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Brain Tumor Detection and Classification using Artificial Intelligence

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ABSTRACT
The rapid development of artificial intelligence has brought new solutions in the field of medicine, especially in the analysis of medical images. The program introduces a new method called "Brain Tumor Detection, Classification Using Artificial Intelligence" to identify brain tumors accurately, efficiently. The system integrates the latest Technology that includes the YOLOV2 algorithm for tumor detection and the Mobile NetV2 architecture for tumor classification. This paper utilizes MATLAB environment, with graphics processing capabilities and artificial intelligence toolbox. The YOLOV2 algorithm is known for its ability to detect real objects and has been used to identify brain tumors in MRI scans. The system focuses on dividing tumors into two groups: benign and malignant. Mobile NetV2 architecture for tumor classification is recognized for its effectiveness and efficiency in clinical data processing. This model was developed using data containing MRI images of brain tumors.
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KEYWORDS
MRI images, Machine Learning, Deep Learning, Artificial Intelligence, Malignant, Benign

1. INTRODUCTION

Brain tumors are a serious health problem worldwide, with a profound impact on patient quality of life and survival rates. Conventional diagnostic methods, such as MRI and CT scans, require significant expertise and time for analysis, leading to delays in diagnosis and treatment initiation [2]. The image is organized by groups of pixels in an area. These pixels are similar based on some relationship, such as color, density, or texture, and help find and identify objects or areas in an image. Segmentation of specific objects will be done by identifying all pixels (2D images) or vowels (3D in ages) belonging to an object. Radiologists perform physical examinations (CT scans) and magnetic resonance imaging (MRI) for patients using computer tomography scans [3].

Thereby facilitating timely medical interventions and improving patient prognosis. The utilization of artificial intelligence for brain tumor detection and classification produces optimize treatment planning, healthcare providers can enhance diagnostic accuracy and ultimately improve patient outcomes in the management of brain tumors [4-5].

2. LITERATURE SURVEY

The author S.G. Prasad proposed “Machine learning techniques for brain tumor classification and diagnosis”. In the realm of brain tumor classification and diagnosis, learning techniques have been deployed to enhance accuracy and efficiency [6]. Support vector machines serve as a robust tool, adept at discerning patterns within medical imaging data to classify tumors with precision. Their ability to find optimal hyper planes in high-dimensional features makes them particularly valuable. SVM has been widely applied in brain tumor classification by utilizing digitally controlled features extracted from medical imaging data such as MRI or CT scans, Excel image analysis tasks by automatically extracting hierarchical features from raw data, thereby eliminating the need for manual feature engineering [7-8]. Machine learning techniques from a powerful arsenal in the quest for precise brain tumor classification and diagnosis, advancing clinical decision-making and ultimately improving patient outcomes [9].

Rao et. al., and Lakshmi et. al., presented “Image classification of tumor following magnetic resonance”, which Diagnostic technology using magnetic resonance imaging for brain tumors. The process always follows that of removing the lower part of the mesh. This situation is not suitable for diagnosis. To solve this problem, the concept model adopts the convolution model. The hyper parameter was not optimized using the Adam optimizer and lost its functionality model. The model extracts various features and divides them into early stages of the brain tumor [10-11]. The suggested structure utilizes deep learning and hyper parameters. Was not optimized using the Adam optimizer and lost its functionality [12].

The authors proposed a model based on deep learning model” by Fast diagnosis, accurate and timely treatment. In recent years, this article presents a new brain tumor model that combines the listening process and various methods to solve the above problems. Using the monitoring process to select important target data fields, ignoring irrelevant content. The multipath network splits the data into multiple channels, then transforms each channel and combines the results of each branch to create a file of 3064MR images, completing 98.61% accuracy, more on this data outperformed previous research from networks [13-14].

3. PROPOSED SYSTEM

The proposed system, "Brain Tumor Detection and Classification Using Artificial Intelligence," presents a comprehensive, innovative approach to address the limitations of the existing system in brain tumor diagnosis. By integrating advanced AI techniques and leveraging state-of- the-art technologies, this system aims to enhance the accuracy, efficiency, and reliability of brain tumor detection and classification which employs the YOLOV2 (You Only Look Once version 2) algorithm for accurate and efficient brain tumor detection in magnetic resonance imaging scans. The proposed system utilizes the MobileNetV2 architecture for tumor classification. MobileNetV2 is a lightweight convolutional neural network architecture optimized for mobile and embedded devices.

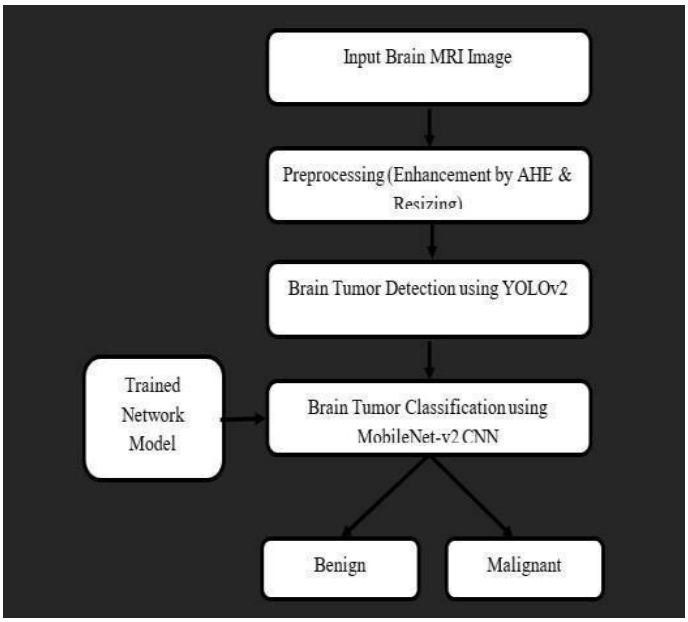

Fig. 1 Flowchart of Proposed Methodology

TECHNOLOGIES USED:

MATLAB: An advanced computing language and interactive algorithm development, data visualization and computing environments.

Machine Learning: Machine learning is a computer algorithm that can improve itself and learn from examples without needing precise instructions from programmers.

4. RESULTS

The accuracy rate of 97.14% shows that the system is powerful, has accuracy to detect and classify brain tumors. The combination of YOLOV2 for detection and MobileNetV2 for classification results in a brain-based solution. Here the pictures are the output of the tumour which is Classified by the algorithm MobileNet 2 as Benign as shown in Fig. 2. With a green color in the last box and Malignant in Fig.3, we have designed the confusion matrix shown in Fig. 4 for the respective tumors.

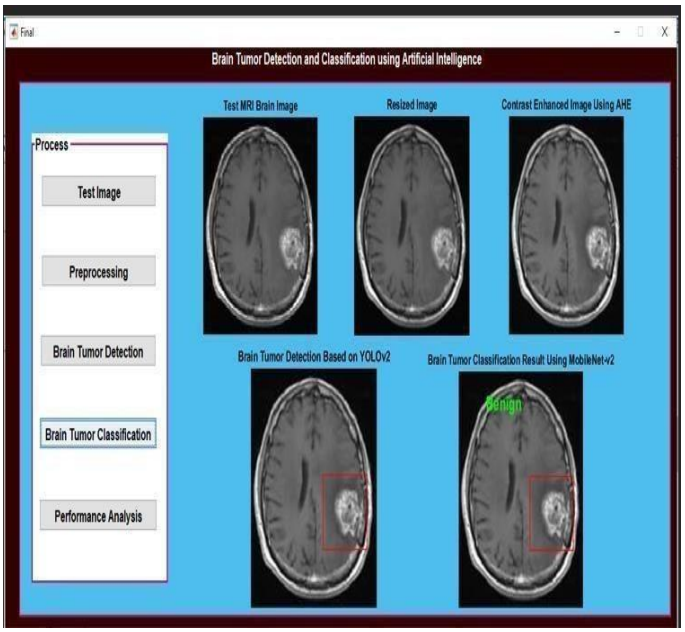

Fig. 2 Benign

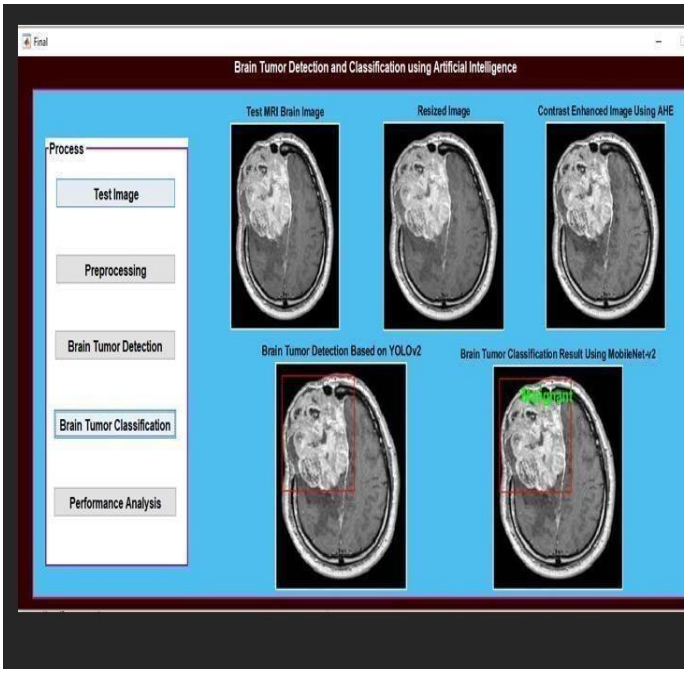

Fig.3 Malignant

The results also include the performance analysis as we can see in fig. 6 which is calculated by taking the parameters such as Accuracy, Precision, Recall, F_Score and at the end. The overall performance is displayed in fig:6 to 100%, These is the

Brain Tumor Detection using YOLOV2 and Classification using MOBILENET2 using Matlab 2024b with AI tool boxes

Fig. 4 Confusion Matrix

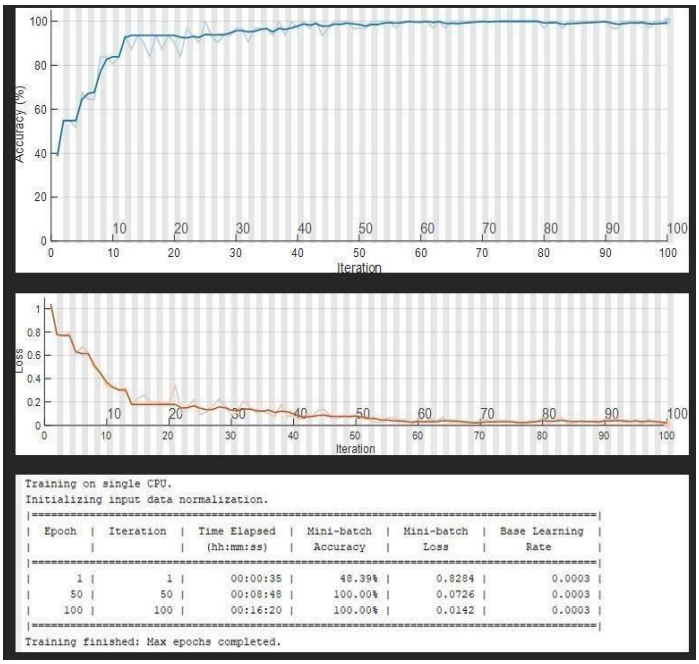

Fig. 5 Accuracy Plot

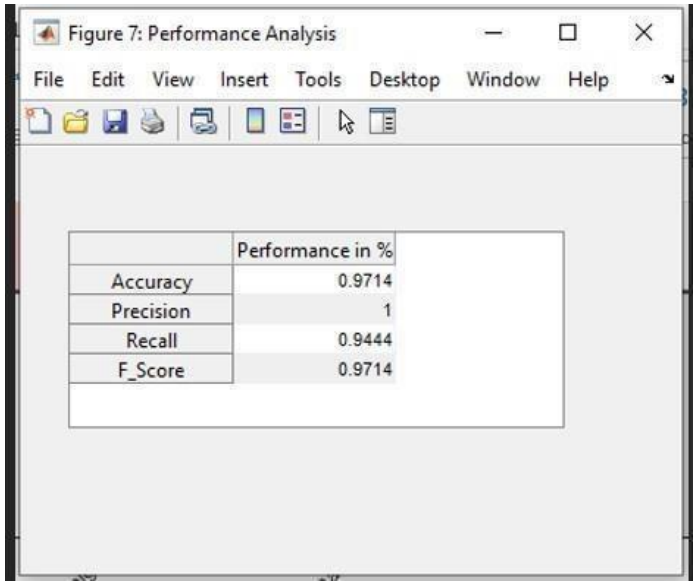

Fig.6 Performance Analysis

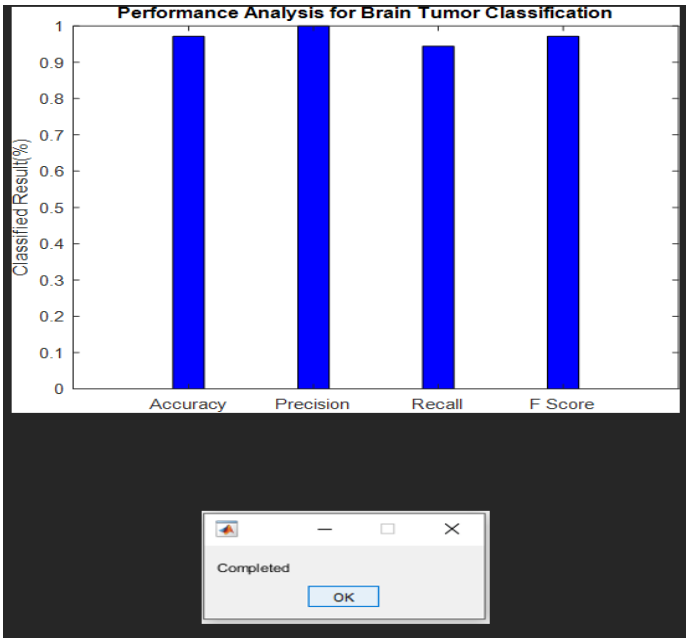

Fig. 7 Performance Analysis Classification

The comparison table with the existing and our proposed work is shown in Table 1.

5. COMPARISION TABLE

Table 1. Comparison table of existing work

Aspect	Our Work	Existing Work [1]	Existing Work [7]
Dataset	500	300	400
Algorithm used	YOLO V2, MobileNet V2	CNN, SVM	Machine learning algorithms, local texture and abnormality features
Accuracy	97%	92%	85%
Precision	100%	95%	87%
Recall	90%	80%	90%
F-Score	95%	90%	86%
Hardware Requirements	Windows10	Linux,GPU	Windows
Software Requirements	Matlab 2024b	Python, Tensor flow	Machine leaning
User Interface	Matlab GUI	Command line	Web application

The proposed system, "Brain Tumor Detection and Classification Using Artificial Intelligence," presents a comprehensive and innovative approach to address the limitations of the existing system in brain tumor diagnosis. By integrating advanced AI techniques and leveraging state-of-the-art technologies, this system aims to enhance the accuracy, efficiency, and reliability of brain tumor detection and classification. The proposed is an easy way and which can take up to more than 500 data set while compared to the existing system [15-16], It has increased Percentage of accuracy, precision, recall. f-score. These work uses a single hardware of Windows and a simole and updated software version of matlab 2024b which is of less complex and no high time consumption

6. CONCLUSION

The "detection and classification of brain tumor using artificial intelligence" work uses the power of artificial intelligence and technology to suggest ways to diagnose brain tumors. By combining the yolov2 algorithm for tumor diagnosis and the mobilenetv2 architecture for tumor classification. the proposed work addresses the shortcomings of the existing system and offers a comprehensive solution for accurate and efficient diagnosis. The work capitalizes on the real-time and precise tumor detection capabilities of the yolov2 algorithm, and this accuracy is complemented by the mobilenetv2 architecture's fine-tuned classification prowess.

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