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# Using Transfer Learning, a Mobile Application Detects Brain Tumors

*[1] BHARATH BALAJI.R [1] PRADEPP.K.V*

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## Abstract:

The segmentation, identification, and extraction of contaminated tumour regions from magnetic resonance (MR) images is a serious problem, but it is a time-consuming and labor-intensive operation carried out by radiologists or clinical experts, whose accuracy is totally reliant on their knowledge. As a consequence, using computer-assisted technologies to circumvent these limits becomes more vital. In this study, we looked into Berkeley wavelet transformation (BWT) based brain tumour segmentation to improve performance and reduce the complexity of the medical image segmentation process. Furthermore, relevant properties are extracted from each segmented tissue to improve the support vector machine (SVM) based classifier's accuracy and quality rate. The experimental results of the recommended technique have been examined and validated for performance and quality analysis on magnetic resonance brain pictures based on accuracy, sensitivity, specificity, and dice similarity index coefficient. With 96.51 percent accuracy, 94.2 percent specificity, and 97.72 percent sensitivity, the recommended technique for discriminating normal and diseased tissues from brain MR images was shown to be effective. The results of the testing revealed an average dice similarity index coefficient of 0.82, showing that the automated (machine) extracted tumour area coincided with the manually determined tumour region by radiologists. The simulation results show the relevance of quality parameters and accuracy when compared to state-of-the-art approaches. The main objective is to develop a smartphone app for identifying brain tumours.

**Keywords**— Berkeley wavelet transformation, magnetic resonance, support vector machine

## 1. Introduction (Heading 1)

Tumors will have a significant impact on the brain. Brain cells are killed in the region affected by the tumour, which might lead to brain collapse. The tumor's outcome is determined by its size and location in the brain. The Brain linked every aspect of the body together to create perfect sense. If anything occurs to the brain, our whole system crumbles. Some neurons in the brain do not have the potential to renew, while others cease regenerating as a person ages. If the tumour is in one of the non-regenerative locations, a person may lose one of his or her senses. A person's life may be saved if a tumour is discovered at an early stage. Artificial intelligence is transforming healthcare in a variety of ways, including disease diagnosis through medical imaging, surgical robots, and increasing hospital efficiency. Deep learning has been shown to be more effective than traditional methods in diagnosing illnesses.

✉ *BHARATH BALAJI.R*

from X-rays, MRI scans, and CT scans, which might considerably increase diagnostic speed and accuracy. Tumors are found and identified via a highly skilled medical method. One such procedure is magnetic resonance imaging (MRI). On MRI, we will train and evaluate our model. These photos are fed into the model, which is then trained to identify and pinpoint brain tumours. We concentrated on performance since we were working with very sensitive data, therefore we employed the transfer learning approach to develop a model with great accuracy. Transfer Learning is a Machine Learning approach in which a model is trained and created to do certain tasks and then re-used to perform some other tasks that are vaguely linked to the prior job. It is nothing more than adapting a skill learned in one context to another. When the input data is much less than predicted, Transfer Learning is generally used. In this situation, a fresh model may be unable to detect pattern or identify features, but a pre-trained model may readily learn pattern and identify features. Transfer Learning enables us to begin with previously acquired characteristics and apply that knowledge to the present work.problem. Since we We employed transfer learning to improve accuracy since we had very little data. We utilised a model

(ResNet50) in this study that is an enhanced version of the winner of the 2015 ImageNet competition. This model has 150+ layers, allowing it to identify even the smallest details. In our project, TensorFlow is employed to support Transfer Learning of the CNN pre-trained model. We investigated the CNN architecture in order to identify a mode that can detect and learn brain properties through transfer learning. While testing and modifying network parameters and dataset features. We download the model once it has been trained with the brain MRI dataset in order to use it in the development of a mobile application. A smartphone application is constructed using Flutter in which a brain MRI is routed through the trained model to identify brain tumours. The mobile software may also capture a photo using a mobile camera and transmit it to the model. When a picture is supplied to a model through a mobile application, the model attempts to learn the image's properties in order to identify brain tumours.

## 2. Materials and Methods

Habib [1] utilised an artificial convolutional neural network (ANN) to identify tumours using a brain tumour dataset comparable to the one used in this article. During testing, he scored an accuracy of 88.7 percent. He used a new neural network, which gave him with more precision. In a sequential pattern, the neural network is composed of two max pooling layers and one convolutional 2d (Convo2d) layer. Lin and Chang [2] tracked brain tumour items using K-means clustering techniques and color-based segmentation. K-means clustering groups comparable locations together based on colour. The fascinating element of this article is that they used the K-means method to cluster color-spaced images from greyscale images. The researchers in [4] detected brain cancers using MRI or second resonance imaging. They categorised MRI scans, which was difficult due to the wide range of brain tumour sizes and forms. The two supervised learning algorithms for detecting brain tumours are Decision Tree classifier and Multi-Layer Perceptron. The authors of this research [7] described how misdiagnosis caused by image processing or machine learning affects humans and demonstrated that they never always provide a correct answer or outcome. Other variables must be considered when recognising a brain tumour. They employed an MRI augmentation approach in this article. This is done by feeding photos into the model from multiple angles and viewpoints. This method enables the model to train on a variety of fresh pictures and get high results and scores. They employed a CNN in conjunction with the LinkNet design.

**Convolutional Neural Network (CNN)**

The structure of connections between neurons in convolutional networks was inspired by biological processes in that it conforms to the organisation of the animal visual cortex. It's a technique for extracting and learning characteristics from photographs. Neural networks include convolutional neural networks, which are a kind of neural network (CNN).

They are made up of neurons capable of learning weights and biases. Each neuron gets a large number of inputs, calculates their weighted total, then runs them through an activation function before responding with an output. Many layers of artificial neurons make up convolutional neural networks. Artificial neurons are mathematical functions that compute the weighted sum of several inputs and create an activation value that closely resembles that of biological neurons.

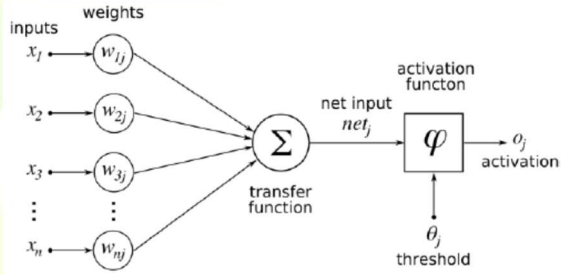


Figure 3.1 CNN

## 3. Discussion

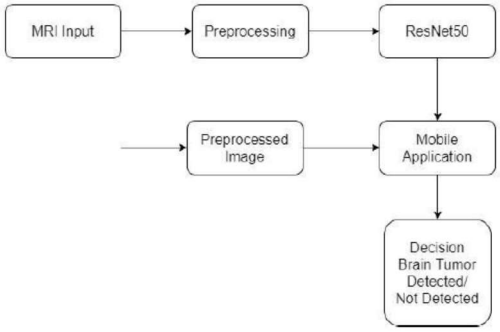


**Figure 2: Architecture Diagram**

. Preprocessing's main purpose is to improve the quality of MR images so that they may be processed further by a human or machine vision system. Additionally, preprocessing aids in the improvement of certain MR image parameters, such as increasing the signal-to-noise ratio, improving the visual appearance of the MR image, removing irrelevant noise and unwanted background parts, smoothing the inner part of the region, and preserving its edges [5].

To improve the signal-to-noise ratio and hence the clarity of the raw MR images, we applied adaptive contrast enhancement based on a modified sigmoid function.

## 4. Conclusion

This method will alter how individuals think about and respond to brain tumours. It is because when individuals can see what is going on in their brain, they will gradually stop seeing brain tumours as a huge concern, even though they are fear kills more individuals than brain tumours. As a result, people's dread is objective. This application will pave the road for your vision to become a reality. Normal individuals may snap a photo to determine whether or not their brain is impacted. The programme is simple and, in layman's terms, anybody can use it. It minimises the number of hospital visits. The customer does not need to be concerned about wrong detection since the model is the best at identifying brain tumours. It either detects brain tumours when they do not exist or misses tumours even in their early stages. At the user's convenience, a second opinion may be provided to the doctor. The model is specialised to detecting brain tumours, as shown by its testing and validation accuracy. For confirmation, the programme displays the chosen picture to the user.

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