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Image Processing for Identifying Brain Tumor using Intelligent System

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ABSTRACT :- MRI is the technique that uses X-ray equipment to produce detailed images of section inside the human body. MRI Scanning is very beneficial for detecting the diseases like cancer, tumors etc. in human body. But, the system noise during testing, the effect of spatial similar regions in the image makes it difficult to detect the actual region for diagnosis leading to miscalculations. The objective of the proposed research is to develop a robust recognition system, developing a new algorithmic approach to overcome the effect of de-noising and de-blurring of MRI images, increase the sensitivity and reduce the time for analysis.

KEYWORDS :- MRI, filtration, Morphological approach, Gabor Wavelet, fuzzification.

I INTRODUCTION

MRI has got significant role in medical field for detecting and analyzing diseases. MRI is used to examine the chest, Kidney, Tumor, Cancer, Injuries, Bond, Joints, Bleeding, Blood Vessels etc. MRI provide detailed cross sectional views of all types of tissue in our body, this makes easier to diagnose. But, Many MRI suffer from deterioration in the quality of the image because of noise, blur deficiency. These two factors makes difficult to analyze. Analysis of MRI is very essential to take decision. Bad analysis result in wrong decision, which results failure in detection. Removing noise and blur is very crucial. Researchers have been working for decades on removal of noise and blur from MRI images.

Image noise is random pixels scattered all over the regions of image. Source of noise and blur comes from movement of cameras and poor illumination when capturing the image or object movement during capturing the image. Noisy images provide less information. Removing noise and blur is big challenge in image reconstruction. Most of the algorithms have disadvantage of information loss like, edge information, small spatial structures etc. Preserving edges and small spatial structures in MRI is a challenging task for researchers for Identification of tumors, cancer cells or small injuries. Various types of filtering techniques are used as de-noising tool such as wavelet based filtering (43, 44, 45, 46), median filtering (47) etc. all the researchers goal is to achieve high efficiency and accuracy in the performance of algorithm.

The proposed research is aimed to provide more accurate algorithm that increase the sensitivity & reduce the time of analysis.

II REVIEW OF THE EXISTING SYSTEMS

In the approach of medical diagnosis, automated processing is in greater demand. Due to higher level of observation and large factor of analysis for disease detection, time for diagnosis is increasing. As well the accuracy of radiologist detection is more dependent on the expertization of the individual. The constraint of resources, manpower and time of diagnosis, automated systems are to be developed. Among various analysis of medical scan information, MRI analysis for brain tumor detection is observed to be an upcoming work. Automation of brain tumor detection helps in the preliminary diagnosis, and faster decision making. Wherein automated systems are having an advantage of time saving

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diagnosis, the accuracy of detection and complexity of coding is still a concern of development. Various researchers are focusing on the development of automated brain tumor detection based on advanced image coding and signal processing techniques. To improve the accuracy in such coding, artificial intelligence are been incorporated. Towards such coding, in [1,39] a magnetic resonance spectroscopy (MRS) in the assessment of brain tumors and grading brain glioma, was presented. In this approach a Pathology grading was correlated with metabolic ratios for the decision of brain glioma. In [2] a model was applied to distinguish normal brain tissue from brain metastases and to identify the primary tumor of brain metastases in 15 independent test images. The developed approach, demonstrates that significance of using magnetic resonance spectroscopy (MRS) for the diagnosis of tumor information in MRI diagnosis. A report on the new quality-improvement opportunities as well the further objectives for MRI analysis was outlined [3].

For the cause of tumor formation and defects observed in such case, in [4] a study for the determination of onset characteristics during tumor development was presented. The stage representation of tumor developments leads to the accurate training of the diagnosis system. In [5], an extensive comparative analysis was performed to illustrate the merits and demerits of various available techniques for automated diagnosis. It also explores the applicability of the techniques in brain disorder diagnosis in MR images. [6,42,36] presents a review of the existing methods to incorporate spatial dependency into the computation of mutual information (MI). A spatially dependent similarity measure was introduced, named spatial MI, which is extended to 3-D brain image registration. This extension eliminates the artifact for translational and misregistration process. In [7,26] Articles relating to application of ultrahigh field (UHF) MRI to brain anatomy and brain tumors with living subjects were presented. Studies were grouped into one of three categories based on area of focus: "Anatomical Structures Involved with Brain Tumors," "Tumor characterization," and "Treatment Monitoring." The process of segmentation using watershed algorithm was outlined in [8].

The method illustrates the ability of watershed segmentation to separate the abnormal tissue from the normal surrounding tissue. To get a real identification of involved and noninvolved area for analysis of data to distinguish the involved area more precisely. For the segmentation process, in [9] a graph-based concurrent brain tumor segmentation and a report to diseased patient registration framework was presented. Both segmentation and registration problems are modeled using a unified pair wise discrete Markov Random Field model on a sparse grid superimposed to the image domain. Segmentation is addressed based on pattern classification techniques, while registration is performed by maximizing the similarity between volumes and is modular with respect to the matching criterion. A substantial methodological framework including new data analysis method was developed in [10] to meet the challenge of working with big data. Malignant imaging phenotypes determined by MRI providing a mean of panoramic and noninvasive surveillance of oncogenic pathway activation for patients treatment was presented. In [11,40,41], to summarize and compare the methods of automatic detection of brain tumor through Magnetic Resonance Image (MRI), different stages of Computer Aided Detection (CAD) system was presented.

Brain Image classification techniques were studied. In [12] a method to classification EEG signal for detection of primary brain tumor detection, in combination of multi-wavelet transform and artificial neural network was presented. Uncertainty in the EEG signals is measured by using the Approximate Entropy. This observation leads to the process of tumor detection based on EEG analysis. [13,37,33] Describes a Matlab implementation, to detect & extraction of brain tumor from MRI scan images of the brain. Incorporates with noise removal functions, segmentation and morphological operations which are used for MRI image coding. To implement and evaluate a magnetic resonance imaging atlas-based automated segmentation (MRI-ABAS) procedure for cortical and sub-cortical grey matter areas definition, suitable for dose distribution analyses in brain tumor patients undergoing radiotherapy (RT) was presented in [14]. The MRI-ABAS procedure consists of grey matter classification and atlas-based regions of interest definition was presented.

The approach of automated classification of the proposed approach was outlined in this work. In [15,17,28] an artificial neural network (ANN) approach by Back propagation network (BPNs) and probabilistic neural network (PNN) was presented. The method is developed to classify the type of tumor in MRI images of different patients with Astrocytoma type of brain tumor. Image processing techniques have been developed for the detection of tumor in the MRI images. The Gray Level Co-occurrence Matrix (GLCM) used for feature extraction is proposed. For the noise free processing if MRI sample in [16,32] an Artificial Bee Colony Algorithm that try to abstract the tumor part using Fuzzy C-Means Clustering is

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proposed. In [18] present an overview of the current research being carried out using the data mining techniques for the diagnosis of brain tumor. Study to identify the most well performing data mining algorithms used on medical brain MRI and Clinical parameters were analyzed. various algorithms were been identified defined by, Decision Trees, Support Vector Machine, Artificial Neural Networks and their Multilayer Perceptron model, and Fuzzy C-Means. Analyses show that it is very difficult to name a single data mining algorithm as the most suitable for the brain tumor detection or classification.

In [19], a comparative study of transform techniques namely Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT) each separately combined with the Probabilistic Neural Network (PNN) is used for the classification of brain tumor is presented. The system was defined by three stages for the diagnosis of brain tumor. In the first stage, MR image is obtained and preprocessing is done to remove the noise and sharpen the image. In the second stage, DCT and DWT is used for feature extraction .In the third stage, Probabilistic Neural Network with Radial Basis Function distinguishes brains abnormality. Finally the performance of DCT and DWT in diagnosing the brain tumor is compared using the parameters such as sensitivity rate and precision rate. An approach useful for enhanced detection of brain tumor using Post -processing and Pre-processing steps of Digital image processing is presented in [20]. Six variant ways of processing an image for the detection of mass region is applied on to the MRI images.

To correctly classify the histopathological type of defect in MRI images, a hybrid model of tumor detection is presented in [21,22,23], obtaining, about 99.93% of the cases used to build the model and in as much as 99.16% of new cases. Malignant and benign types of tumor infiltrated in human brain are diagnosed with the help of an MRI scanner. With the slice images obtained using an MRI scanner, image processing techniques are utilized to have a clear anatomy of brain tissues. A hybrid Self Organizing Map (SOM) with Fuzzy K Means (FKM) algorithm is applied, which offers successful identification of tumor and good segmentation of tissue regions present inside the tissues of brain. In [24,25] a extensive literature on the approach of developing medical testing for developing methods on tumor detection and its cure is focused. New approach of processing tumor cell detection based on image coding, with approach of classification, detection and recognition is focused. An emphasize on the multimodal, multi-scale nature of neuro imaging data is presented is presented in [27,31]. The process is developed by a multi way (tensor) structure, where the defined processes is summarized by a relatively small number of components or “atoms.”

In [30] focus on survey of well-known brain tumor detection algorithms that have been proposed so far to detect the location of the tumor is presented. The development is focused on those techniques which use image segmentation to detect brain tumor. These techniques use the MRI Scanned Images to detect the tumor in the brain. Differences between some well-known techniques are also considered. In [35] signal-image post-processing techniques called Intensity-Curvature Measurement Approaches with application to the diagnosis of human brain tumors detected through Magnetic Resonance Imaging (MRI) is developed. Post-processing of the MRI of the human brain is performed using the model functions: (i) bivariate cubic polynomial, (ii) bivariate cubic Lagrange polynomial, (iii) monovariate sinc, and (iv) bivariate linear. The derived results revealed that the classic-curvature, the signal resilient to interpolation and the intensity-curvature functional are able to add additional information useful to the diagnosis carried out with MRI. In [38] feature extraction from MR Images is carried out by DAUB-4 Wavelet method. Due to better contrast it improves easily hanging signals of an image and reduces the overhead. PCA is used to select the best features for classification. These PCA selected features are given as an input to SVM for classification. Two SVM kernel functions, Linear and Radial Basis Kernel were used.

III PROPOSED METHODOLOGY

With the objective of developing a robust recognition system, in this work, a focus is made on developing a new algorithmic approach for preprocessing, segmentation, and representation and classification process. A system architecture of the recognition approach for the tumor detection and classification is developed. A framework with such objective was developed in [32,29]. In reference to the past framework developed, a proposing system architecture for the developing approach is developed as shown in figure 1.

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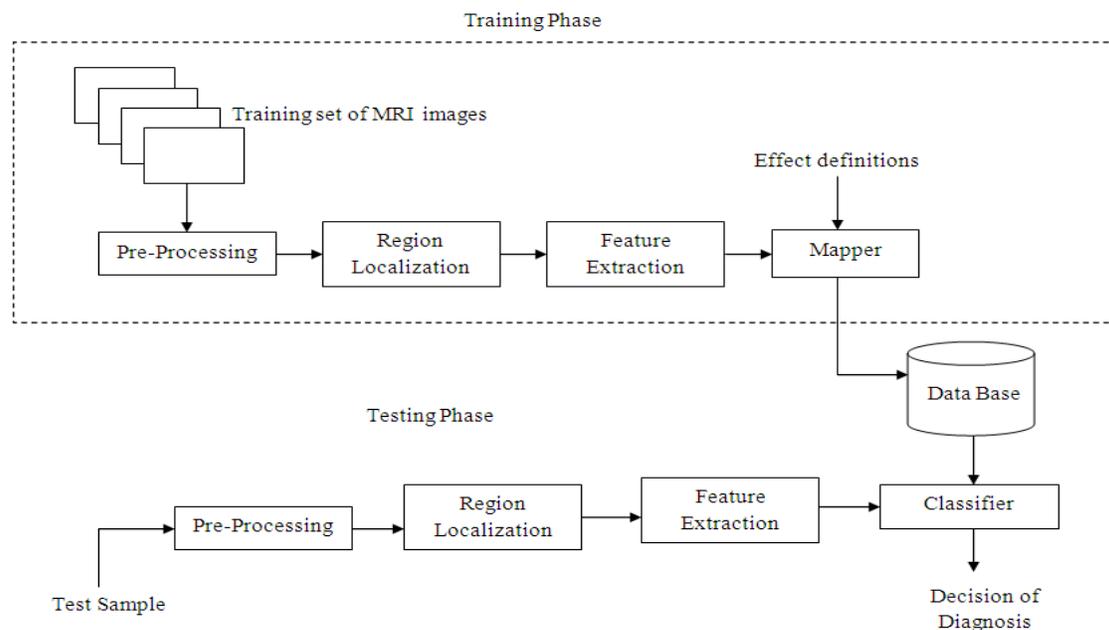


Figure 1: Proposed system architecture for the automated Diagnosis system

The suggested architecture constitute of a pre-processing, region localization, feature extraction, mapper and classifier unit. In the pre-processing unit the given sample is processed for a standard processing size, extracting the pixel values and performing filtration to eliminate noise effects. The process of denoising was observed in various literatures to eliminate noise effects at preprocessing level. In recent approach towards denoising of MRI sample at preprocessing median filtration was suggested [32]. Wherein median filtration are effective under a discrete level of noise effect, under dynamic noise variations the immunity is reduced. Towards improving the filtration performance, a intelligence to such filter were then developed. In [32] the filtration process was enhanced using fuzzification approach. Wherein KFCM approach was introduced for filtration. However in the fuzzification process it was observed that, the filtration process is governed by the fuzzy rules. These fuzzy rules are defined based on the observations developed over past processing. As the noise effects are dynamic, these rules would fail under noise with a abrupt variation in its effect level. Hence to achieve the objective of robust filtration process in this work, a focus is made on developing dynamic filtration process using a hybrid model of median filtration with fuzzy system following, dynamic decision processing. The suggestive approach, formulates the noise decision at median filter based on a dynamic framing, with the fuzzy rule adapting with the derived variance values based on adaptive median filtration.

In the second stage of the processing, the processed sample is then processed for region localization and segmentation. Wherein most methods were developed for segmentation of regions from a given MRI sample, les focus is made on its localization. Localization of the mass elements in the MRI sample could minimize the overhead coming for processing the whole sample. With this objective a simpler however robust approach of mass localization in MRI sample using recursive Morphological approach with its fusion is suggested. In the approach of segmenting such region, a walker based approach was suggested in [34]. This logic present a simpler approach of region segmentation via boundary region tracking. In this approach the approaches of walker approach with a region localization will be developed. The approach of segmentation will then be decided based on, the mass density observation, to extract the required region of interest. In the process of feature extraction, among different method Gabor-wavelet approach was majorly used in recent approaches. In [29] the usage of Gabor- wavelet approach for the extraction of descriptive features for MRI processing is presented. Wherein Gabor-wavelet approaches are more descriptive in texture feature representation, as well provide invariance

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features, the method doesn't reveals much detail of the finer textures at the segmented region. Towards a finer improvement in feature representation a multi-level wavelet with Gabor approach could provide still finer details of the MRI sample. These features can improve the representation accuracy, intern improving the decision accuracy. Such approach will be very effective under detection of tumor effect at initial stages where the regions of healthy and effected are variant at very few locations.

The final stage of this developing approach is the classifier unit, which is dominantly been developed using SVM classifier. SVM classifiers are mostly used due to its simpler processing in implementation and accurate decision. Various formats of kernels were used to develop such SVM operation [29]. However the accuracy of the decision is based on the knowledge it is provided with. In various pattern recognition approaches, a new concept of relevant feedback logic was observed. The relevant feedback logic, improves the accuracy by recursive updation of training knowledge in the SVM model. With this advantage a Multi class SVM (M-SVM) will be developed with the integration of relevant feedback logic to improvise the decision accuracy. To validate the performance of the proposing approach the system will be evaluated with performance metric of sensitivity, accuracy, precession, TPF, FPF, TN, FN, specificity, recall rate for the proposing method in comparison to the conventional models presented in [29],[32] and [34].

IV CONCLUSION

For accurate medical diagnosis de-noising & de-blurring of MRI is very much essential. The various methods of de-noising and de-blurring are discussed in this paper. All the algorithms are efficient to improve the quality of degraded image. Algorithm has to be still more effective to obtain more accurate diagnostic information. Also, there is a need to improve algorithms to make system robust. This proposed research is aimed to develop a more accurate algorithm which is very sensitive and reduced the time of analysis and also economical.

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