Multi-class brain tumor image classification

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Abstract

Cancer is a leading cause of death and become a critical life-threatening hazard in the world. Brain cancer is one of the most dangerous health risks that affect all ages, genders, and races. In general, tumors are the primary cause of brain cancer. In this regard, computer-aided diagnosis systems have become handy tools to support physicians in the superior diagnosis of critical diseases like brain cancer. Moreover, automation of visual examination will speed up the diagnosis process. Hence, researchers have been motivated to implement computer-assisted diagnosis (CAD) systems. The design of medical imaging data-based CAD systems has evolved as one of the most important areas of research in medical imaging and diagnostic radiology. The primary goal of any medical image-based CAD system is to detect abnormality from the medical images. The type of disease and input image are the primary factors to define application areas of the medical image-based CAD system.

Magnetic resonance imaging is a common diagnostic tool because it displays more accurate data about brain cells than other imaging methods. These MR image-based CAD systems support the diagnosis of brain diseases through medical image analysis. Medical image analysis is the primary task of contemporary CAD systems. Analysis of medical images includes various sub-tasks and can be primarily segregated into four types: image classification, object detection, segmentation, and image registration. The proposed research work has focused on brain tumor image classification.

Classification of brain tumors is one of the most important tasks in clinical image processing. Identifying the type of brain tumor is the fundamental task in brain tumor diagnosis and treatment. In addition to that, feature extraction plays an important role in accurate image classification as it depends on the feature patterns of the brain tumor image. Moreover, early tumor detection and classification are essential as a failure of the initial test can lead to cancer. All these things motivated researchers the implementation of computer-assisted brain tumor classification. Initially, the research focused on binary classification using hand-crafted feature extraction and machine learning models. However, recent works have focused on multi-class brain tumor classification using deep learning.

A separable convolution-based neural network model has proposed for the three-class brain tumor type classification. Two convolution blocks have utilized in the proposed model that converts (128, 128) input image to (30, 30) feature map. Each convolution block consists of a separable convolution layer with ReLU activation and average pooling. The flatten layer converts the multi-dimensional feature map into a one-dimensional feature vector. Finally, the classification layers accept the one-dimensional feature map to perform classification using dense and soft-max layers.