# An Efficient Implementation of Deep Convolutional Neural Networks for MRI Segmentation

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**Deep learning is one of the subsets of machine learning that is widely used in Artificial Intelligence (AI) field such as natural language processing and machine vision. Image segmentation as a subsets of machine vision is one of the most common steps in digital image processing, classifying a digital image into different segments. Tumors have different shapes, sizes, brightness and textures can appear any in the brain. These complexities are the reasons to choose high capacity of Deep Convolutional Neural Network (DCNN) containing more than one layer. The DCNN extracts high-level concepts low-level features and it is appropriate for large volumes data. In fact, in deep learning, the high-level concepts are defined by low-level features. In this study, a DCNN was proposed for more accurate and faster segmentation of the brain MR images to help physicians in the diagnosis and treatment of brain tumors. The purpose was to separate damaged tissues, despite their low-contrast and Y-shaped structure in segmentation images, as well as to resolve the imbalance in the training dataset. In order to improve network performance, a pooling layer was used to summarize the information of previous layers, and a ReLU was used to create a nonlinear layer. At the same time, the connection of the convolutional layers was established so that the potential for network parallelism would be high after forming independent paths. Previously, in optimization algorithms, the accuracy achieved for network training was less and high-cost function. In this regard, in this study, a new optimization algorithm was developed for learning DCNN with robust architecture in relation to the high volume data. The proposed DCNN contains two parts: architecture and optimization algorithm. The architecture and the optimization algorithm are used to design a network model and to optimize parameters for the network training phase, respectively. The architecture contains five convolutional layers, all using 3×3**

kernels, and one fully connected layer. Due to the advantage of using small kernels with fold, it allows making the effect of larger kernels with smaller number of parameters and fewer computations. All the pixels of an MR image are classified using a patch-based approach for segmentation. The proposed DCNN was validated in multi-modality MR images of BRATS database. Using the Dice Similarity Coefficient metric, accuracy results reports on the BRATS2016, brain tumor segmentation challenge dataset, for the complete, core, and enhancing regions as 0.90, 0.85, and 0.84 respectively. Employing Caffe library and GPUs to parallelize computations, a good performance attain and the experimental results show that the performance is improved. Comparison the proposed DCNN with other commonly used methods represents the improvement of the performance of the proposed DCNN on the relatively large data set. Results showed that our proposed DCNN more accurate than other methods as a result of its deep and hierarchical extraction.

**Keywords : Efficient implementation, Split the images, neural network**