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Performance Analysis of Machine Learning Algorithms for MRI Using Wavelet Feature Extraction

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ABSTRACT:

In the restorative field, restorative picture combination plays a crucial part in diagnosing brain tumors that can be classified as kind or harmful. To diminish instability and minimize excess whereas extricating all the valuable data from the source pictures, it is the handle of joining numerous pictures of the same scene into a single combined picture. In this audit for cerebrum tumor acknowledgment utilizing different strategies. At display, the dealing with of clinical pictures is a making and critical field. These progressions allow us to recognize indeed the most humble deformations interior the physical body. Abnormal advancement of tissues interior the intellect which impact fitting cerebrum capacities is considered as a cerebrum tumor. The essential objective of clinical picture dealing with is to spot exact and imperative information utilizing pictures with the base botch conceivable. X-ray is especially wont to get pictures of the physical body and damaging tissues since of its tall objectives and superior quality pictures differentiated and other imaging progressions. Intellect tumor recognizable pieces of confirmation through MRI pictures might be a troublesome task since of the eccentrics of the cerebrum. X-ray pictures are routinely arranged and in this way the intellect tumor are habitually fragmented. Index Terms—About four key words or expressions in in sequential order arrange, isolated by commas.

INTRODUCTION

In regular clinical applications such as disease diagnosis and treatment planning, medical image processing has developed as one of the critical factors. The quality of medical images is usually unsatisfactory due to the technical limitations, degrading the accuracy of human interpretation and further medical image analysis, thus requiring an improvement in the quality of these images. Several denoising approaches have been proposed, such as adaptive filters, methods based on wavelets, etc. The physical body consists of many sorts of cells. Each cell features a specific function. These new cells help to keep the human body healthy and properly working. When some cells lose their capability to regulate their growth, they grow with none order. The extra cells formed form a mass of tissue that is named as the tumor. The tumors can be benign or malignant. Malignant tumors lead to cancer while benign tumor is not Cancerous. Magnetic resonance imaging (MRI) may be a technique that depends on the measurement of magnetic flux vectors that are generated after an appropriate excitation of strong magnetic fields and radiofrequency pulses in the nuclei of hydrogen atoms present in the water molecules of a patient's body. The MRI scan is much better than the CT scan for diagnosis as it doesn't use any radiation. The radiologists can evaluate the brain using MRI. The MRI technique can determine the presence of tumors within the brain. The MRI also contains noise caused thanks to operator intervention which may cause inaccurate classification. The large volume of MRI is to analyze; thus, automated systems are needed because they're less expensive -. Automated detection of tumors in MR images is important as high accuracy is required when handling human life. The supervised and unsupervised machine learning algorithm technique can be employed for the classification of brain MR image either as normal or abnormal. During this paper, an efficient automated classification technique for brain MRI is proposed using machine learning algorithms. The supervised machine learning algorithm is used for classification of brain MR image. In recent years, the fatality rate has increased because of the encephalon tumors at each age group. As per the report available in the “American Encephalon Tumor Sodality (ABTA)” Feb 24, 2016[1], the teen-agers and adolescent among 15 to 39 age groups are prone to malignant encephalon tumors. Rudimentally, encephalon tumors are regarded as malignant and benign tumors which grow unwantedly in the encephalon. “Malignant” tumors include cancerous cells which are developed due to “non-uniform” structure. Benign tumors are of consistent structure and have “non-cancerous” cells. The growth of the tumor tissues causes vision crisis, regurgitating affinity etc. to the patients. The in-volute arrangement of “tumor” analysis turns into a stimulating task for the clinical medicos. The features are extracted from MR images using rough set theory. The selected features are fed as input to feed forward neural network classifier which differentiates between the normal and abnormal brain and the accuracy of about 90% is obtained. Further, we propose the use of the ml algorithm to overcome the drawbacks of traditional classifiers. We investigate the performance of a machine learning algorithm namely the classifier WNN in this work.

LITERATURE REVIEW

The research work applied, based on Neural Network (NN) and k- Nearest Neighbor(k-NN) algorithms on tumor classification has been achieved 87% accuracy. Joshi proposed brain tumor detection and classification systems in MR images by first extracting the tumor portion from brain image, then extracting the texture features of the detected tumor using gray level co-occurrence matrix (GLCM) and then classified using a neuro-fuzzy classifier. shasidhar proposed a modified fuzzy c-means (FCM) algorithm for MRI brain tumor detection. The texture features are extracted from the brain MR image and then a modified FCM algorithm is used for brain tumor detection. The average speed-ups of as much as 80 times a traditional FCM algorithm are obtained using the modified FCM algorithm. Rajesh and malar proposed brain MR image classification based on rough set theory and feed-forward neural network classifier. The features are extracted from MR images using rough set theory. The selected features are fed as input to feed forward neural network classifier which differentiates between the normal and abnormal brain and the accuracy of about 90% is obtained. Ramteke and monali proposed automatic classification of brain MR images in two classes normal and abnormal based on image features and automatic abnormality detection. The statistical texture feature set is obtained from normal and abnormal images and then the KNN classifier is used for classifying an image. The KNN obtain an 80% classification rate. Othman proposed a probabilistic neural network technique for brain tumor classification. Jafari and shafaghi proposed a hybrid approach for brain tumor detection in MR images based on support vector machines (SVM). The texture and intensity features are used. The accuracy of about 83.22% is achieved and is more robust. Thus, from an extensive literature survey, we found that most of the current brain tumor detection system uses texture, symmetry, and intensity as features. Texture features are important property of the brain as texture perception has a very important aspect in the human visual system of recognition and interpretation. Further, we propose the use of the ml algorithm to overcome the drawbacks of traditional classifiers.

PROPOSED SYSTEM

Automated detection of tumors in MR images involves feature extraction and classification using a machine learning algorithm. Brain tumour is detected by using wavelet-based feature extraction is a powerful technique used in the analysis and processing of signals and images. It involves using wavelet transforms to decompose a signal into components at various scales, which can help in identifying patterns, edges, or other features that are not apparent in the raw data. Wavelet coefficients obtained from decomposition represent localized frequency information in the signal or image domain. These coefficients serve as compact representations of the original data, capturing both fine and coarse details simultaneously. Wavelet transforms are inherently robust to noise due to their ability to separate signal components from noise at different scales. This property makes wavelet-based feature extraction particularly useful in denoising applications, where noisy signals or images need to be processed for further analysis. Wavelet coefficients and derived features are often interpretable in the context of the original data, allowing for insights into the underlying structures or patterns. Visualization techniques, such as scalograms or feature histograms, aid in understanding the distribution and significance of wavelet features. In this paper, a system to automatically detect a tumor in MR images is proposed as shown in the figure.

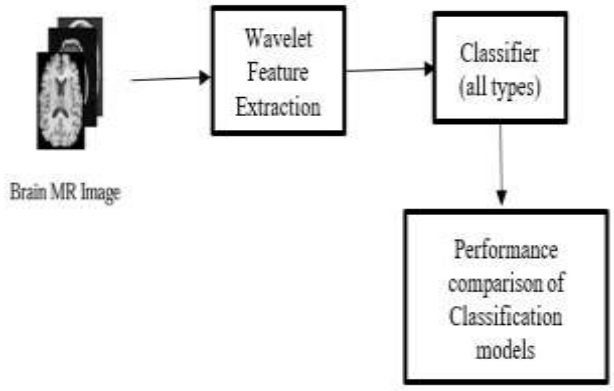

Fig 1 - Proposed Methodology

This method is particularly useful in fields like image processing, audio signal processing, and machine learning where feature extraction plays a crucial role in tasks such as classification, compression, and noise reduction. Machine learning classifiers are one of the top uses of AI technology – to automatically analyze data and also are helpful to automate tasks that previously had to be done manually. A classifier is the algorithm itself – the rules used by machines to classify data. The model is trained using the classifier, so that the model, ultimately, classifies your data. This paper proposed based on Wavelet feature extraction plays a crucial role in machine learning tasks, especially in the context of signal processing and image analysis.

METHODOLOGY

For the segmentation of a medical image there are numerous algorithms which are utilized by many researchers. Wavelets find their way in recent research works. The features for the classification were extracted using wavelet transform decomposition technique. Then the extracted features are used for

classification. In the recent years, the brain tumor is the one of the leading causes of death irrespective of the age. With the advancement of imaging and image processing techniques it is expected to provide more information to the physicians to take the accurate decision for better healthcare. The brain tumors can be detected using any one of the imaging modality and further processed by using image processing tools for accurate classification of tumors.

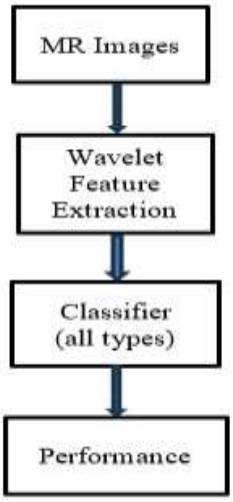

Fig 2 - Flow chart of proposed work

Many researchers have reported various preprocessing algorithms, feature extraction techniques and classification algorithms. The preprocessing should be carried out with an appropriate filter so that the image edges could not be missed. The general block diagram for MRI brain image feature and classification is shown in Figure1. The test MRI images undergo the processes like feature extraction, classification and performance of brain MR images.

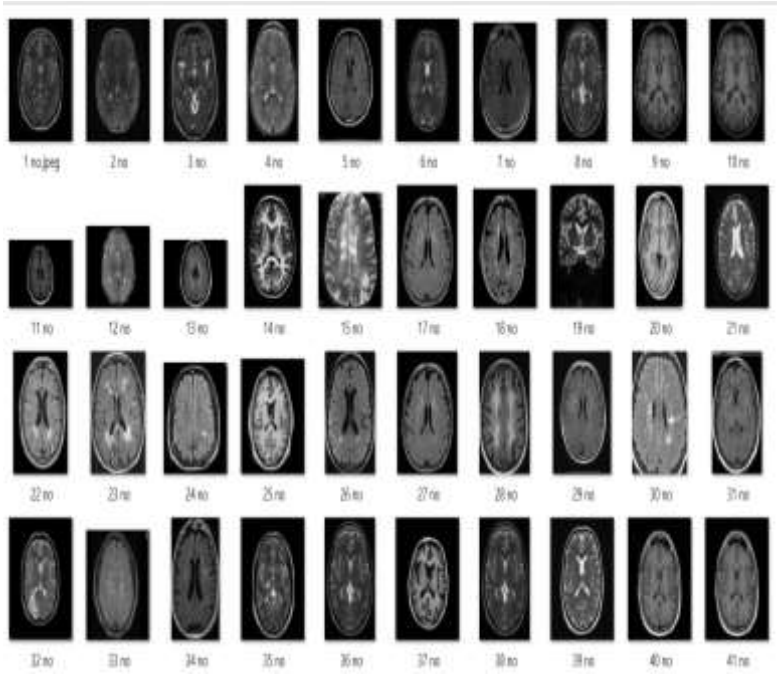

Fig 3 - MRI images with tumor

In the Wavelet Analyzer, choose wavelet coefficient Selection 2D then load an MR Image one after the other, here we used all the wavelet family.

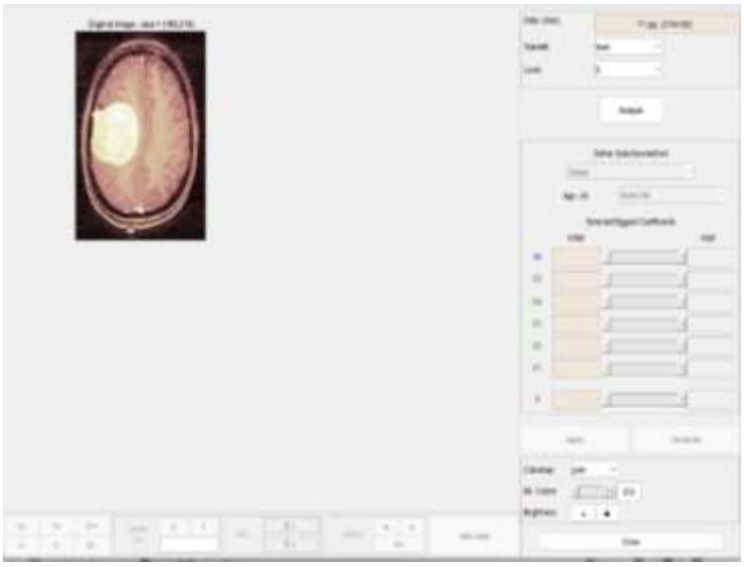

Fig 4 - loading an image

Load the brain tumor MR Images in each wavelet family individually to analyse the image.

A. Wavelet Feature Extraction:

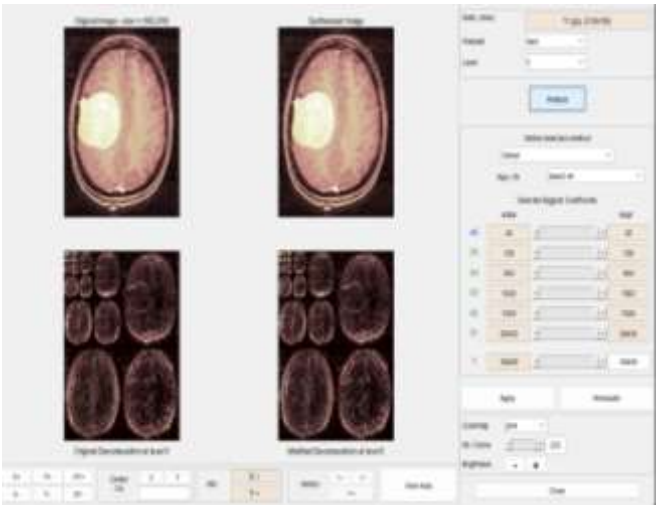

Fig 5 - Analyzing the loaded image

The tool displays its wavelet decomposition below the original image (on the left). The selected coefficients are displayed in the middle of the window, below the synthesized image (which, at this step, is the same since all the wavelet coefficients are kept). There are 11874 coefficients, a little bit more than the original image number of pixels, which is 96x96 = 9216.

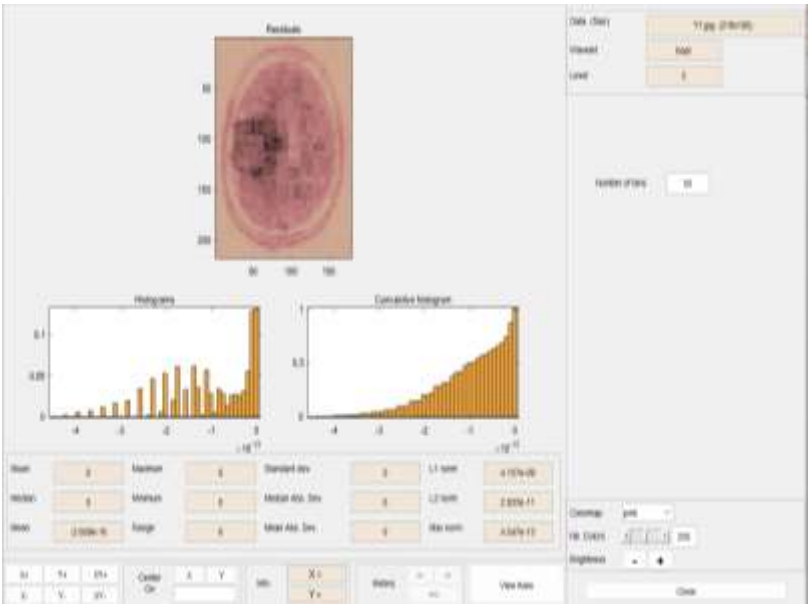

Fig 6 - Graphical picture

B. Classification:

Classification Learner App:

After training multiple models, compare their validation errors side-by-side, and then choose the best model.

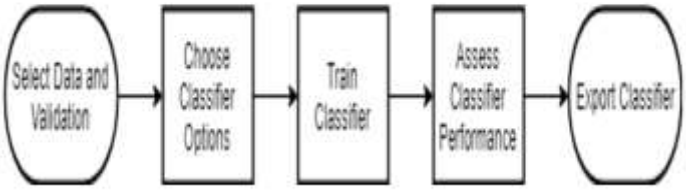

Fig 7- General workflow for training classification models

Classification is a type of supervised machine learning in which an algorithm “learns” to classify new observations from examples of labeled data. To explore classification models interactively, use the Classification Learner app. For greater flexibility, you can pass predictor or feature data with corresponding responses or labels to an algorithm-fitting function in the command-line interface.

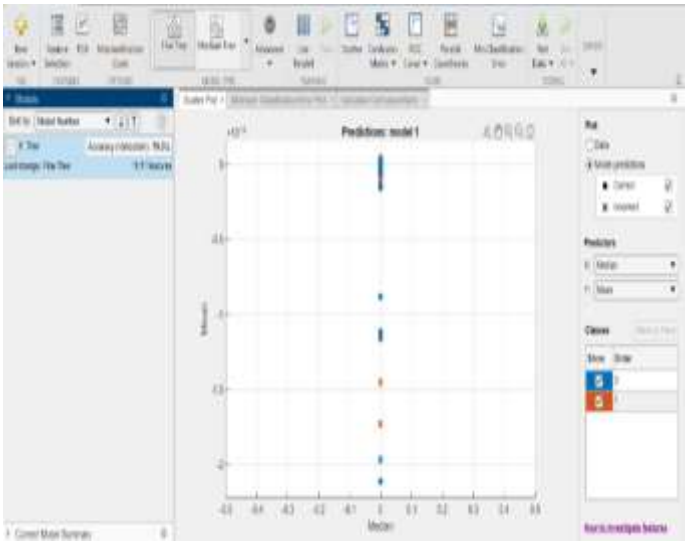

Fig 8 - Scotter plot Graph

After you train a classifier, the scatter plot shows model prediction results. You can show or hide correct or incorrect results and visualize the results by class.

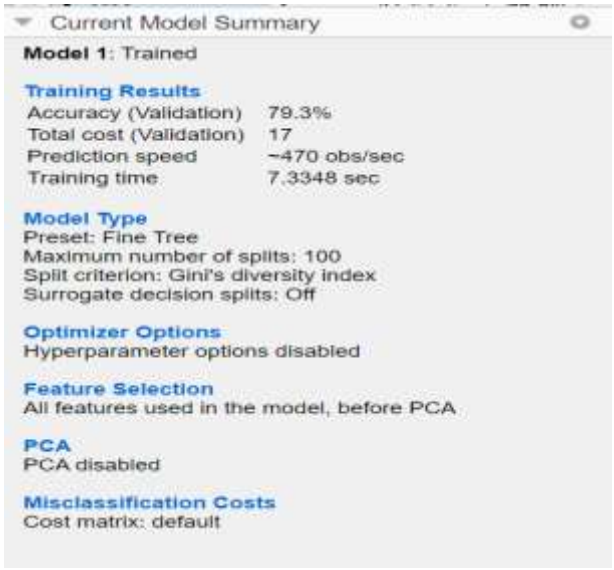

Fig 9 - Trained results

Accuracy is measured by comparing the total number of MRI brain images to the number of total images and calculating the percentage of healthy and tumorous brain tissue that can be reliably predicted. The greatest consideration has been given to determining the optimal value for the evaluation parameter of the estimating classifier. The accuracy of the recommended approach is compared to that of the standard methods.

RESULT

During this research effort, we have measured “Dataset-160 and Dataset-255” MR encephalon pictures. We have worn 2*2 matrix justification method to keep away from above fitting problem.

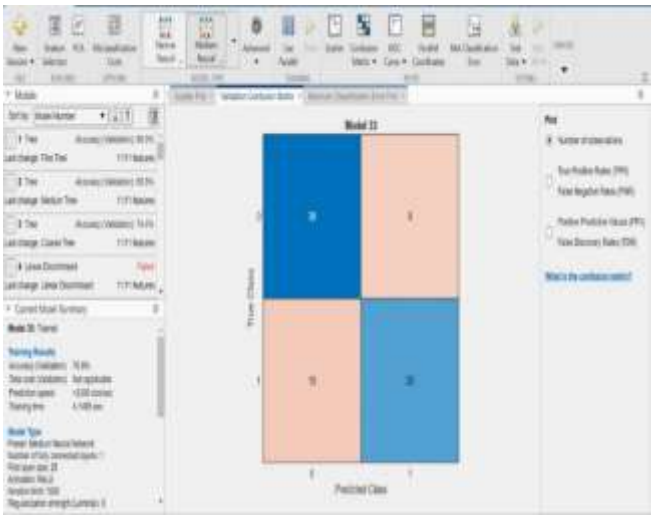

Fig 10 - Sample Screenshot of Result

The proposed method has a high accuracy of 90% compared with the existing methods. The various classifiers are used based on classifier are applied and compared. The results shows that Haar and Daubechies wavelet, result in the highest classification accuracy, proving of capability of wavelet transform feature to be informative in this application.

CONCLUSION

In Conclusion, the high resolution Magnetic resonance imaging (MRI) has become most popular imaging techniques for the technicians and doctors. MRI plays a vital role of acquisition of brain images in the study of biomedical imaging. The work proposed in this thesis provides unique solutions to

detect the brain tumor using a Wavelet Feature Extraction and various classifier techniques and compared. In the conclusion, we can state that Coiflets performed worse as compared to all wavelets performance, classification using Optimizable KNN with the least accuracy 79.76%.

FUTURE SCOPE

Machine learning algorithm based on Wavelet Feature Extraction can be considered as future work for detecting and classification of benign and malignant tumor. The application of machine learning feature less models also be considered for brain tumor classification. The Haar wavelet and Daubechies wavelet are the best performed techniques which forms a high accuracy. Similarly, different "feature reduction" methods can also be used to increase the performance accuracy of the classifiers. Further, different "advanced textures" feature selection can be measured for classification of brain tumors. Optimizable Discriminant, Optimizable SVM and Wide Neural Networks can also be utilized for large dataset of magnetic resonance image.

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