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Name :
Shafaf Ibrahim

Title :
A New Hybrid Technique for Nosologic Segmentation of Primary Brain Tumors

Supervisor :
Associate Prof. Dr. Mazani Manaf (MS)
Dr. Noor Elaiza Abd Khalid (CS)
Dr. Mohd Ezane Aziz (CS)

The main purpose of this research is to design a comprehensive algorithm which aims to aid the medical practitioners mainly the radiographers, radiologists and neurologists in primary brain tumors diagnosis. Detection of primary brain tumors is inspired by the necessity of high accuracy as it deals with human life. Presently, various imaging modalities techniques have incarnated as a tool for the doctors and radiologists to help them in diagnosis and treatment domain. While these are highly accurate and fast, they still require experienced and competent medical practitioners for the proper interpretation. Thus, the involvement of information technology is highly demanded in introducing reliable, simple and accurate computer systems. This study presents an algorithm for nosologic segmentation of primary brain tumors on Magnetic Resonance Imaging (MRI) brain images. The MRI technique has been chosen as the digital imaging modality since it provides clearer image for the tissue area as compared to the other techniques that focusing more on bone study such as Computed Tomography (CT) Scan and X-ray. The purpose of segmentation is to highlight the tumor areas, whereas classification is used to identify the type of the primary brain tumors. For this purpose, an algorithm which hybridized the Intensity Based Analysis (IBA), Grey Level Co-occurrence Matrices (GLCM), Adaptive Network-based Fuzzy Inference System (ANFIS) and Particle Swarm Optimization (PSO) Clustering Algorithm (CAPSOCA) is proposed. The combination of several computer vision techniques was presented which aims to deliver reproducible nosologic segmentation of primary brain tumors which are gliomas and meningiomas. A Rule Based Expert System (RBES) is used to preliminarily classify the various types of primary brain tumors. It is designed to incorporate with the CAPSOCA algorithm which intended to strengthen the classification outcomes. The performance of the proposed CAPSOCA algorithm is compared with the PSO and ANFIS algorithms separately. The performance of the algorithms is quantified by two measurements which are segmentation accuracy and classification accuracy. The segmentation accuracy is evaluated using two approaches which are tumor template matching and comparison with ground truth. On the other hand, the classification accuracy is quantified using truth table by comparing the classification outcomes with histopathology diagnosis collected from the patient's record. The study revealed that very high pixel detection is noticeable in PSO algorithm which leads to over-segmentation in the tumor areas, and indirectly affected the segmentation accuracy. On the other hand, the ANFIS is found to have limited pixel detection in nosologic segmentation of primary brain tumors. The CAPSOCA was proven to be the best algorithm for nosologic segmentation of primary brain tumors from the MRI images data. It appeared to return the highest percentages of accuracy as compared to the PSO and ANFIS for both segmentation and classification at 78.79% of accuracy for gliomas segmentation, 76.68% of accuracy for meningiomas segmentation and 76.30% of accuracy for classification accuracy.

*** (MS) = Main Supervisor (CS) = Co Supervisor**