Chapter 7
Developing Brain Tumor Detection Model Using Deep Feature Extraction via Transfer Learning

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ABSTRACT

The timely prognosis of brain tumors is gambling a great role within the pretreatment of patients and keep the life of suffers. The manual classification of brain tumors is a difficult task for radiologists due to the intensity variation pixel information produced by the magnetic resonance machine and it is a very tedious task for a large number of images. A deep learning algorithm becomes a famous algorithm to conquer the problems traditional machine learning algorithms by automatically feature extraction from the input spaces and accurately detect the brain tumors. One of the most important features of deep learning is transferred a gain knowledge strategy to use small datasets. Transfer learning is explored by freezing layers and fine-tuning a pre-trained model to a recommended convolutional neural net model. The proposed model is trained using 4000 real magnetic resonance images datasets. The mean accuracy of the proposed model is found to be 98% for brain tumor classifications with mini-batch size 32 and a learning rate of 0.001.

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INTRODUCTION

Recently, cancer is considered one of the highest crisis diseases that affect the lives of humans in the world. According to the International Agency for Research on Cancer (IARC), the latest news about the brain and other nervous system cancers are published by GLOBOCAN, 296, 851 new cases and 24, 1037 cancer in death were diagnosed in 2018 (Bray et al.,2018). MR image is one of the methods to identify cancer. Cancer is a fast and uncontrollable boom of ordinary tissues that damages the nearby healthy tissues of the brain (Rindi et al., 2018). A brain tumor will be treated by surgery, radiation therapy, and chemotherapy. The prevention of neoplasm will rely upon several factors just like the size, type, and grade of the tumor. But MR images are critical in neoplasm treatment by showing the characteristics of brain tumors throughout the method of the medical process to assist the specialists in the identification of it.

Timely diagnosis of brain tumor is playing a great role in the pretreatment of patients and save the life of patients. The classification of brain tumors is still a challenging area for researchers. The manual classification of brain tumors is accomplished by medical radiologist. The manual classification of the brain is a tedious task for radiologists when the MR images have a similar structure. The tasks performed by a radiologist is to discover to identify the brain MR image is tumors or non-tumors and detect the abnormal stages of tumors. A large quantity of time was spent by radiotherapists and doctors for the identification of tumors and segmenting it from different brain tissues. So, the manual classification of brain tumors is very tedious for a huge quantity of MR images data, non-reproducible and time-wasting due to the range of the patient become increases from day today. To mitigate the issue, autonomous classification is the best approach to analyze brain MR images with a minimum time for a radiologist. In this chapter, we have to focus on the classification of brain MR images into normal and abnormal images. A real MR image dataset is utilized in this study that collected from the pioneer diagnosis center.

The classic methods are used for the detection of brain tumors into different stages from MR images. The main steps used by conventional methods are preprocessing, segmenting, feature extraction, dimension reduction and classification of brain tumor MR images. The traditional machine-learning algorithm uses handcrafted feature extraction methods (Machhale et al., 2015). The handcrafted feature extraction method is depending on the knowledge experts of the domains. The handcrafted method is a laborious task for non - experts to use conventional algorithms. The performance of the model is depending on the feature extraction methods. There are numerous classic algorithms proposed for brain neoplasm identification using feature extraction methods (Balan et al, 2018). The feature extraction methods are low level feature (Duron et al., 2019), first-order statics (Tong et al., 2019), second-order statics (Padlia et al., 2019), wavelet (Devi et al., 2018), Gabor (Vidyarthi et al., 2015) and fisher vector extractions (Cheng et al., 2016). There are numerous methodologies proposed for brain tumor classifications using handcrafted feature extractions in machine learning algorithms (Kumar et al., 2016; Praveen et al., 2016; Sonavane et al., 2016;Panda et al., 2019; Mathew et al.,2017).

Recent works on medical image analysis on brain tumor classification focuses on deep learning algorithms due to its good performance classification results. The deep learning algorithm is a type of classic algorithms that use automatic feature extraction methods (Talo et al., 2019). Deep learning algorithms overcome the problems of classic algorithms due to its hand-crafted feature extraction methods (Greenspan et al.,2016).The foremost distinction between machine learning and deep learning approach is handcrafted feature extraction is executed manually using feature engineers or humans but in case of deep learning approach, the feature extraction is done automatically without feature engineers (Moolayil, 2019).