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Survey Paper on MRI Brain Image based Brain Tumor Prediction using Machine Learning

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ABSTRACT: - Creating machines that behave and work in a way similar to humans is the objective of artificial intelligence (AI). In addition to pattern recognition, planning, and problem-solving, computer activities with artificial intelligence include other activities. A group of algorithms called "deep learning" is used in machine learning. With the aid of magnetic resonance imaging (MRI), deep learning is utilized to create models for the detection and categorization of brain tumors. This allows for the quick and simple identification of brain tumors. Brain disorders are mostly the result of aberrant brain cell proliferation, which can harm the structure of the brain and ultimately result in malignant brain cancer. This paper provides an in-depth analysis of current approaches that produce the best outcomes in their respective fields. To get effective feature extraction pictures from MRI brain scans, a variety of classifiers are available. The primary phase in these methods entails a few actions that must be carried out while employing various techniques in order to define the aberrant developments in brain MRI scans. Most currently used methods extract significant information from MRI brain scans using different models related to feature extraction framework in ML.

KEYWORDS:- MRI Brain Image, Machine Learning, Classification

I. INTRODUCTION

The brain, which is the primary component of the human nervous system, and the spinal cord make up the human central nervous system (CNS) [1]. The majority of bodily functions are managed by the brain, including analyzing, integrating, organizing, deciding, and giving the rest of the body commands. The human brain has an extremely complicated anatomical structure [2]. There are some CNC disorders, including stroke, infection, brain tumors, and headaches, that are exceedingly challenging to recognize, analyze, and develop a suitable treatment for [3].

A brain tumor is a collection of abnormal cells that develops in the inflexible skull enclosing the brain. Any expansion within such a constrained area can lead to issues. Any type of tumor developing inside the skull results in brain injury, which poses a serious risk to the brain. In both adults and children, brain tumors rank as the tenth most-prevalent cause of death [4]. There are many different types of tumors, and each one has extremely low survival rates based on the texture, location, and shape.

Around 250,000 people are affected by brain tumors every year, with 2% of those cases being confirmed as malignancies. The predicted number of adults in the United States with a brain tumor in 2020 was 23,890, with 13,590 men and 10,300 women. In 2020, 1879 reported cases of brain cancer were anticipated to be diagnosed in Australia. Every year, 14.1% of Americans are affected by primary brain tumors, of which 70% are children. Although there is no early therapy for primary brain tumors, they do have long-term negative effects. Brain tumor cases increased significantly globally between 2004 and 2020 from nearly 10% to 15%.

There are about 130 different forms of tumors that can affect the brain and CNS, all of which can range from benign to malignant, from exceedingly rare to common [5]. The 130 brain cancers are divided into primary and secondary tumors:

1. Primary brain tumors: Primary brain tumors are those that develop in the brain. A primary brain tumor may develop from the brain cells and may be encased in nerve cells that surround the brain. This type of brain tumor can be benign or malignant [6].

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2. Secondary brain tumors: The majority of brain malignancies are secondary brain tumors, which are cancerous and fatal. Breast cancer, kidney cancer, or skin cancer are examples of conditions that begin in one area of the body and progress to the brain. Although benign tumors do not migrate from one section of the body to the other, secondary brain tumors are invariably cancerous [7].

A study stated that brain tumors are responsible for about 85–90 percent of all significant CNS tumors. To drastically lower the fatality rate from brain tumors, early identification is important. Medical experts have significantly utilized medical imaging for tumor identification. One of the most-popular methods for the early diagnosis of brain tumors is magnetic resonance imaging (MRI). Radiologists routinely manually detect brain tumors.
The amount of time it takes to grade a tumor depends on the radiologist's skill and experience. However, the process of identifying a tumor is imprecise and expensive. A patient's odds of survival can be significantly lowered by misdiagnosing a brain tumor, which can result in serious problems. The MRI technique is becoming more and more popular as a solution to address the limitations of human diagnosis.
In the healthcare industry, deep learning is frequently utilized for analysis, classification, and detection. The first time the CNN was utilized was in 1980. The CNN's computing capacity is based on a model of the human brain. Humans notice and recognize objects based on their outward appearance. Similar in operation, the CNN is renowned for processing images. Some of the most well-known CNN models include ResNet (152 layers), GoogLeNet (22 layers), AlexNet (8 layers), and VGG (16–19).

II. LITERATURE REVIEW

A B Malarvizhi et al. [1], a few phases in the undertaking were commotion evacuation, morphological procedure based on division, highlight extraction, NB classifier, the cerebrum picture was gotten from the patient. They got picture was oppressed for = pre-preparing and the component extraction was implemented after that classification. Thus, the brain tumor was forecasted in accurate way with the utilization of NB classifier technique. The huge image database of ImageNet was utilized for pre-training the CNN model. The input images of brain were trained using this model. The extracted high-level attributes considered the same as input to the entirely joined layer after that soft-max energizing. The database taken from Harvard medical school contained MR brain images had employed for testing the technique.

Muhammad Arif et al. [2], described that the main goal of this paper was that the associate innovative methodology was utilized to detect the brain tumors. The wavelet –based picture combination algorithm was executed to CT and MR pictures so as the outmoded plus corresponding information was extracted. In this way, the detected tumor was improved within the consolidated image. In addition, a superior spatial determination wiener filtering was generated along with a high dissimilarity fused output image was acquired using CLAHE. The texture analysis was done with GLCM. The division of gray matter picture, withdrawal of cerebrum qualities and order of anomaly in the MRI cerebrum picture were contained while identifying or perceiving the gray matter cancer. The cutting edge cancer location techniques were recommended through WDAPP-CNN. The cancerous zone was fragmented utilizing watershed calculation in exact manner. The finished characteristics of the cerebrum were extricated by the dynamic point projection design and the cancer and non-cancer districts of the MRI picture of cerebrum had sorted with CNN orders. The BRATS dataset was implemented efficiently to obtain the testing and detect the abnormality of the brain image. It introduced a procedure for examining and ordering the picture de- noising channels in which Median, Adaptive, Averaging, Un-sharp covering and Gaussian channel had involved and this method was done for evacuating the added substance clamors accessible in the MR pictures. The PSNR and MSE were utilized to analyze the de-noising execution of the considerable number of techniques that was considered. This paper recommended another plan to recognize the cerebrum tumor with the use of standardized histogram and division through K-implies bunching calculation. he NB and SVM classifier were carried out for classifying the MR images effectively. In this way, an accurate prediction and classification was offered in this paper.

Munagalapalli Thanuj et al. [3], suggested the fragmentation method for separating the MR picture of cerebrum to detect edge of cancer structure. The unsharp approach was employed to improve the MRI brain image particularly earlier than segmenting the MRI image with the utilization of the Otsu technique. The Otsu was capable for detecting an appropriate threshold so as the tumor part was segmented from the image. Some objects were appeared by the binary image subsequent to the detection of threshold. Thus, the label was assigned to an image for generating a dual picture accompanied by the totally colorless cancer section in arranges to find out the view of the region in the picture in accurate manner. Therefore, the unsharp masks in particular had employed to discover the edge of tumor image. The edge image was processed and integrated by means of the inventive to displace the fragmented picture to

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approximation the picture arrangement. The outcomes of model on brain MR likeness locate represented which the efficiency of suggested technique and it was designed to detect the primarily as well as secondary cancers in biomedical pictures.

Nikita Mahajan et al. [4], suggested a strategy to recognize the cerebrum cancer naturally in MRI pictures. There were three stages of introduced calculation. The online sources, accessible openly had utilized to develop the database of cerebrum tumor MRI pictures during picture procurement. The picture was changed over to grayscale and the commotion channels were actualized for the improvement of the picture in pre-preparing stage. The picture was part into four bunches of changing power levels utilizing k-implies grouping calculation under the post-preparing stage. The bunch with the tumor was found. A while later, morphological and locale properties tasks were applied to remove the tumor. Various qualities were found alongside the region and edge of the tumor and the exactness of the extraction. The deployment of those pull out attributes would be performed in the expectations for classifying brain tumors with more accuracy using NN. The effective outcomes and accuracy were obtained from the presented technique. A computer aided detection system was suggested on the basis of morphological reenactment as well as statute base identification of tumors in this study with the utilization of the morphological attributes of ROI. The pre-processing, the segmentation, the step of identifying the ROI and the step of detecting the tumors were various steps that had comprised in this study. There were 497 MR image slices of 10 patients had utilized in these techniques and the accuracy obtained from the computer aided detection system was computed as 84.26%.

S. Karpakam et al. [5], discussed a system that had potential to detect the brain tumor in more exact way and various attributes of tumor were analyzed. A technique based on computer aided image processing was presented in this system that provided an enhanced precision tempo of detecting the cerebrum cancer alongside through the computation of the volume and location of tumor. The information was also offered in this system that assisted in determining the tumor whether it was malignant or not. This paper discussed the system that was used for the uncovering of cerebrum cancer from MR picture. In favor of that purpose, the thresholding as well as morphological process had combined with histogram-based technique and a systematic investigation was obtained in it. The research was conducted using BRATS database of MRI. The methodology obtained the tempo of flourishing recognition that was evaluated 86.84%.

Monisha Barakala et al. [6], in this article focused on detecting the gray matter cancer from Magnetic Resonance pictures of the cerebrum. In the nervous system, the cerebrum was the frontal the majority component. When the cells were growing rapidly referred as tumor. The MRI was the device necessitated for diagnosing the tumor of brain. The normal MR images were not appropriate for fine analysis. Thus, there was need of segmentation which was a significant process to analyze the tumor images in effectual way. Clustering was the most appropriate to segment the biomedical image because the unsupervised learning was carried out in it. The K-Means clustering was employed in paper work in which the detected tumor demonstrated some abnormality that was rectified later on with the utilization of morphologic mechanism beside in the company of necessary picture practicing schemes for fulfilling the objective of unscrambling the tumor units from the standard units.

N. N P. Patil et al. [7], stated that the major purpose of this paper was that an effective technique was constructed for detecting the brain tumor in premature phases. There were a few phases in the undertaking were commotion evacuation, morphological procedure based on division, highlight extraction, NB classifier, the cerebrum picture was gotten from the patient. They got picture was oppressed for = pre-preparing and the component extraction was implemented after that classification. Thus, the brain tumor was forecasted in accurate way with the utilization of NB classifier technique. The huge image database of ImageNet was utilized for pre-training the CNN model. The input images of brain were trained using this model. The extracted high-level attributes considered the same as input to the entirely joined layer after that soft-max energizing. The database taken from Harvard medical school contained MR brain images had employed for testing the technique. The VGG16, ResNet and Inception were three pre-trained models that had implemented to perform the analysis. Its accuracy obtained on experimented database was evaluated 100%. The obtained outcomes demonstrated that the classification accuracy was enhanced from the data augmentation. The pre-processing, segmentation, identification of the areas of interests and identification of tumor were various steps that had performed in this study. The labels were assigned to the acquired areas of interests after performing the steps of preprocessing and segmentation. The features of these areas of interests were extracted under the feature extraction. In the final stage, the areas of interests were recognized whether they were mass or not in accordance with these features. There were 845 number of MRI sections belonging to 13 patients had employed in this technique and classification success attained from this technique was computed 86.39%.

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Problem Identification:-

- One of the most crucial tasks in any brain tumor detection system is the isolation of abnormal tissues from normal brain tissues.
- Interestingly, domain of brain tumor analysis has effectively utilized the concepts of medical image processing, particularly on MR images, to automate the core steps, i.e. extraction, segmentation, classification for proximate detection of tumor.
- The past works of many researchers under medical image processing and soft computing have made noteworthy review analysis on automatic brain tumor detection techniques focusing segmentation as well as classification and their combinations.

III. BRAIN TUMOR USING MACHINE LEARNING

The malignant and benign are two main categories of the brain tumor. The skull is pressurized to enlarge from inside in case of growth of any benign or malignant tumor. This tumor leads to cerebrum lesion and that could be dangerous to existence also. The brain tumor is divided into two kinds - primary or secondary. The tumor which happens in the cerebrum is known as primary brain cancer. Various gray matters are gentle. An optional cerebrum tumor is additionally metastatic mind tumor. This tumor starts because of spreading of disease cells spread in the cerebral matter as of an additional limb in which lung or bosom is included. The encephalon could start inside the brain or it spread to from the rest of the organs of anatomy. It can broaden to the cerebrum. The growth rate and the position of a brain tumor investigate its impacts on the function of nervous system. The kind of brain tumor and also its size and location have assisted in prescribing the treatment options of brain tumor.

Machine Learning

Machine Learning is a subset of Artificial Intelligence concerned with “teaching” computers how to act without being explicitly programmed for every possible scenario. The central concept in Machine Learning is developing algorithms that can self-learn by training on a massive number of inputs. Machine learning algorithms are used in various applications, such as email filtering and computer vision, where it is difficult or infeasible to develop conventional algorithms to perform the needed tasks [4]. Machine learning enables the analysis of vast amounts of information. While it usually delivers faster, more precise results to identify profitable prospects or dangerous risks, it may also require additional time and assets to train it appropriately. Merging machine learning with AI and perceptive technologies can make it even more effective in processing vast volumes of information. Machine learning is closely associated with computational statistics, which focuses on making predictions using computers. Machine learning approaches are conventionally divided into three broad categories, namely Supervised Learning, Unsupervised Learning & Semi-supervised Learning, depending on the nature of the "signal" or "feedback" available to the learning system.

Face anti-spoofing (FAS) has lately attracted increasing attention due to its vital role in securing face recognition systems from presentation attacks (PAs). As more and more realistic PAs with novel types spring up, traditional FAS methods based on handcrafted features become unreliable due to their limited representation capacity. With the emergence of large-scale academic datasets in the recent decade, machine learning based FAS achieve remarkable performance and dominate this area.

Supervised Learning

A model is trained through a process of learning in which predictions must be made and corrected if those predictions are wrong. The training process continues until a desired degree of accuracy is reached on the training data. Input data is called training data and has a known spam / not-spam label or result at one time.

Unsupervised Learning

By deducting the structures present in the input data, a model is prepared. This may be for general rules to be extracted. It may be through a mathematical process that redundancy can be systematically reduced, or similar data can be organized. There is no labeling of input data, and there is no known result.

Semi-Supervised Learning

Semi-supervised learning fell between unsupervised learning (without any labeled training data) and supervised learning (with completely labeled training data). There is a desired problem of prediction, but the model needs to learn

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the structures and make predictions to organize the data. Input data is a combination of instances that are marked and unlabeled.

IV. CONCLUSION

Medical image processing gains popularity due to various types of disease detection, prediction and classification. The processing and evaluation of normal as well as abnormal images is the major objective of medical image processing which helps in diagnosing the tumor affected regions from brain image dataset. It enables the automated processing to challenging scenarios without human intervention. But how accurately and effectively it is diagnosing the tumor images, it depends on the techniques we are using in various phases of cancer recognition. Detecting the brain cancer from MRI pictures is the major aim of this study.

REFERENCES

[1] A B Malarvizhi, A Mofika, M Monapreetha and A M Arunnagiri, “Brain tumour classification using machine learning algorithm”, Journal of Physics: Conference Series, pp. 01-09, 2022.

[2] Muhammad Arif , F. Ajesh, Shermin Shamsudheen, Oana Geman, Diana Izdrui and Dragos Vicoveanu, “Brain Tumor Detection and Classification by MRI Using Biologically Inspired Orthogonal Wavelet Transform and Deep Learning Techniques”, Hindawi Journal of Healthcare Engineering, Vol. 2022, pp. 18, 2022.

[3] Munagalapalli Thanuj, Panidapu Ravi Teja, Pallam John David Living Stun, K. Kranthi Kumar and R. Sudha Kishore, “Brain Tumour Detection Using Deep Learning Techniques”, 5th International Conference on Inventive Research in Computing Applications (ICIRCA), IEEE 2023.

[4] Nikita Mahajan and Hariram Chavan, “A Robust Approach for Brain Tumor Detection using Transfer Learning”, 5th International Conference on Inventive Research in Computing Applications (ICIRCA), IEEE 2023.

[5] S. Karpakam, N. Senthilkumar, R. Kishorekumar, U. Ramani, P. Malini and S. Irfanbasha, “Investigation of Brain Tumor Recognition an Classification using Deep Classification using Deep Learning in Medical Image Processing”, International Conference on Augmented Intelligence and Sustainable Systems (ICAISS), IEEE 2022.

[6] Monisha Barakala, Venkata Ramana Attada and Cristin Rajan, “Brain Tumor Classification and Detection Using Machine Learning Algorithm”, International Conference on Augmented Intelligence and Sustainable Systems (ICAISS), IEEE 2022.

[7] N. N P. Patil S. Patil and M. Kokatanur "Alpha Beta Pruned UNet - A Modified UNet Framework to Segment MRI Brain Image to Analyse the Effects of CNTNAP2 Gene towards Autism Detection" 2021 3rd International Conference on Computer Communication and the Internet (ICCCI) pp. 23-26 2021.

[8] Fatih Ozyurta Eser Sertb and Derya Avci "An expert system for brain tumor detection: Fuzzy C-means with super resolution and convolutional neural network with extreme learning machine" Medical Hypotheses vol. 8 October 2020.

[9] M. Hasan, HA. Jalab, F. Meziane , H Kahtan , AS Ahmad , “ Combining Deep and Handcrafted Image Features for MRI Brain Scan Classification,” IEEE Access,pp.79959–79967, 2019.

[10] A. Gumaei, MM. Hassan, MR. Hassan, A Alelaiwi ,G. Fort ino , “ A Hybrid Feature Extraction Method With Regularized Extreme Learning Machine for Brain Tumor Classification”, IEEE Access, pp. 36266 -36273, 2019.

[11] HT. Zaw, N. Maneerat, KY. Win,“Brain tumor detect ion based on Naïve Bayes classification”, International Conference on Engineering, Applied Sciences and Technology,pp.1-4,2019.

[12] T K Keert hana , S. Xavier, “An Intelligent System for Early Assessment and Classification of Brain Tumor”, Proceedings of he 2nd International Conference on Inventive Communication and Computational Technologies,pp.1-4,2018.

[13] T L. Narayana, T S.Reddy, “An Efficient Optimization Technique to Detect Brain Tumor from MRI Images,” International Conference on Smart Systems and Invent ive Technology,pp.1-4,2018.

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