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Review of Various Brain Tumor Detection Techniques with Machine Learning

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Abstract: ***In the existing paper, weight based algorithm is used to classify the normal and cancer cells and it is been analyzed that weight based algorithm taken long time to classify the data. To classify the data in minimum amount of time HMM classifier is used for classification. The second issue with weight based algorithm is of accuracy. As due to weight calculation accuracy of classification is less which can be improved with the use of Bayesian classifier In the feature selection part on three features are used which are mass, density and margin . In the improvement more features like tissue color will be added which improve detection rate. The techniques which are already proposed are reviewed in this paper. The already proposed techniques are reviewed in terms of technique, advantages, disadvantages and outcomes.***
KEYWORDS: Segmentation, Feature Extraction, Classification, Brain tumor

Introduction

Neural networks are a set of algorithms, modeled freely after the human cerebrum, that are intended to perceive patterns. They decipher tangible data through a sort of machine perception, naming or clustering raw input. The patterns they perceive are numerical, contained in vectors, into which all real-world data which may be the images, sound, text or time series, which must be translated. Artificial neural networks hold just a little measure of this complexity and utilize simpler neurons and associations, yet keep the idea of local computation. Various network architectures are utilized, ordinarily with hundreds or thousands of adjustable parameters [1]. The resulting condition forms are sufficiently general to unravel a large class of nonlinear classification and estimation problems and sufficiently complex to hide a multitude of sins. One advantage of the network representation is that it can be implemented in enormously parallel PCs with every neuron at the same time doing its

calculations. Profound learning maps inputs to outputs. It discovers correlations. It is known as a "universal approximator", in light of the fact that it can learn to surmised the function f(x) = y between any input x and any output y, accepting they are connected through correlation or causation by any means. In the process of learning, a neural network finds the correct f, or the right manner of transforming x into y. profound learning can play out various tasks. There is a need to grow such systems which learn from their experience since idea behind Neural Networks is learning [2]. There are three types of learning in ANN; supervised, unsupervised and reinforced. Before executing, the network is trained, tested lastly implemented. In supervised learning, input and also output is given to the network. All classification tasks rely on named datasets; that is, humans must exchange their insight to the dataset all together for a neural to learn the correlation amongst labels and data. This is known as supervised learning. Clustering or grouping is the detection of similarities. Profound learning does not expect labels to detect similarities. Learning without labels is called unsupervised learning. Unlabeled data is the majority of data in the world. One law of machine learning is: the more data a calculation can train on, the more precise it will be. The term "tumor," which truly implies swelling, can be connected to any pathological process that produces a lump or mass in the body [3]. Tumors are a major manifestation of an immense and varied group of diseases called neoplasms or all the more regularly cancers. Be that as it may, numerous different diseases, for example, infections can produce tumors, and they are a source of confusion in imaging diagnosis. Cerebrum tumors can divided by the place of creation to primary and secondary tumors. People with tumors or potential tumors are imaged for detection, classification, staging, and correlation. Detection can be subdivided into diagnosis, case finding, and screening, contingent upon the level of suspicion. People referred diagnosis, since they have signs and symptoms of cancer are noted. MR imaging is utilized to identify tumor put, yet ordinarily it is hard to determine the sort of tumor with visual observation as it were. Using ANN, help in diagnoses due to its capacity to determine all correlations and variances between pixels in the image [4]. Image segmentation alludes to the process of partitioning a digital image into various sections i.e. set of pixels, pixels in a region are comparative as per some homogeneity criteria, for example, shading, intensity or surface, in order to locate and identify objects and boundaries in an image [5].

Steps of Brain Tumor Detection

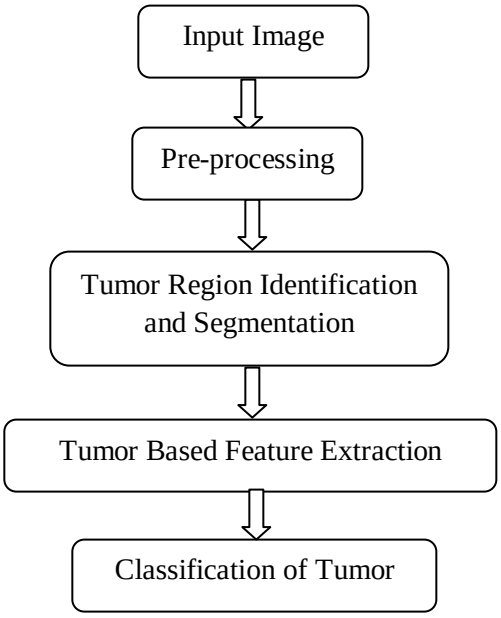

Figure 1: Basic Steps for Brain Tumor Detection

A. Preprocessing of an Image: This is the first step of image processing it is used to enhance the chances of detecting the suspicious region. Finer details of the image are enhanced and noise is removed from the image. Clinical MRI when

corrupted by noise reduces the accuracy of the image. Various filters are used to remove this noise. Anisotropic filter is used to remove background noise, weighted median filter is used to remove salt and pepper noise. Wavelet based de-noising method makes wavelet and scaling coefficient biased [6].

B: Segmentation methods: Image segmentation is the method of breaking down an image into small parts. Segmentation is performed to make the analysis easier. There are following types of image segmentation.

i. Boundary approach or Thresholding: It is the most commonly used segmentation method. In the thresholding method the gray image is converted to binary image . After thresholding the image has segmented into two values 0 and 1.

ii. Edge approach: In edge-based segmentation method, the detected edges in an image are assumed to represent object boundaries and used to identify these objects. Edge based segmentation very rarely gives the absolute distinct and closed boundaries needed for a direct segmentation. Chances are more that false edge detection and many of the times it requires edge linking to join the partial edges into an object boundary [7].

iii. Region approach Region based approach depends on the assumption that the bordering pixels within one region have similar values. It focuses on finding object region instead of its edges. It compares one pixel with its neighbors, if the congruence criteria satisfies then the pixel can be set to belong to the cluster as one or more of its neighbors. Different clustering algorithms are used in this type of approach.

- K-means algorithm: K-means algorithm is widely used clustering technique. Which is also known as hard clustering algorithm, it partitions a given dataset into c or k clusters. This algorithm is simple fast and robust to implement. It has some disadvantages as it may not be successful to find overlapping clusters and it also fails to cluster noisy data and non-linear datasets.
- Fuzzy clustering Fuzzy clustering also known as soft clustering. In this an object is a member of a single cluster as well as a member of many clusters. That is, objects which are located on the boundaries of the clusters are not forced to belong to a certain cluster, rather they can be member of many clusters.
- Genetic Algorithms GA and it's many versions are well received in academe and industry because of its advantages such as it is ease of implementation, ability to solve higher nonlinearities and it's intuitiveness. GA has three main operators as recombination, mutation and selection operator.

C. Feature Extraction: Extracting the exact tumor is a crucial task in case of brain tumor because of the complex structure of brain. Certain parameters are taken into account for feature extraction as size, shape, composition, location of the image.

As per the results obtained from the feature extraction the classification of the tumor is done.

Literature Review

Michele Tonutti, et.al, (2017) proposed a new approach to infer a patient-particular deformation model for brain pathologies by consolidating the results of pre-computed finite element method (FEM) simulations with machine learning calculations. The models can be computed immediately and offer an accuracy comparable to FEM models [8]. The models can predict the position of the nodes with errors below 0.3 mm, past the general threshold of surgical accuracy and appropriate for high fidelity AR systems. The SVR models perform superior to the ANN's, with positional errors for SVR models reaching under 0.2 mm. The results represent an improvement over existing deformation models for real time applications, giving smaller errors and high patient-specificity. The proposed approach addresses the current needs of image-guided surgical systems and can possibly be employed to model the deformation of a soft tissue.

Kazemi K., et.al, (2014) presented performance evaluation of three generally utilized brain segmentation software packages SPM8, FSL and Brainsuite [9]. The calculated similarity between the segmented tissues utilizing different tools and corresponding ground truth demonstrates variations in segmentation results implemented in SPM8-VBM toolbox. A couple of studies has investigated GM, WM and CSF segmentation. In these studies, the skull stripping and bias correction are performed separately and they just evaluated the segmentation. Consequently, in this study, evaluation of finish segmentation

framework comprising of pre-processing and segmentation of these packages is performed. The achieved results can assist the clients in choosing an appropriate segmentation software package for the neuroimaging application of interest.

Kanwarpreet Kaur, et.al, (2016) presented a method for recognizing the tumor influenced images from the normal ones from the database. The procedure includes preprocessing, segmentation, highlight extraction and classification [10]. Ensemble based classification is finished utilizing neural system. The area of abnormal portion is likewise computed. The proposed system helps in simple diagnosis of normal and abnormal brain. It turns out to be accurate for accessible databases. The area for the abnormal portion is likewise accurately calculated. GUI being easy to use can be utilized by anybody for the classification purpose. Further, the PET sweeps can likewise be utilized for the detection and classification purpose.

Smita.A.Nagtode, et.al, (2016) proposed brain tumor detection and classification utilizing discrete wavelet transform and Probabilistic neural system. Exploiting wavelet transform use in confront recognition and its proper outcomes, this Gabor Wavelet approach can be utilized as a part of other image studies, for example, practical images [11]. The proper study of Basic brain images is of tremendous significance in the early detection of brain inconsistency and disorder, as they give imperative detached information in the brain. In this paper, a two dimensional Gabor wavelet analysis application for brain images, for early identification of tumor and a method for brain tumor classification, where images are classified into non-cancerous (benign) brain tumor and cancerous (malignant) brain tumor. The system can be intended to recognize and classify alternate types of tumors too with couple of changes.

D. Sridhar, et.al, (2013) proposed another method for Brain Tumor Classification utilizing Probabilistic Neural Network with Discrete Cosine Transformation. The regular method for computerized tomography and magnetic resonance brain images classification and tumor detection is by human inspection. Operator assisted classification methods are impractical for a lot of data and are additionally non reproducible. Computerized Tomography and Magnetic Resonance images contain a noise caused by operator performance which can prompt serious inaccuracies in classification [12]. The utilization of Neural Network systems indicates great potential in the field of medical diagnosis. The proposed method gives quick and better recognition rate when compared to past classifiers. The principle advantage of this method is its high speed processing ability and low computational requirements.

G. Kharmega Sundararaj, et.al, (2014) developed another approach for programmed classification of brain tumor in CT images. The proposed method comprises of four stages specifically preprocessing, include extraction, and highlight reduction and classification [13]. The acquired experimental are evaluated utilizing the metric similarity record (SI), cover fraction (OF), and extra fraction (EF). For comparison, the performance of the proposed method has fundamentally improved the tumor detection accuracy with other neural system based classifier. Classification rate is over 94% in case of Linear SVM and 92% in case of k-NN. A similar method can be intelligently extended to different types of CT images too. The stated results demonstrate that the proposed method can make an accurate and strong classifier.

Yi Feng Wu, et.al, (2015) studied that based on the Ogden model and the Levenberg-Marquardt nonlinear advancement calculation, a professional method that can realize the comprehensive fitting of the uniaxial tension, biaxial tension, planar tension and straightforward shear experimental data of rubbers was developed. The test data from Treloar was fitted exceptionally well, and the determined parameters by utilizing this method were proved to be right and practical in the numerical verification in ANSYS [14]. At that point, the constitutive model of the hyper-viscoelastic materials which combines the Ogden model with the summed up Maxwell model was explained in detail and the parameter identification calculation was proposed based on the integration of the relaxation modulus.

Table of Comparison

Authors Names	Year	Technique	Advantages	Disadvantages	Outcomes
Michele Tonutti, et.al,	2017	A new approach was proposed to infer a patient-particular deformation model for brain pathologies by consolidating the results of pre-computed finite element method (FEM) simulations with machine learning calculations.	The SVR models perform better than the ANN's, with positional errors for SVR models reaching under 0.2 mm.	The programming environment of MATLAB is slower.	The proposed approach addresses the current needs of image-guided surgical systems and can possibly be employed to model the deformation of a soft tissue.
Kazemi K., et.al,	2014	In this study, evaluation of finish segmentation framework comprising of pre-processing and segmentation of these packages is performed.	The accuracy of the segmented GM, WM and CSF and the robustness of the tools against changes of image quality has been assessed using Brainweb simulated MR images and IBSR real MR images.	The comparisons made were very limited which did not show the accurate outcomes of proposed approach.	The achieved results can assist the clients in choosing an appropriate segmentation software package for the neuroimaging application of interest.
Kanwarpreet Kaur, et.al,	2016	A method was proposed for recognizing the tumor influenced images from the normal ones from the database.	The area for the abnormal portion is also accurately calculated. GUI being user friendly can be used by anyone for the classification purpose.	The PET sweeps were not utilized for the detection and classification purpose.	The proposed system helps in easy diagnosis of normal and abnormal brain. It proves to be accurate for available databases.
Smita.A.Nagtode, et.al	2016	Exploiting wavelet transform use in confront recognition and its proper outcomes, this Gabor Wavelet approach can be utilized as a part of other image studies, for example, practical images	It effectively classifies the tumor types from MRI brain images taken under different clinical positions and technical state, which were able to show high variations that clearly specify the abnormalities and affected area with brain disease.	Limited number of patient's data and samples of image were used to test the proposed method.	The system can be intended to recognize and classify alternate types of tumors too with couple of changes.

D. Sridhar, et.al,	2013	Another method for Brain Tumor Classification utilizing Probabilistic Neural Network with Discrete Cosine Transformation was proposed.	For generalization, the proposed method should achieve 100% Recognition rate on other Brain Tumor image databases and also on other combinations of training and test samples.	Only 5 classes of Brain tumors are considered in this research.	The proposed method gives quick and better recognition rate when compared to past classifiers.
G. Kharmega Sundararaj, et.al	2014	Another approach was proposed for programmed classification of brain tumor in CT images. The proposed method comprises of four stages specifically preprocessing, include extraction, and highlight reduction and classification.	The classification performances if this study shows the advantages of this technique: it is rapid, easy to operate, non-invasive and inexpensive.	The overall accuracy of proposed system is less.	Classification rate is over 94% in case of Linear SVM and 92% in case of k-NN. A similar method can be intelligently extended to different types of CT images too.
Yi Feng Wu, et.al,	2015	Based on the Ogden model and the Levenberg-Marquardt nonlinear advancement calculation, a professional method that can realize the comprehensive fitting of the uniaxial tension, biaxial tension, planar tension and straightforward shear experimental data of rubbers was developed.	The method for identifying parameters in Ogden model proposed in this paper is practical and efficient.	Only limited samples were used to perform the simulations.	At that point, the constitutive model of the hyper-viscoelastic materials which combines the Ogden model with the summed up Maxwell model was explained in detail and the parameter identification calculation was proposed based on the integration of the relaxation modulus.

Conclusion

In this work, it is been concluded that to detect breast cancer various techniques has been proposed in the previous times. The most efficient technique of breast cancer detection is based on morphological scanning, split and merge segmentation and on nearest neighbor classifier. In this work, to improve efficiency of the breast cancer detection nearest neighbor classifier is replaced with HMM classifier. The split and merge segmentation will split the input image on the basis of their properties. The output of split and merge segmentation is given as input to HMM classifier which will classify the features of the basis of their properties. The cancer and non cancer cells are marked with different colors.

References

[1] Tzourio-Mazoyer, N., Landeau, B., Papathanassiou, D., Crivello, F., Etard, O., Delcroix, N., Mazoyer, B., Joliot, M., "Automated anatomical labeling of activations in SPM using a macroscopic anatomical parcellation of the MNI MRI single-subject brain", 2002, NeuroImage, 15 (1), 273–289.
[2] Van Dijk, K. R. A., Hedden, T., Venkataraman, A., Evans, K. C., Lazar, S. W., Buckner, R. L., "Intrinsic functional connectivity as a tool for human connectomics: Theory, properties, and optimization", 2010, Journal of Neurophysiology 103 (1), 297–321.
[3] Y. Zhang, E. Londos, L. Minthon, C. Wattmo, H. Liu, L.O. Wahlund, "Usefulness of computered Tomtgraphy linear measurements in diagnosing Alzheimer's disease", 2008, Acta Radiol, vol. 49(1), pp.91-97.
[4] A.R. Oksengaard, M. Haakonsen, R. Dullerud, K. Engedal, K. Laake, "Accuracy of CT scan measurements of the medial temporal lobe in routine dementia diagnostics", 2003, International Journal of Geriatric Psychiatry vol. 18, pp.308-312.
[5] Rueda, M. R., Posner, M. I., Rothbart, M. K., "The development of executive attention: Contributions to the emergence of self-regulation", 2005, Developmental Neuropsychology 28 (2), 573–594.
[6] Sorg, C., Riedl, V., Mhlau, M., Calhoun, V. D., Ler, T. E. L., Drzezga, A., Kurz, H. F. A., Zimmer, C., Wohlschlger, A. M., "Selective changes of resting-state networks in individuals at risk for Alzheimer's disease", 2007, Proceedings of the National Academy of Sciences of the United States of America 104 (47), 18760–18765.
[7] Stam, C. J., "Modern network science of neurological disorders", 2014, Nature Review Neuroscience, 15 (10), 683–695.
[8] Michele Tonutti, Gauthier Gras, Guang-Zhong Yang, "A machine learning approach for real-time modelling of tissue deformation in image-guided neurosurgery", 2017 Elsevier B.V. All rights reserved.
[9] Kazemi K., Noorizadeh N., "Quantitative Comparison of SPM, FSL, and Brainsuite for Brain MR Image Segmentation", 2014, J Biomed Phys Eng 4(1).
[10] Kanwarpreet Kaur, Gurjot Kaur, Jaspreet Kaur, "Detection of Brain Tumor using NNE Approach", 2016, IEEE International Conference On Recent Trends In Electronics Information Communication Technology.
[11] Smita.A.Nagtode, Bhakti B. Potdukhe, Pradnya Morey, "Two dimensional Discrete Wavelet Transform and Probabilistic Neural Network used for Brain Tumor Detection and Classification", 2016, IEEE.
[12] D. Sridhar, Murali Krishna, "Brain Tumor Classification U sing Discrete Cosine Transform and Probabilistic Neural Network", 2013 International Conference on Signal Processing, Image Processing and Pattern Recognition [ICSIPR].
[13] G. Kharmega Sundararaj, Dr. V. Balamurugan, "Robust Classification of Primary Brain Tumor in Computer Tomography Images Using K-NN and Linear SVM", 2014, IEEE.
[14] Yi Feng Wu, Ai Qun Li and Hao Wang, "Parameter identification of hyperelastic and hyper-viscoelastic models", 2015, Advances in Structural Engineering and Mechanics (ASEM).

