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MRI IMAGE CLASSIFICATION FOR DETECTING BRAIN TUMOR USING DEEP NEURAL NETWORK

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Abstract

Brain tumor identification is really challenging task in early stages of life. But now, it became advanced with various machine learning and deep learning algorithms. Nowadays, brain tumor automatic identification is of great interest. To detect the brain tumor, the MRI images of patient's are used. The objective of the proposed system is to identify whether tumor is present in patient's brain or not. It is very important to detect the tumors at starting level for a healthy life of a patient. There are many literatures on detecting these kinds of brain tumors and improving the detection accuracies. The segmentation, detection, and extraction of infected tumor area from magnetic resonance (MR) images are primary concern but a tedious and time taking task performed by radiologists or clinical experts, and their accuracy depends on their experience only. So, the use of computer aided technology becomes very necessary to overcome these limitations. The severity of brain tumor is estimated using Convolutional Neural Network(CNN) algorithm which gives us accurate results, extra feature extraction methods, identify and classify brain tumor images successfully.

Keywords: Brain tumor, Deep learning, TensorFlow, ConvolutionNeural Networks (CNN)

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I. INTRODUCTION

1.1 DEEP LEARNING

Deep learning is a branch of machine learning which is completely based on artificial neural networks, as neural network is going to mimic the human brain so deep learning is also a kind of mimic of human brain. It's on hype nowadays because earlier we did not have that much processing power and a lot of data. A formal definition of deep learning is- neurons Deep learning is a particular kind of machine learning that achieves great power and flexibility by learning to represent the world as a nested hierarchy of concepts, with each concept defined in relation to simpler concepts, and more abstract representations computed in terms of less abstract ones. In brain approximately 100 billion neurons all together this is a picture of an individual neuron and each neuron is connected through thousands of their neighbors. The question here is how it recreates these neurons in a computer. So, it creates an artificial structurecalled an artificial neural net where we have nodes or neurons. It has some neurons for input value and some for-output value and in between,there may be lots of neurons interconnected in the hidden layer. It needs to identify the actual problem to get the right solution and it should be understood, the feasibility of the Deep Learning should also be checked (whether it should fit Deep Learning or not). It needs to identify the relevant data which should correspond to the actual problem and should be prepared accordingly. Choose the Deep Learning Algorithm appropriately. Algorithm should be used while training the dataset. Final testing should be done on the dataset

1.2 BRAIN TUMOR

The brain is the most sensitive organ of our body, which controls the core functions and characteristics in the human body and according to the National Brain Tumor Society, in the United States, about 700,000 people live with a brain tumor, and the figure will rise to 787,000 [3]by the end of 2020. Compared with other cancers such as breast cancer or lung cancer, a brain tumor is not more common but, still, a brain tumor is
the number 10th leading cause of deaths worldwide. An estimated 18,020
6204 adults will die this year from brain cancer.

The Brain tumor is caused by tissue abnormality that develops within the brain or in

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the central spine, interrupting proper brain function. A Brain tumor is marked as Benign and Malignant. Benign brain tumorsdo not contain cancer cells and grow gradually. They do not spread and commonly stay in one region of the brain, whereas malignant brain tumors contain cancer cells and grow quickly and spread through to other brain and spine regions as well. A Malignant tumor is life-threatening and harmful. The Brain tumor is diagnosed using several techniques such as CT scan, EEG, but Magnetic Resource Image (MRI) is the most effective and widely used method. MRI uses powerful and effective magnetic fields and radio waves to generate internal images of the organs within the body. MRI provides more detailed information on the internal organs and is, therefore, more effective than CT or EEG scanning.

In the past few years because of AI and Deep learning, significant advancement has been made in the medical science like Medical Image processing technique which helps doctors to the diagnose disease early and easily, before that, it was tedious and time-consuming. So to resolve such kind of limitations computer-aided technology is much needed because Medical Field needs efficient and reliable techniques to diagnose life-threatening diseases like cancer, which is the leading cause of mortality globally for patients. So in our study with the help of Brain MRI Images, provide a method for classification of brain tumors into cancerous and non-cancerous using convolutional neural network model.

II. LITERATURE SURVEY

In [1], Brain tumor segmentation plays an important role in diagnosing brain tumor. Intense interest has been received in applying convolution neural networks in medical image analysis, but its performance is restricted by the limitation of the depth of the network. And how to accelerate the information propagation and make full use of all thehierarchical features in the network is also of vital importance. To addressthese problems, this paper proposed Deep Residual Dilate Network withMiddle Supervision, which combines the residual network with dilated convolution. The spatial fusion block, consisting of a pixel discriminator and a region discriminator, has been designed to reserve the detailed information in the region of small tumor. It evaluates the relationship between this single pixel and its adjacent region to obtain the spatial structure information of brain tumors. The main purpose of our research is to effectively propagate the feature in 56 each layer and increase the information diversity to

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enhance 57 the entire feature hierarchy for medical image recognition.

In paper [2], Brain cancer classification is an important step that depends on the physician's knowledge and experience. An automated tumor classification system is very essential to support radiologists and physicians to identify brain tumors. However, the accuracy of current systems need to be improved for suitable treatments. They propose a hybrid feature extraction method with regularized extreme learning machine for developing an accurate brain tumor classification approach. The approach starts by extracting the features from brain images using the hybrid feature extraction method; then, computing the covariance matrix of these features to project them into a new significant set of features using principle component analysis (PCA). Finally, a regularized extreme learning machine (RELM) is used for classifying the type of brain tumor. Classification accuracy of the proposed approach is evaluated and compared using a new public dataset of brain tumor images.

In paper [3], Polarization-sensitive optical coherence tomography (PS-OCT) for distinguished brain tumors from normal brain tissues. Ex vivo samples were obtained from two patients with grade II and II-III glioma; healthy porcine brain tissues were utilized as the control group. In the results obtained from normal porcine brain, white matter contains significantly higher birefringent property over grey matter indicated by phase retardation. Based on the knowledge obtained from porcine brain experiment, a similar high-birefringent tissue is observed partially on the edge of the sliced glioma, and such tissue is considered as white matter because glioma originates through the mutation of the healthy white matter's glia cells.

In this paper [4], Segmentation of brain tumors from magnetic resonance imaging (MRI) data sets is of great importance for improved diagnosis, growth rate prediction, and treatment planning. The proposed system introduces a new methodology that combines random forests and active contour model for the automated segmentation of the gliomas from multimodal volumetric MR images. A segment the brain substructures from volumetric MR images through a novel combined ccRFs and mpAC approach. The proposed mpAC model refines the voxel classification of the ccRFs model through a contour evolution scheme.. Different levels of the structural information is subsequently integrated into concatenated and connected random forests for gliomas structure inferring.

In paper [5], An automatic content-based image retrieval (CBIR) system for brain

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tumors on T1-weighted contrast-enhanced magnetic resonance images (CE-MRI). The key challenge in CBIR systems for MR images is the semantic gap between the low-level visual information captured by the MRI machine and the high-level information perceived by the human evaluator. The proposed system uses a deep convolutional neural network (CNN) VGG19-based novel feature extraction framework and apply closed-form metric learning (CFML) to measure the similarity between the query image and database images. Developed a new CBIR approach to brain tumor retrieval based on transfer learning and fine tuning, which can serve as a helpful tool for clinical diagnosis. The proposed strategy of transfer learning with fine-tuning suggests using a pre-trained CNN as an off-the shelf feature extractor and training the separate method for retrieval, and it also demonstrates the transferability of learning from natural images to medical brain MR images. The experimental results revealed that the proposed CBIR outperformed state-of-the-art methods on CE-MRI dataset.

In paper [6], A new multi-atlas segmentation (MAS) framework for MR tumor brain images. The basic idea of MAS is to register and fuse label information from multiple normal brain atlases to a new brain image for segmentation. However, most of them are developed for normal brain images, and tumor brain images usually pose a great challenge for them. To address this challenge, in the first step of our MASframework, a new low-rank method is used to get the recovered image ofnormal-looking brain from the MR tumor brain image based on the information of normal brain atlases. The iteration, both the recovered image and the registration of normal brain atlases to the recovered image are gradually refined. We have compared our proposed method with a state-of-the-art method by using both synthetic and real MR tumor brain images. Experimental results show that our proposed method can get effectively recovered images and improves segmentation accuracy.

In paper [7], Brain tumors are the most common malignant neurologic tumors with the highest mortality and disability rate. Because of the delicate structure of the brain, the clinical use of several commonly used biopsy diagnosis is limited for brain tumors. Radiomics is an emerging technique for noninvasive diagnosis based on quantitative medical image analyses. In this paper, we propose a sparse representation-based radiomics (SRR) system for the diagnosis of brain tumors. The proposed model includes sparse representation-based feature extraction, iterative sparse representation-based feature selection and multi-feature

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collaborative sparse representation classification. Compared with traditional radiomics methods, sparse representation- based feature extraction can finely and effectively quantify the high- throughput texture features of images, as it investigates the texture characteristics of patches of the images.

III. Proposed Architecture

The classification of brain tumors is performed by biopsy, which is not usually conducted before definitive brain surgery. The improvement of technology and machine learning can help radiologists in tumor diagnostics without invasive measures. A machine-learning algorithm that has achieved substantial results in image segmentation and classification is the convolutional neural network (CNN).

The classification was performed using a T1-weighted contrast- enhanced MRI image database which contains three tumor types. A input, using the whole images, so it was not necessary to perform any preprocessing or segmentation of the tumors, Samples of more number of images are collected that comprised of different classes such as normal and abnormal. Different number of images is collected for each class thatwas classified into input images. Implementing the deep learning techniques on a small dataset of 253 brain MRI images. We trained the dataset through AlexNet andtrain the model by using LeNet in CNN model and finding the high accuracy of brain tumor. The dataset includes 155 images of malignant cancer and 98of benign non-cancerous tumors. We split our dataset into 2 separate segments for training, and testing. The training data is for model learning, validation data is sample data for model evaluation and model parameters tuning. Test data is for the final evaluation of our model. To deployment this process by showing the prediction result in the local host web application.

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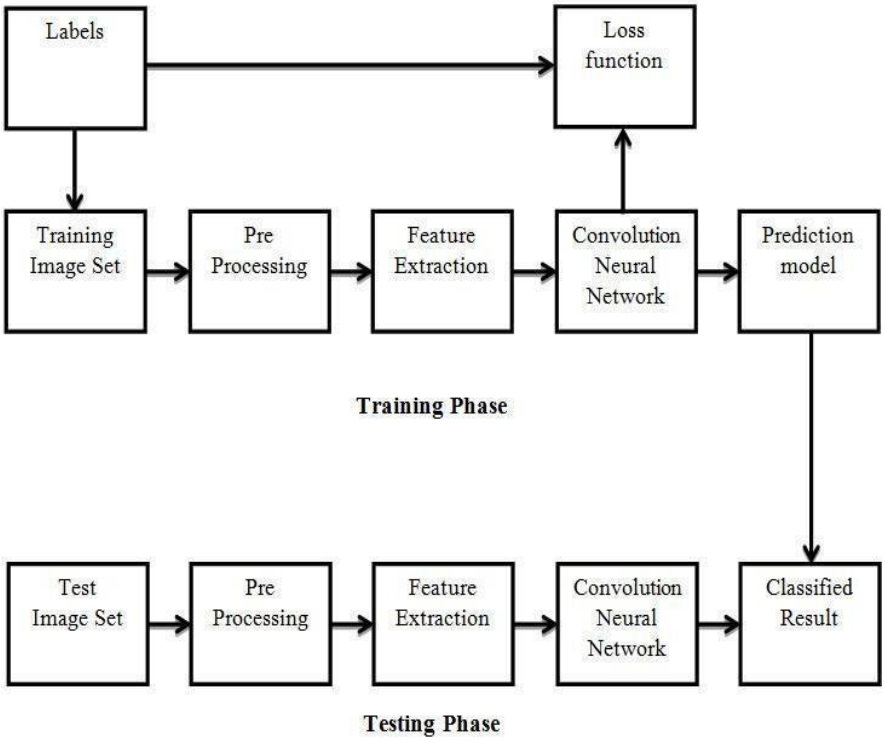

Fig 3.1: Block diagram of proposed brain tumor classification

Figure 3.1 displays a block diagram of a convolution neural network-based brain tumor classification method. The preparation and testing phases of a CNN- based brain tumor classification are separated. The number of images is divided into different categories by labelling them with terms like tumor and non-tumor brain image, and so on. Preprocessing, feature extraction, and classification are all used in the training phase.

3.1.1 Proposed Methods

3.1.2.1 MRI Dataset

The Brain MRI image dataset are downloaded from Kaggle. The MRI brain images were as taken as input to preprocessing steps. The appearance of the brain MRI image has generated with the help of MRI scanner. the strong magnetic fields and radio waves help to generate MRIimage. MRI directly effects the treatment of patients. The tumor has highlighted in the MRI image with white color.

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3.1.2.2 Pre-Processing

The pre-processing is a very important step in image processing for improving the quality of the image. Skull masking and the image noise removing is a very important step in brain MRI image classification it will help to improve classification accuracy rate. It improves the accuracy of diagnosis and helps in improving the classification result.

3.1.2.3 Feature Extraction

A slightly less common, more specialized approach to deep learning is to use the network as a feature extractor[7]. Since all the layers are tasked with learning certain features from images, we can pull these features out of the network at any time during the training process. These features can then be used as input to a machine learning model such as Support Vector Machine (SVM).

3.1.2.4 Convolutional Neural Network

The Convolution Neural Network (CNN) classifier is used mainly for image and video recognition. The CNN is able for automatically learning the respective feature for data itself. The CNN follows few steps like receiving different inputs, calculating the sum of their weights, forward output to activation function and respond with the desired output. Based on CNN classification, the Brain MRI images important features like lines, edges, and object etc. complex features automatically able to identify with more accurately.

The Convolution Neural Network has majorly 4 layers. Input layer, Convolution layer, pooling layer and Fully connected layer . The equation shown the Rectified Linear Unit (ReLU) activation function which has input

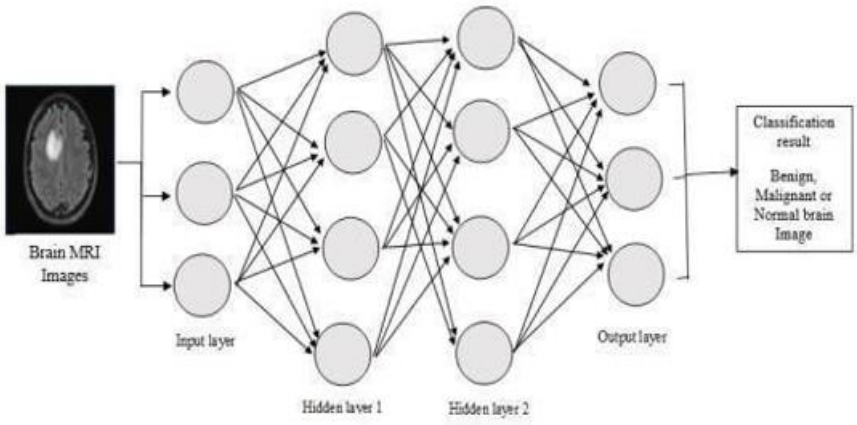

Fig. 3.2. Structure of a Convolution Neural Network

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x as an input value. If the input value is less than 0, in this time the output is 0. If the input value is greater than 0, in this time the output is not changed the same equal to the input.

ReLU(x)={0,if x<0,{x if x>=0

IV. RESULTS

The dataset contains tumor and non-tumor MRI images collected from different online resources. The dataset is publicly available, consists of 253 real brain images developed by radiologists using data from affected patients. The model is trained for 110 epochs with a batch size of 32. The experiment is done using TensorFlow and Keras librariesin python. The brain tumor detection is performed by using deep neural network. The training accuracy and validation loss are calculated to find the efficiency of brain tumor classification.

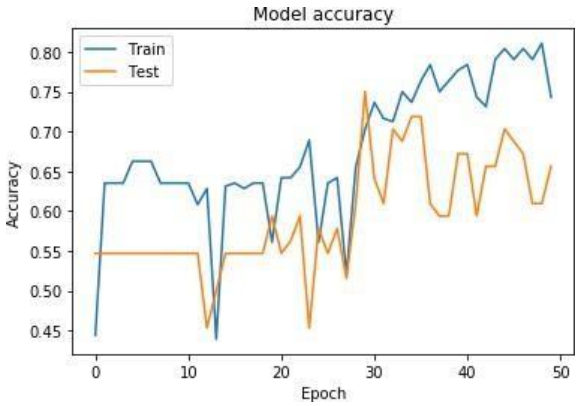

Fig 4.4: Accuracy of the Model

In fig shows the difference of accuracy based on the brain tumor dataset which used for training and testing the model, the blue line represents the training the dataset and orange line represent the testing the dataset.

This model shows the loss of accuracy from training and testing the dataset

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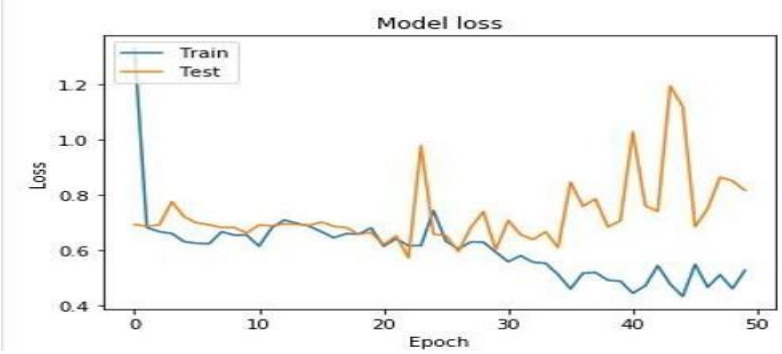

Fig 4.5: Model Loss

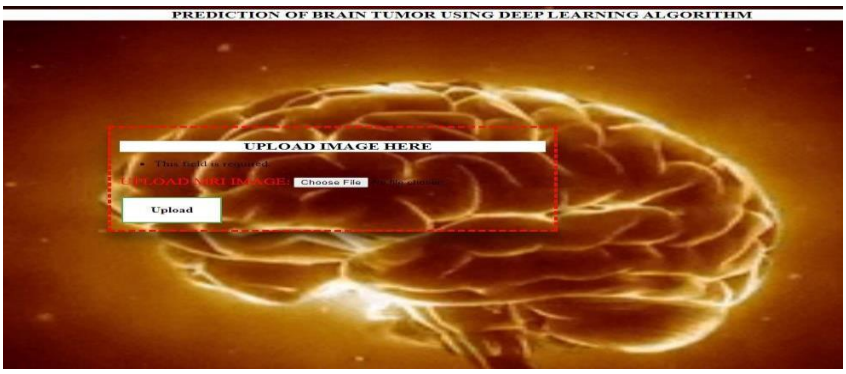

Fig 4.6: Upload the image in Django Framework

The Uploaded Images of the Patient's MRI Scan predicts whether it consist oftumor or not and gives it as the output .

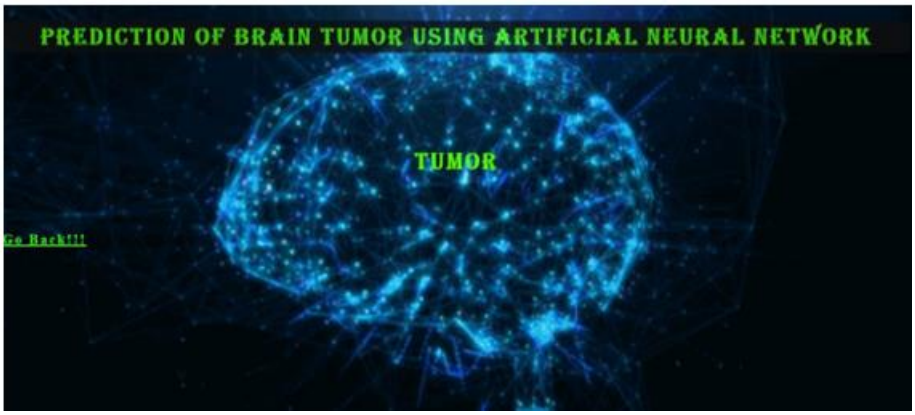

Fig 4.7: Tumor Output

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The above figure 4.7 shows the output for tumor detection.

V. CONCLUSION

The proposed system consists of the details about the layers which was used for the classification of brain tumor using the MRI images from the normal persons and the persons who had brain tumor. From thegraphs, it is proven that the accuracy of the model has reached good level, if it is deployed in the real-time scenario and it helps people in diagnosing the brain tumor without wasting the money on check-up. If the brain tumor is confirmed, then the person can reach the nearest hospital to get the treatment. It can be the best way of practice for peopleto save money. The data plays a crucial role in every deep learning model, if the data is more specific and accurate about the symptoms of the brain tumor, then that can help in reaching greater accuracy with better results in web framework.

The classification model with the help of custom CNN layers is used to classify whether the patient has a brain tumor or not through MRI images. With a few number of training samples, the model gave 95%accuracy. Increasing the training data may be by adding more MRI images of patients and perform deep learning techniques to achieve higher classification accuracy.

VI. REFERENCES

[1] Yi Ding, Chang Li , Qiqi Yang(2019), " How To Improve The Deep Residual Network To Segement Multi-Modal Brian Tumor Images.

[2] Abdu Gumaei,Mohammad Mehedi Hassan,Md Rafiul Hassan(2019), "Hybrid Feature Extraction Method With Regularized Extreme Learning Machine For Brain Tumor Classification.

[3] R. Viswanathan, Basetty Mallikarjuna and Bharat Bhushan Naib (2000)FeedbackBased Gait Identification Using Deep Neural Network Classification (JCR)Journal of Critical Reviews ISSN-2394-5125, Vol 7, Issue 4.

[4] Chao Ma , Gongning Luo (2018), "Concatenated And Connected Random Forests With Multiscale Patch Driven Active Contour Model For Automated Brain Tumor Segmentation Of Mr Images.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

[5] Dr. Karthika, T.Edison,ET all (2019)"Network Intrusion Detection System Using Artificial Neural Network in Data Mining" Journal of Recent Patents on Computer Science BMS-CSENG-2019-HT15-476-18.

[6] Zhenyu Tang, Sahar Ahmad, Pew-Thian Yap (2018), "Multi-Atlas Segmentation Of Mr TumorBrain Images Using Low-Rank Based Image Recovery.

[7] Guoqing Wu , Yinsheng Chen , Yuanyuan Wang (2017), "Sparse Representation-Based RadiomicsFor The Diagnosis Of Brain Tumors.

[8] N. Deepa, R.Chandrasekar, R. Sathiyaseelan and ET all (2014)Dimension Reduction using Multivariate Statistical Model, International Journal of Applied Engineering Research, Volume 9, Number 14 (2014) pp. 2531-2538.

[9] A. Ullah, M. Khan, M. Sajjad, S. Khan, S. W. Baik, W. Wu, Multi- grade brain tumor classification using deep CNN with extensive data augmentation, J. Comput. Sci., 30 (2019), 174–182.

[10] Samui, P and et all (2015). Determination of rock depth Using artificial intelligence techniques, Geoscience Frontiers, Vol. 1, pp. 6.

[11] Dan Lascu, Mihaela Lascu, Mircea Gurbin, "Tumor Detection and Classification of MRI Brain Image using Different Wavelet Transforms and Support Vector Machines", 2019 42nd International Conference on Telecommunications and Signal Processing (TSP), Budapest, Hungary, 2019, pp. 505-508.

[12] Pijush Samui, Dookie Kim, and ET all (2014). Spatial variability of rockdepth using adaptive neuro-fuzzy inference system (ANFIS) and multivariate adaptive regression spline (MARS), Environ Earth Sci, Vol. 73, pp. 4265–4272.

[13] Hifzan Ahmed, Shailja Shukla, "Comparative Analysis of Global Feature Extraction Methods for Off-line Signature Recognition", International Journal of Computer Applications, Volume 48-No.23, June 2012.

[14] M. S. S. Ram,S. Basheera, Classification of brain tumors using deep features extracted using CNN, J. Phys., 1172 (2019), 012016.

[15] Yun-Qian Li, Kai-Shih Chiu, Xin-Rui Liu, Tien-Yu Hsiao, "Polarization- sensitive optical coherencetomography for brain tumor characterization.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

[16] Ms. V. Anjana Devi(2014) "Fuzzy Based Decision Model for Detecting Misbehaving Attacks in MANET", International Journal of Applied Engineering Research, vol.9, no.23, pp.20059-20083, 2014.

[17] Ms. V. Anjana Devi(2014) "ECC Based Malicious Node Detection System for MANET", Journal of Theoretical and Applied Information Technology, vol.68, no.2, pp.239-248. Oct.2014.

[18] Dr. V. Anjanadevi, Dr.R. Hemalatha, R. Venkateshwar, J. Naren and Dr.G. Vithya(2019)," A framework for the Diagnosis of Diabetic Retinopathy Using Deep Learning Techniques" International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 01, pp.405-411.

[19] [19] B. Mallikarjuna and ET all (2000) Prediction of decay modes of Higgs Boson using Classification Algorithm Journal of Critical Reviews. ISSN-2394-5125 Vol 7, Issue 7.

[20] Dr. Anjana Devi V, P.S.Mitra, K.Pooja Dharshini(2000), "HAR system creating a security alert by implementing a deep learning approach "Sambodhi"- UGC Care list,Vol.43,issue.04.pp.25-30.

[21] S. Dhanasekaran, V. Anjana Devi ,S. Sankara Narayanan , P. Vijayakarthik ,S. Hariharasitaraman ,S. Rajasekaran (2002),"A Smart Digital Attendance Monitoring System for Academic Institution Using Machine Learning Techniques", Webology, Volume 19, Number 1, pp.3109-3118

[22] Dr. V. Anjana Devi(2002),"An Improvised Ensemble mechanism for Improving Bandwidth in Optical Network", ICTACT Journal on Communication Technology , December 2022, volume 13, Issue:04,pp.2815-2819.

[23] Dr. V. Anjana Devi(2003), "Evaluation of Glucose Concentration In Blood Stream And Effects Of Psychological Stress On Diabetes Management Using Data Science", "2nd International Conference on Recent Advances in Mechanical Engineering (ICRAME 2023) on 24th & 25th February 2023" at St. Martin's Engineering College (SMEC), Secunderabad.

[24] [25] Dr. V. Anjana Devi(2003), "Ride Sharing With Privacy And Security Using Hashed Time Contract And Trust Fair Payment Harnessing Block-Chain Technology", "2nd International Conference on Recent Advances in Mechanical

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

Engineering (ICRAME 2003) on 24th & 25th February 2023" at St. Martin's Engineering College (SMEC), Secunderabad.

[25] [26]Dr. V. Anjana Devi(2003), "Secure Online Pre-Medical Diagnosis Using Attribute Based Encryption","2nd International Conference on Recent Advances in Mechanical Engineering (ICRAME 2023) on 24th & 25th February 2023" at St. Martin's Engineering College (SMEC), Secunderabad.