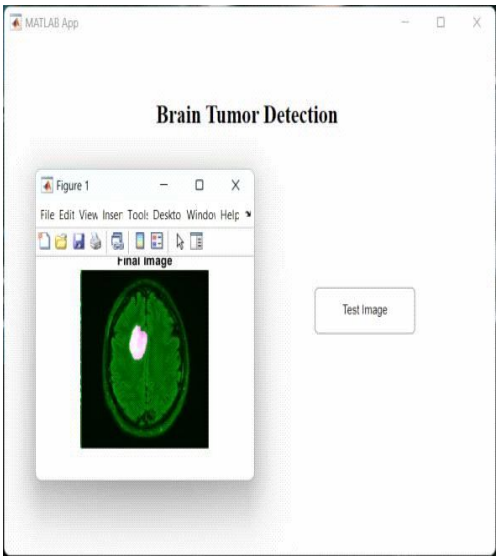


Fig 2 Final output

V. COMPARISON

	CNN	ANN
Accuracy	Higher Accuracy	Less than CNN
Speed	Faster	Faster
Reliability	Less errors	More errors than CNN
Cost	Cost-effective	Costly
Availability	Widely available	WidelyAvailable

VI. CONCLUSION

The purpose of this research was to identify brain tumors utilizing imaging techniques. Segmentation was the primary technique employed, and it was carried out by following a process based on threshold segmentation and morphological operators. Human brain MRI scan images were used to test the proposed segmentation method, which helped to identify tumors in the images. Human brain samples were obtained, scanned using MRI technology, and then processed utilizing segmentation techniques to get effective results. This method produces reliable and efficient outcomes.

VII. ACKNOWLEDGEMENT

We sincerely appreciate our esteemed institution Bansilal Ramnath Charitable Trust's Vishwakarma Institute of Technology and Respected Director Prof. Dr. Rajesh Jalnekar for providing us with the invaluable opportunity to work on this project. We are deeply grateful for the resources, guidance, and support that were made available to us, which facilitated the successful completion of this project.

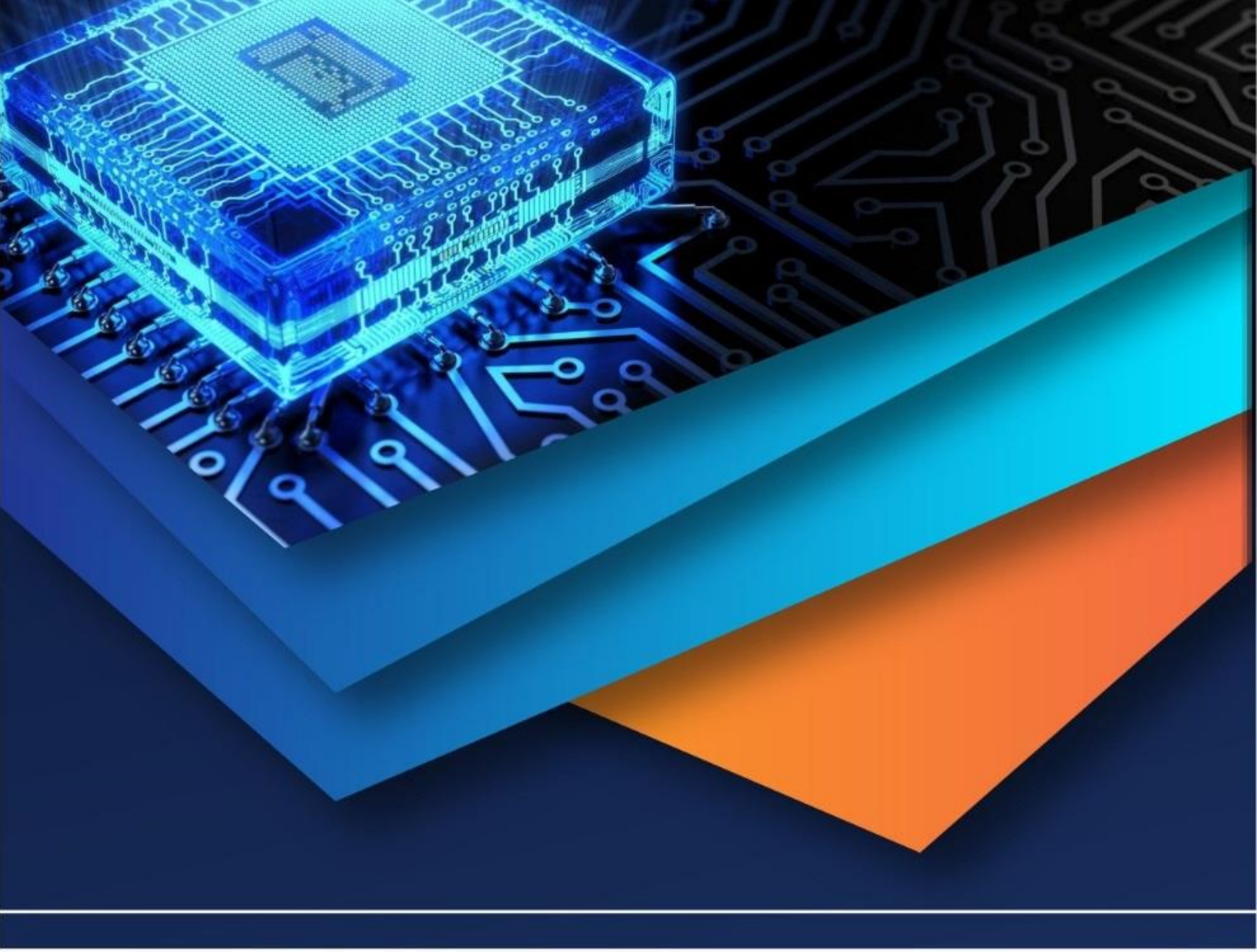
We would like to acknowledge the invaluable contributions of our distinguished professor and project guide, Prof. Dr. Sachin Sawant and Prof. Dr. Sonali Antad respectively, for their unwavering dedication, mentorship, and support. Their expertise and guidance were instrumental in helping us navigate the challenges we encountered during this project.

We are privileged and honored to have had the opportunity to undertake this project, and we remain committed to leveraging the skills and knowledge gained during this process to positively impact society.

REFERENCES

[1] Gopal,N.N.Karnan, M. , ―Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques .
[2] Natarajan P, Krishnan.N, Natasha Sandeep Kenkre, Shraiya Nancy, Bhuvanesh Pratap Singh, "Tumor Detection using threshold operation in MRI Brain Images".
[3] Joshi, D.M.; Rana, N.K.; Misra, V.M. Classification of Brain Cancer using Artificial Neural Network
[4] SafaaE.Amin, M.A. Mageed, "Brain Tumor Diagnosis Systems Based on Artificial Neural Networks and Segmentation Using MRI"
[5] P.Vasuda,S.Satheesh, Improved Fuzzy C-Means Algorithm for MR Brain Image Segmentaton.
[6] Suchita Goswami, Lalit Kumar P. Bhaiya," Brain Tumor Detection Using Unsupervised Learning based Neural Network".
[7] Clark, M.e., Hall, L.O., Goldgof, D.B.,Velthuizen, R., Murtagh, F.R,Silbiger, M.S., "Automatic tumor-segmentation".
[8] Fletcher-Heath, L.M., Hall, L.O., Goldgof, D.8., Murtagh, F.R, "Automatic segmentation of non-enhancing brain tumors in magnetic resonance images".
[9] Cuadra, M.B., Gomez, J., Hagmann, P., Polio, e., Villemure, J.G.,Dawant, 8.M., Thiran, J.- Ph., "Atlas-based segmentation of pathological brains using a model of tumor growth".
[10] Shweta Jain, "Brain Cancer Classification Using GLCM Based Feature Extraction in Artificial Neural Network
[11] Singh, N. K., & Kumar, A. (2020). Brain tumor detection using image processing techniques: a review. Journal of medical systems, 44(7), 127
[12] Mala, K. S., & Rajamani, V. (2013). Brain tumor detection using image processing. International Journal of Computer Science and Network Security, 13(3), 47-51.
[13] Hameed, S. A., & Riaz, S. (2018). Brain tumor detection and segmentation using image processing techniques. International Journal of Computer Applications, 179(22), 28-33.
[14] Kaur, H., & Kumar, A. (2019). Detection and classification of brain tumor using image processing techniques: a review. Journal of medical systems, 43(12), 331.
[15] Gupta, A., & Singh, D. (2018). Detection of brain tumor using image processing techniques. International Journal of Engineering and Technology(UAE), 7(4).
[16] Datase Kaggle https://www.kaggle.com/datasets/navoneel/HYPERLINK "https://www.kaggle.com/datasets/navoneel/brain-"brainHYPERLINK "https://www.kaggle.com/datasets/navoneel/brain-"-mri-images-for-brain-tumor-detection.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)