iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IX **Month of publication:** September 2018

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IX, Sep 2018- Available at www.ijraset.com

Brain Tumor Detection using PCA and NN with GLCM

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Abstract: Brain tumor detection and segmentation is a standout amongst the most difficult and tedious assignment in medical image preparing. MRI (Magnetic Resonance Imaging) is a perception medical method, which gives abundant data about the human delicate tissue, which helps in the finding of brain tumor. In this paper we propose a noble mechanism for detection of brain tumor classes using principal component analysis algorithm which is combined with GLCM feature extraction. The feed forward neural network is used for training of tumor images. This paper has considered 5 different types of tumor for classification. The proposed approach classifies 95% and 90% of tumor classes accurately while training and testing respectively.

Keywords: Brain Tumor, Classification, Disease Identification, Magnetic Resonance Imaging (MRI), Segmentation, Tumor Detection, PCA, Neural Network, GLCM.

I. INTRODUCTION

In general, the tumor is characterized as tissue cluster shaped because of the collection of irregular cells in the body. Regularly, at a fitting time, the old cells are being supplanted by new ones. Because of the coming of cancerous tumor(s), this cycle is disrupted. The tumor cells develop exponentially and don't die, unlike healthy cells.

Two sorts of brain tumors are, a primary tumor and secondary or metastatic tumor [1]. Ordinarily, the primary brain tumor starts in the brain and tends to remain during its growth residency. While, the secondary brain tumor begins somewhere else as cancer in the body, later spreads to the brain region. Further, the primary brain tumor has two sub-division to be specific,

A. Benign tumor,
B. Malignant tumor.

Table 1 demonstrates the features of benign and malignant tumors incorporated. Figure 1 demonstrates the MRI brain images without and with tumors

Table

Benign Tumor	Malignant Tumor
Distinct borders	Invasive borders
Slow Growth	Rapid Growth
Rarely spreads	Often spreads
Less harm	Life- threatening

1) Features of Tumors

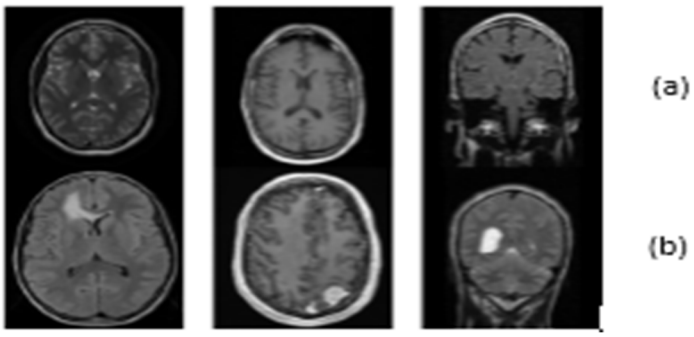


Fig.1. MRI brain images, (a) Typical MRI brain images, and (b) MRI brain images with tumor

In recent times, the introduction of information technology and e-medicinal services framework in the therapeutic field encourages clinical specialists to give better social insurance to the patient. This examination tends to the issues of segmentation of abnormal brain tissues and typical tissues, for example, black tissue, white tissue and cerebrospinal liquid from attractive reverberation pictures utilizing highlight extraction method and support vector machine (SVM) classifier [11, 12].

The tumor is essentially an uncontrolled development of carcinogenic cells in any organ of the body, while a brain tumor is an uncontrolled development of harmful cells in the brain. A brain tumor can be kindhearted or harmful. The kind brain tumor has a consistency in structure and does not contain dynamic (growth) cells, while harmful brain tumors have a non-consistency (heterogeneous) in structure and contain dynamic cells. The gliomas and meningiomas are the cases of second rate tumors, delegated kind tumors and glioblastoma and astrocytomas are a class of high-review tumors, named harmful tumors.

According to the World Health Organization and American Brain Tumor Association [13], the most common grading system uses a scale from grade I to grade IV to classify benign and malignant tumor types. On that scale, benign tumors fall under grade I and II glioma and malignant tumors fall under grade III and IV glioma.

II. LITERATURE SURVEY

Parveenet al. [1], MRI is the most vital method, in detecting the brain tumor. In this paper data mining techniques are utilized for classification of MRI images. Another hybrid strategy based on support vector machine (SVM) and fuzzy c-means for brain tumor classification is proposed. The purposed algorithm is a mix of Support vector machine (SVM) and fuzzy c-means, a hybrid method for expectation of brain tumor. In this algorithm, the image is upgraded utilizing improvement methods for example, differentiate change, and mid-run extend.

Astina Minzet al. [2], In medical diagnostic application, early deformity discovery is a crucial task as it gives basic understanding into analysis. Medical imaging system is currently developing field in engineering. Magnetic Resonance imaging (MRI) is oneof those dependable imaging strategies on which medical diagnostic depends on. Manual examination of those images is a repetitive activity as the measure of information and minute points of interest are difficult to perceive by the human.

Garima Singhet al. [3], Magnetic resonance imaging (MRI) is a strategy which is utilized for the assessment of the brain tumor in medical science. In this paper, a system to ponder and arrange the image de-noising channels, for example, Median channel, Adaptive channel, Averaging channel, Un-sharp covering channel and Gaussian channel is used to expel the added substance noises that showup in the MRI images i.e. Gaussian, Salt and pepper noise and spot noise. The de-noising execution of all the considered systems is analyzed utilizing PSNR and MSE.

G Rajesh Chandraet al. [4], Detection of brain tumor is extremely regular casualty in current situation of health care society. Image segmentation is used to separate the irregular tumor partition in brain. Brain tumor is an irregular mass of tissue in which cells develop, furthermore, duplicate wildly, obviously unregulated by instruments that control cells.

Mukambika P. S., et al. [5], Bio-medical image handling is the most testing and rising field in medical finding. Handling of MRI images is one of the troublesome parts of this field. The present work introduces the similar investigation of two methods utilized for tumor identification of MRI images.

K. Sudharani et al. [6], The Magnetic Resonance Imaging (MRI), and Figured Tomography (CT) gives checked images for Brain Tumor Detection. The development of abnormal cells in an uncontrolled way is tumor. The present paper proposed the c1assification and recognizable proof scores of brain tumor by utilizing a k-NN algorithm which depends on preparing of k. In this work, Manhattan metric has connected and ascertained the separation of the c1assifier. The algorithm has been executed utilizing the Lab View.

Ketan Machhaleet al. [7], this paper proposes a scholarly classification framework to perceive ordinary and strange MRI brain images. These days, choice and treatment of brain tumors depend on manifestations and radiological appearance. Magnetic resonance imaging (MRI) is a most vital controlled device for the anatomical judgment of tumors in brain. In the present examination, different strategies were utilized for the classification of brain cancer. Under these strategies, image preprocessing, image highlight extraction and resulting classification of brain cancer is effectively performed.

Rasel Ahmmedet al. [8], Cell is the littlest unit of tissues, whose anomalous development causes tumor in Brain. Support Vector Machine (SVM), Artificial Neural Network (ANN) based tumor and its stages classification in brain MRI images is displayed in this examination work. This work is begun with the upgrade of the brain MRI images which are acquired from oncology division of College of Maryland Medical Center.

Zhe Xiaoet al. [9], Accurate tumor segmentation is a basic and pivotal advance for PC supported brain tumor analysis and surgical arranging. Subjective segmentations are broadly embraced in clinical conclusion and treating, yet they are neither exact nor solid.

An automatically and target framework for brain tumor segmentation is firmly anticipated. Be that as it may, they are as yet confronting a few difficulties, for example, bring down segmentation precision, requesting from the earlier learning or requiring the human mediation. In this paper, a novel and new coarse-to-fine strategy is proposed to portion the brain tumor.

Mohammad Havaei et al. [10], In this paper, author exhibits a completely programmed brain tumor segmentation technique in view of Deep Neural Networks (DNNs). The proposed networks are custom-made to glioblastomas (both low and high review) imagined in MR images. By their exceptional nature, these tumors can show up anyplace in the brain and have any sort of shape, size, and difference. These reasons spur our investigation of a machine learning arrangement that endeavors an adaptable, high limit DNN while being to a great degree productive. Here, author gives a depiction of various model decisions that creator have observed to be essential for acquiring aggressive execution. Author investigates specifically unique designs in view of Convolutional Neural Networks (CNN), i.e. DNNs particularly adjusted to image information.

III. METHODOLOGY

In this section we present the proposed methodology in detail. The proposed framework is divided into various modules. These modules are:

A. Pre-processing
B. Feature Extraction
C. Segmentation
D. Classification

Fig. 2. Shows the architecture of proposed work.

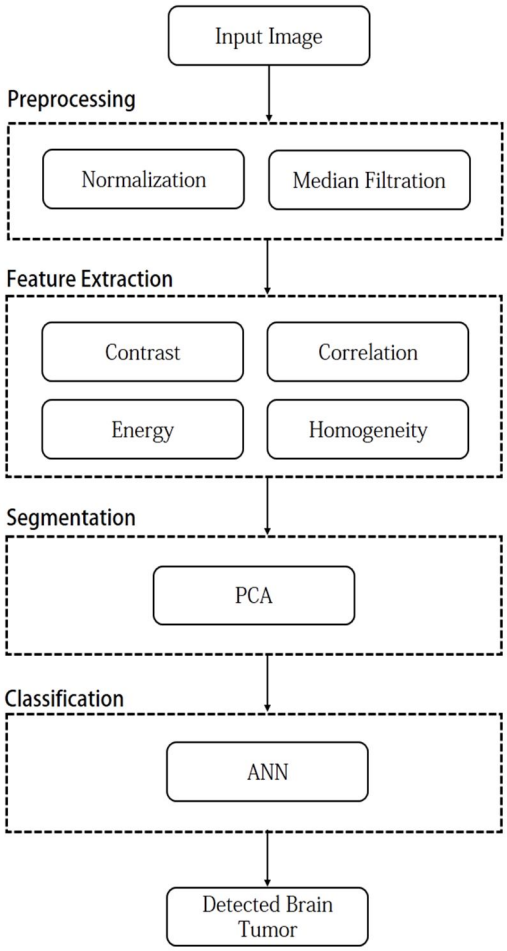


Fig. 2. Architecture of Proposed System

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IX, Sep 2018- Available at www.ijraset.com

A. Pre-Processing

Brain X-Ray images are taken as input for pre-processing. These images contain lot of noises in them. The noises present will reduce the accuracy of classifier. So to perform experiments without being influenced by the noises we need to pre-process the images. The pre-processing is done via normalization of pixels of tumor. Fig. 3. Shows the normalization steps.

Algorithm: Normalization of JPG format image

Input: .jpg format brain MRI image

Output: normalized image for faster processing

- Read jpg image
- Get the maximum pixel value of the image components (multiple value)

$$\max_{value} = \max(image\_pixels)$$

- Getting the maximum value from all the max components (single value)

$$\max_{value} = \max(\max_{value}.)$$

- Divide max_value by 255

Divide all the image components by 255

Fig. 3. Normalization algorithm working

Another process of removal of noises from images is by applying median filtering. It is used to remove the salt and pepper noises from the images. The algorithm is shown in fig. 4.

B. Feature Extraction

The features play important role in deciding to which class the tumor belongs. Hence, extracting features play an important role. There are basically 4 features that are extracted:

1) Contrast

$$Contrast = \sum_{n=0}^{N_g-1} n^2 \sum_{|i-j|=n} P_d(i,j)$$

2) Correlation

$$Correlation = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\sum_{|i-j|=n}(i-\mu i)P_d(i,j)}{\sigma_i\sigma_j}$$

3) Homogeneity

$$Homogeneity = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P_d(i,j)}{1+|i-j|}$$

4) Energy

$$Energy = \sum_{i=1}^{N_g} \sum_{j=1}^{N_g} P_d^2(i,j)$$

Algorithm: Mean Filtering Process

Input: MRI Image

Output: Preprocessed MRI Image

1. Read jpeg image and store it in two dimensional array
2. Generate and extract matrix for 3 * 3 window size from image and calculate median of all.
3. For 3 * 3 values, intensities are calculated and compared with the given range values.
4. Repeat step 2 and 3 until all the pixels are traversed.

Fig. 4. Median filtering working

C. Segmentation

Segmentation is performed for finding different region of interest from the datasets. The segmentation is done using PCA algorithm. The pseudocode for PCA algorithm is shown below.

Algorithm: PCA

1) Get the tumor dataset
2) Subtraction of mean from the pixels
3) Co-variance matrix construction
4) Eigen value calculation
5) Selection of principal components on the basis of highest Eigen values.

D. Classification

The classification is performed using Neural Network training. The feed forward neural network is taken for training.

IV. RESULT

In this section we will discuss the outcomes obtained via experimenting with the tumor datasets. We have considered 5 different types of tumor. They are shown in below table.

TABLE I. Different types of tumor

SNO	Name	Class
1	Astrocytoma	Class 1
2	Glioma	Class 2
3	Meningional	Class 3
4	Meta Carcinoma	Class 4
5	Sarcoma	Class 5

The detail snapshot of the dataset are presented in fig. 5 to fig. 7.

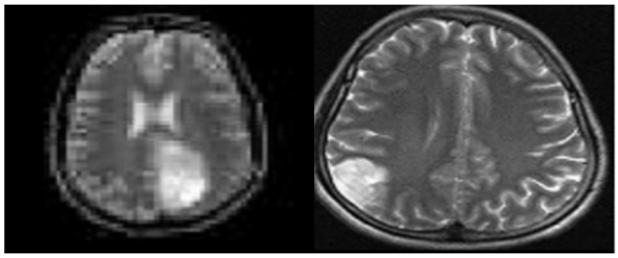


Fig. 5. Astrocytoma (Class-2) and Glioma (Class-2)

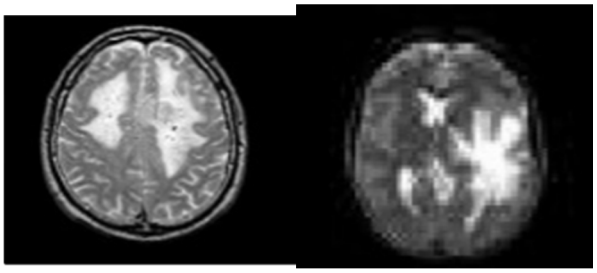


Fig. 6. Meningional (Class-3) and Meta Carcinoma (Class-4)

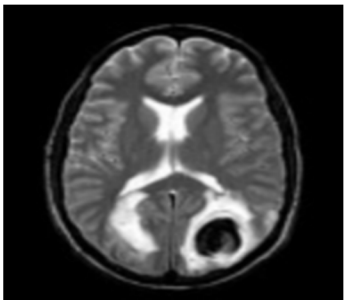


Fig. 7. Sarcoma (Class-5)

The results performed using neural network training are depicted in fig. 8.

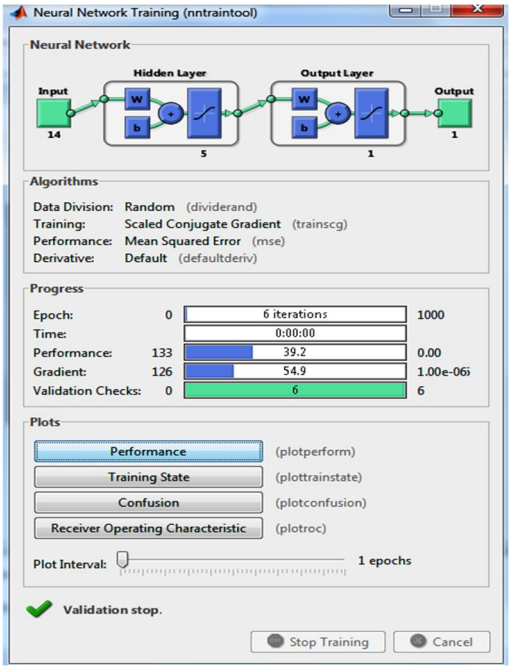


Fig. 8. Neural Network training

The outcomes of experiments are shown in fig. 9 to 13.

SNO	Class of Dataset	Tumor Dataset Name	Predicted Class
1	CLASS-1	A	1
2		B	1
3		C	1
4		D	2
5		E	1

Fig. 9. Classified tumor images for class-1

SNO	Class of Dataset	Tumor Dataset Name	Predicted Class
1	CLASS-2	A	2
2		B	4
3		C	2
4		D	2
5		E	2

Fig.10. Classified tumor images for class-2

SNO	Class of Dataset	Tumor Dataset Name	Predicted Class
1	CLASS-3	A	3
2		B	3
3		C	3
4		D	3
5		E	3

Fig.11. Classified tumor images for class-3

SNO	Class of Dataset	Tumor Dataset Name	Predicted Class
1	CLASS-4	A	4
2		B	4
3		C	4
4		D	4
5		E	4

Fig.12. Classified tumor images for class-4

SNO	Class of Dataset	Tumor Dataset Name	Predicted Class
1	CLASS-5	A	5
2		B	5
3		C	5
4		D	5
5		E	5

Fig.13. Classified tumor images for class-5

V. CONCLUSION

This paper proposes a method for detection of tumor classes. We have considered 5 different classes. We have utilized segmentation, feature extraction and classification technique for detection of tumors. PCA is used for segmentation, GLCM is used for feature extraction and neural network is used for classification of tumors. This paper achieves 95% accuracy while training and 90% accuracy while testing of tumor images.

REFERENCES

[1] Parveen, Amritpal Singh "Detection of Brain Tumor in MRI Images, using Combination of Fuzzy c-means and SVM" in 2nd International Conference on Signal Processing and Integrated Networks (SPIN) 2015 IEEE.

[2] Astina Minz, Prof. Chanddrakant Mahobiya "MR Image classification using Adaboost for brain tumor type" in IEEE 7th International Advance Computing Conference (IACC) 2017.

[3] Garima Singh, Dr. M. A. Ansari "Efficient Detection of Brain Tumor from MRIs Using K-Means Segmentation and Normalized Histogram" in IEEE Issue 2016.

[4] G Rajesh Chandra, Dr. Kolasani Ramchand H Rao " TUMOR DETECTION IN BRAIN USING GENETIC ALGORITHM" in 7th International Conference on Communication, Computing and Virtualization 2016, ELSEVIER.

[5] Mukambika P. S., Uma Rani K. "Segmentation and Classification of MRI Brain Tumor" in International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 07 July -2017.

[6] K. SUDHARANI, Dr. T. C. SARMA, Dr. K. SATYA RASAD "Intelligent Brain Tumor Lesion Classification and Identification from MRI Images Using k-NN Technique" in International Conference on Control, instrumentation, Communication and Computational Technologies(lCCICCT) 2015 IEEE.

[7] Ketan Machhale, Hari Babu Nandpuru, Vivek Kapur, Laxmi Kosta "MRI Brain Cancer Classification Using Hybrid Classifier (SVM-KNN) " in international conference on instrumentation and control (ICIC) MAY 28-30, 2015 IEEE.

[8] Rasel Ahmmed, Anirban Sen Swakshar, Md. Foisal Hossain, and Md. Abdur Rafiq "Classification of Tumors and It Stages in Brain MRI Using Support Vector Machine and Artificial Neural Network" in International Conference on Electrical, Computer and Communication Engineering (ECCE), Cox's Bazar, Bangladesh, February 16-18, 2017 IEEE.

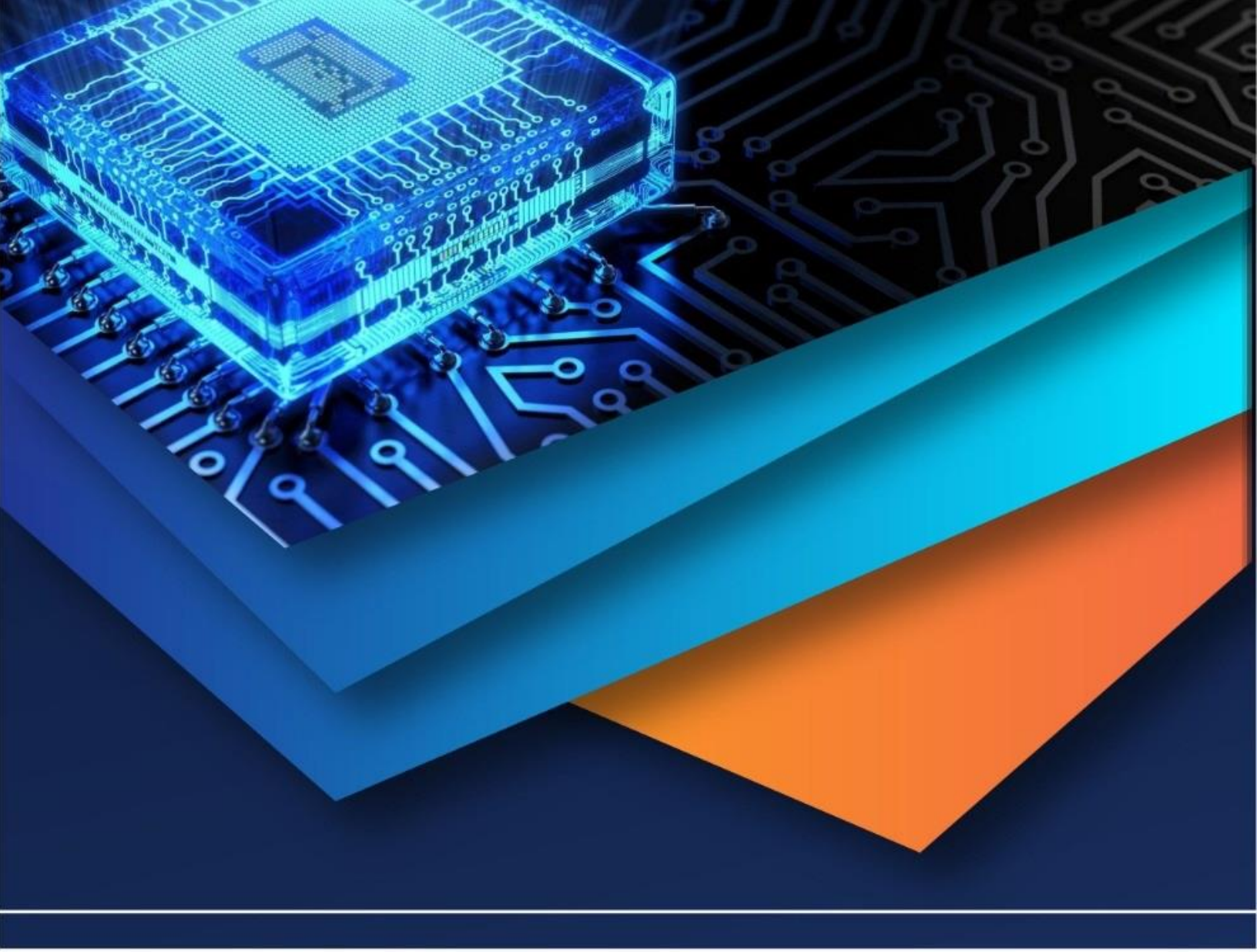
[9] Zhe Xiao *et al.*, "A deep learning-based segmentation method for brain tumor in MR images," *2016 IEEE 6th International Conference on Computational Advances in Bio and Medical Sciences (ICCABS)*, Atlanta, GA, 2016, pp. 1-6.

[10] Mohammad Havaei, Axel Davy, David Warde-Farley, Antoine Biard, Aaron Courville, Yoshua Bengio, Chris Pal, Pierre-Marc Jodoin and Hugo Larochelle, "Brain tumor segmentation with Deep Neural Networks", Medical image Analysis 2017 ELSEVIER

[11] Prakash Mahindrakar and Dr. M. Hanumanthappa, "Data Mining In Healthcare: A Survey of Techniques and Algorithms with Its Limitations and Challenges", Int. Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp.937-941

[12] Kailash Sinha, G.R.Sinha, "Efficient Segmentation Methods for Tumor Detection in MRI Images", 2014 IEEE Student's Conference on Electrical, Electronics and Computer Science, 978-1-4799-2526- 1/14/$31.00 ©2014 IEEE

[13] R.S.RajKumar and G.Niranjana, "Image Segmentation and Classification of MRI Brain Tumor Based on Cellular Automata and Neural Networks", IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 1, Issue 1, March, 2013 ISSN: 2320 – 8791



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