International Journal of Research in Engineering, Science and Management
Volume 4, Issue 8, August 2021
https://www.ijresm.com | ISSN (Online): 2581-5792

Application Based Model for End User Detection of Brain Tumor Detection

Arnab Sarkar[1*], Sayan Ghosh[2]
[1]*Department of Computer Science and Engineering, BP Poddar Institute of Management & Technology, Kolkata, India*
[2]*Department of Information Technology, BP Poddar Institute of Management & Technology, Kolkata, India*

***Abstract*: Image segmentation is widely used to detect tumor in MRI scan, if we consider the rich literature in this field we will find that from primitive methods to recent hybrid methods and model. All the model are consider as state of the art models. All techniques are vivid and deals with an extensive dataset. In this paper we are studying the basic segmentation process and the use of those process in field of brain segmentation on MRI scans. This paper not only deals with the basic techniques of image segmentation but also the modified ways and uses of those techniques to get a better view of the knowledge in hand. The study are mostly comparative thus making the study more precise In this paper we also discus about a theoretical hybrid model which incorporate the optimal techniques already present in this field. The paper is also trying to bring the benchmarked algorithm under one roof to compare them with each other and find the best possible model to achieve a higher accuracy. We will find the major points of benchmarked algorithms to formulate an algorithm to remove the short comings.**

***Keywords*: Segmentation, MRI scan, supervised learning, pixels, image segmentation, thresholding, clustering, features extraction, feature selection.**

1. Introduction

For, the last decade computer vision is one of the field which has shown a high potential and promise of development and research area. Image processing[1] emerge as the one of the targeted research trend of previous few years. If we consider image processing it is not only limited to photo graphical images but also bio medical images. Biomedical imaging means capturing of images for therapeutic and diagnostic purpose. Tumor classification is one of the field in computer vision which has taken a large percentage of the research finding. Starting from the basic to deep learning it has made a steady transition through the development of image processing. It's an eminent field where we can still find room for development and research is going on. So, for someone who is new to the field need to understand the pervious and the recent trend of research going on in this field. This paper focus on to the few of the recent development and methodology involved tumor detection in brain MRI scans.

2. Literature Survey

A. *Old Literature*

Considering the rich literature in hand about this research field we can start at the very beginning from region based thresholding method of brain image segmentation which is simple to use without high complexity and a lot of computational capacity. This method dates back to 90's when the field of research was budding. Next on the list is edge based segmentation which could retrieve the information even through weak boundaries. Upgrade the positional accuracy and could be consider over region based segmentation. Though this methodology had many shortcomings like images with too many edges is problematic. Likewise, to mention thresholding based, Back Ground Subtraction, Watershed Model, K-means Segmentation and many more methodology was used at very root of the study.

B. *Recent Literature*

Shedding light onto the recent literature use of deep learning is vastly use to study brain MRI's. Addition of GPU and high end system and server support has led to high volume of research material leading to the use of deep neural network (more than 5 layers) and which are much better methodology considering the old literature in hand.

There are also researchers who perform brain tumor classification by combining the deep learning concept with other methods. For instance, Mohsen et al. (2018) used deep neural network (DNN) classifier combined with discrete wavelet transform (DWT) and principal component analysis (PCA) to classify brain MRI images into four classes as normal brain, glioblastoma, sarcoma and metastatic bronchogenic carcinoma tumors. The accuracy rate was found to be 96.97%. Khan et al. (2020) proposed a deep learning method for classification of brain tumors into cancerous and non-cancerous using 253 real brain MRI with data augmentation. They used edge detection to find the region of interest in MRI image prior to extracting the features by a simple CNN model. They obtained 89% classification accuracy. In 2019, Kabir Anaraki et al. (2019) proposed CNN and genetic algorithm (GA)-based method to noninvasively classify different grades of glioma using MRI images. They achieved an accuracy of 90.9% for

*Corresponding author: arnabsarkar505@gmail.com

classifying three glioma grade and accuracy of 94.2% for glioma, meningioma and pituitary tumor types. Ertosun and Rubin (2015) developed a deep learning pipeline with ensemble of CNN for the problem of classification and grading of glioma from pathology images. Their method was considered quite successful in cases of lack of data, which is a common problem in the domain of deep learning approaches. They achieved 96% accuracy for HGG vs. LGG classification task and 71% accuracy for LGG Grade I versus LGG Grade II classification task.

Researchers and readers who are interested in further papers on brain tumor classification using CNN can examine the following review articles (Litjens et al. 2017; Lotan et al. 2019; Muhammad et al. 2021; Shaver et al. 2019; Shirazi et al. 2020; Tandel et al. 2019; Tiwari et al. 2020), which are very rich resources on this topic.

3. General Model

Various algorithm, methodology use various technique of image segmentation to determine whether there is a tumor present inside a brain or not taking a MRI scan as input. The above mentioned techniques are all benchmarked techniques known to researcher and most of the new techniques as mentioned like fuzz k-means, modified k-means compare their test results accuracy with the mentioned algorithm. No doubt that the mentioned algorithms and techniques are one of the best and also the upcoming techniques are considered to set the bar higher and higher every time. Keep all these mind and looking at the big picture there is a very urgent need of model which can incorporate the best techniques and can predict a very accurate result which will be a strong and beneficial asset to medical field.

We often talk of situation where a patient is suffering headache is prescribed a MRI scan which procedure is very easy and readily available but difficult part is an available doctor which can diagnose the MRI scan to detect whether there is a tumor or not and if the tumor is there is it rapidly growing and or it is malignant. A delay in the diagnosis and treatment or medication resulted a vital game changer during the long run of treatment and sometime lead to fatality. Another aspect which comes to mind that should be illuminated when the model is construct is that a MRI scan is matter of subject that can change. A MRI scan be taken by a new machine and by old machine can be very different in respect to information loss so we need to consider the pre posing part very thoroughly. There is another reason for preprocessing most of the MRI scans are magnetic imaging techniques to there is high chances of noises so noise removal using various filter is must so a preprocessed scan will also be generated when incorporate the model.

So, keeping all these mind we are trying to formulate a general model which can make the mentioned complication go away. To understand the model, take a scenario a patient living far from a nearest city and only has the opportunity for just a MRI Scan. Now, the center provides the patient with a raw digital image and MRI scan plate which the patient can to the nearest decent hospital in two days and a doctor's appointment will be provided to the person in couple of days which cumulates to four or five days at least. The time wasted will be very critical if the tumor is growing at a rapid pace or is at the final stages. To avoid all the commotion, we will apply our model to work at very efficient way.

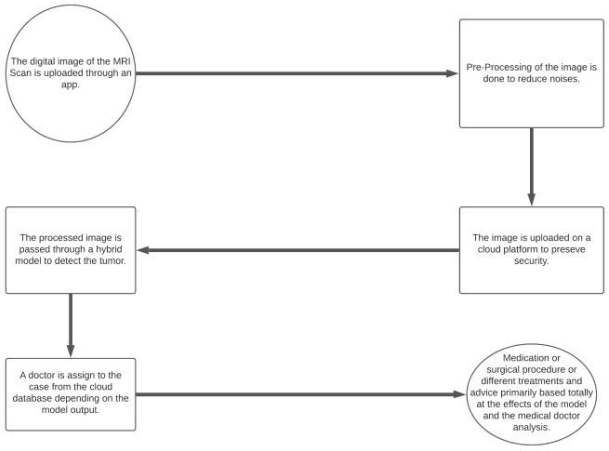

Fig. 1.

4. Parameters

The above mentioned model will be only beneficial if we keep in mind few of the parameters. As, mentioned there are many step involved and each step and process is dependent on an external entity so parameters become a real point of concern while testing the accuracy of the model. So, there are the parameter listed below which will affect the accuracy of the model.

A. Image quality

As the whole model is based on the input image so it is very important that the image that is uploaded to the cloud base is of best quality. Now when a MRI scan is done an image is created and generally a plate is provided which is later on examined by the doctor. In our case it might happen that some took an image (a simple snap or photo click) of the plate and uploaded through the app, this will be a disaster for the model. Firstly, the resolution of the image is changed a normal scan has a very unique resolution and a snap or a photo click will have a very different resolution. Change in the resolution will result to complete new set of features more over reduction of features (i.e. size of the tumor, finer details) or total loss of few features resulting to a very different outcome. Secondly a snapped image might be blurred, bloated or hazy which will be difficult to determine the tumor correctly or even detect a tumor at all.

B. Techniques incorporated

Preprocessing is very important step as regarded in the above mentioned model. But, pre-processing is important but choosing right method for pre-processing is also important. One of the pre-processing technique is choosing a filter to clean the image from unwanted noises. Now there are many filters that can be applied on an image but we have to choose a filter which is best suited for the scans. For our method we will be using mostly Gaussian, median and adaptive filters as the images are magnetic in nature.

Leaving apart the pre-processing the model also has to choose techniques which will isolate the tumor and also detect whether it is malignant or not. Whichever hybrid model we choose the model has to have a very high accuracy that should be our first priority keeping time taken by the model into consideration. We consider also it as challenge which is discussed later.

C. Strong Cloud base

As mentioned above the whole hybrid model is a tad bit complicated and involve many sub steps so there will be a good computational time required for the whole model to generate the desired results which also include finding the best available doctor from the database. All of the discussed model in our literature were built on isolated high end system using a programing platform or simulation platform. In our case or developed model will be uploaded to a cloud or a domain which can handle high complexity computation. This setup is important because of mainly two reason. As the end user or patient will directly upload the mri scan using the app associated with the model we have to store it in a cloud so pit is easily available to the user. Next when the particular medication is advised or a doctor is assigned to the case that will also be automatic and real time which again can only achieve through a cloud based server.

Another thing we have to keep in mind that as the whole model is cloud base and involve lot of step we need to keep the complexity of the algorithm chose to the minimum so that the total complexity can be reduced.

The basic question arises is that can't the whole model be local system based or it is to necessary to use a cloud to do the processing. Moreover, whichever algorithm is considered are local system based so if we are designing a model why we are emphasizing on a cloud base model. The answer is simple the configuration of a localized system might be of different or cannot handle the computational load of the model or the time required by different localize computers may vary drastically. So, avoid this mishap of complexity we prefer it to move to a cloud. Other than mentioned challenge there are few other challenges that we can be easily get rid of by using a cloud base server. One is that the dataset over the time will get large which will be used by the model to enhance the accuracy and case assignment is another aspect which can't be achieve by localized machine.

D. Case Assignment

Cases when assigned should evenly distributed but also kept in mind that a case or doctor should not be left out.

The end step of the model is to choose the best fit available doctor from the provided database or assign a doctor to the case for medication and surgery purpose.

5. Challenges

A. Model should be accurate

The model has to be very accurate we cannot consider a model with an accuracy of 60% it has to have an accuracy more than 95%. To achieve a high accuracy like this is a daunting task on every step we have to optimize and find out the best result selecting filters, features, algorithm etc. which high level of accuracy is an upmost priority and making them work in a synchronous way is also difficult.

B. Speed of processing

Processing of the image should be very fast and the result should provide at high speed as time becomes one of the major factor during medication and surgery. To generate a model with a very high accuracy and speedy is again a challenge in hand.

New and unseen case study will create difficulties. In 1% of the data provided to the model we will find that scan is very much unique and will be seen or tested by the model for the first time at this moment getting an accuracy is biggest question that is pose by the model as the model does not has that learning pattern in it's inventory to detect the scan.

C. Security

Whatever data our proposed hybrid model is developing or dealing with is highly sensitive and also classified subjected for a patient. We have to keep our utmost priority to keep the data safe from hackers and other intruders. We have to also make sure that data doesn't reach the wrong hand or end up in the wrong destination.

6. Conclusion

This paper presented an overview on application based model for end user detection of brain tumor detection.

References

[1] S. S. Hunnur, A. Raut and S. Kulkarni, "Implementation of image processing for detection of brain tumors," 2017 International Conference on Computing Methodologies and Communication (ICCMC), 2017, pp. 717-722.

[2] A. A. Reddy and B. N. Chatterji, "A new wavelet based logo-watermarking scheme," Pattern Recognition Letters, vol. 26, pp. 1019-1027, 2005.

[3] Chavan, Nikita V., B. D. Jadhav, and P. M. Patil. "Detection and classification of brain tumors." International Journal of Computer Applications 112.8 (2015).

[4] Sujji, G. Evelin, Y. V. S. Lakshmi, and G. Wiselin Jiji. "MRI brain image segmentation based on thresholding." International Journal of Advanced Computer Research 3.1 (2013): 97.

[5] H Tang, E.X Wu, Q.Y Ma, D Gallagher, G.M Perera, T Zhuang, MRI brain image segmentation by multi-resolution edge detection and region selection, Computerized Medical Imaging and Graphics, Volume 24, Issue 6, 2000, pp. 349-357,

[6] Juang, Li-Hong, and Ming-Ni Wu. "MRI brain lesion image detection based on color-converted K-means clustering segmentation." Measurement, 43.7 (2010): 941-949.

[7] Badran, Ehab F., Esraa Galal Mahmoud, and Nadder Hamdy. "An algorithm for detecting brain tumors in MRI images." The 2010 International Conference on Computer Engineering & Systems. IEEE, 2010

[8] E. F. Badran, E. G. Mahmoud and N. Hamdy, "An algorithm for detecting brain tumors in MRI images," The 2010 International Conference on Computer Engineering & Systems, 2010, pp. 368-373.

[9] Ramesh, S., S. Sasikala, and Nirmala Paramanandham. "Segmentation and classification of brain tumors using modified median noise filter and deep learning approaches." Multimedia Tools and Applications 80.8 (2021): 11789-11813.

[10] Nabizadeh, Nooshin, and Miroslav Kubat. "Brain tumors detection and segmentation in MR images: Gabor wavelet vs. statistical features." Computers & Electrical Engineering 45 (2015): 286-301.

[11] Parisot, Sarah, et al. "Graph-based detection, segmentation & characterization of brain tumors." 2012 IEEE Conference on Computer Vision and Pattern Recognition. IEEE, 2012.

[12] Kaus, M. R., Warfield, S. K., Nabavi, A., Black, P. M., Jolesz, F. A., & Kikinis, R. (2001). Automated segmentation of MR images of brain tumors. Radiology, 218(2), 586-591.

[13] Wen, Patrick Y., et al. "Medical management of patients with brain tumors." Journal of neuro-oncology 80.3 (2006): 313-332.