ABSTRACT

Brain tumor is one of the major causes for the increase in mortality among children and adults. The early detection is the most effective way to reduce the mortality. The evolution of Computer Aided Diagnosis (CAD) system has made a giant leap in the effective treatment and is meant to be an instrument in the hands of the radiologists. In this work Magnetic Resonance Imaging (MRI) of brain images have been investigated.

In medical image processing, if any segmentation scheme fails to detect the Region of Interest (ROI) precisely, it leads to misclassification which will have grave effects on the human beings. Another important challenge in image processing is the presence of noise during the image capturing process which may result either under segmentation or over segmentation. This research work focuses on these two challenges and has implemented effective segmentation methodology employing metaheuristic algorithms

The detection of suspicious region is performed in four phases namely Image acquisition and Pre-Processing, Enhancement and De-Noising, Segmentation and Classification.

In the first phase, MRI brain image is acquired and film artifacts from the MRI images are removed using tracking algorithm. In addition to this, the non-brain region is eliminated using Dual Threshold Morphological

(DTM) based skull stripping algorithm. Even after the pre-processing is over, the influence of noise in the image remains as it is which in turn affects the detection accuracy and further processes. Therefore an efficient enhancement technique is implemented using Adaptive Center Weighted Median (ACWM) filter for the removal of the high frequency noise components without disturbing the edges. It offers higher PSNR value of 23.65dB which is approximately 4% more than the existing techniques. The contrast enhancement obtained is 0.93 which is 2% more than the existing techniques.

In the third phase, segmentation is performed by two stages namely bilateral registration segmentation and single image segmentation. The registration segmentation is implemented by two major techniques namely Rigid Registration Segmentation (RRS) using GA and Non-Rigid Registration Segmentation (NRRS) using GA.

In RRS-GA, Global Affine Transformation (GAT) is performed for registration. The feature based RRS -GA with GAT is severely affected by narrow gap pixel intensities. To overcome this issue a hybrid transformation registration by GAT followed by Local Affine Transformation (LAT) is implemented in the NRRS-GA technique. In this technique LAT is performed on the global transformed target images which are divided into blocks of size 16x16. To get the accurate registration, GA continuously optimizes the registration results. The method developed and presented in this report has achieved higher detection rate of 81.03% by NRRS-GA which is 6% better than the existing basic medical image registration techniques.

Single image segmentation has been implemented using Markov Random Field - Maximum A Posteriori - Parallel Ant Colony Optimization (MRF-MAP-PACO) technique. In the proposed MRF-MAP-PACO technique, master-slave approach has been adapted which reduces the computational time by 10-30 seconds achieving the detection rate of 96.59% which is 5% more compared with the existing segmentation techniques.

In the fourth phase Classification aims at finding the correlation between the proposed system results and the radiologists' results based on Pixel Similarity Index (PSI). To evaluate the performance of the system a simple Receiver Operating Characteristic (ROC) curve analysis is performed. Computational results indicate that MRF-MAP-PACO-PSI technique outperforms the existing methods by achieving the classification accuracy of 96.89%. By using the proposed CAD system, brain tumor can be detected and diagnosed at the earliest stage which facilitates the reduction in the mortality rate.