Convolutional Neural Networks for brain tumor images classification

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Abstract

Lately, the brain tumor is taken into account as one of the most detrimental neurological disorders. Therefore, diagnosing precisely and immediately what type of brain tumor disease in order for doctors to give patients plausible treatments in time is of utmost importance. Nevertheless, determining what kind of brain tumor is excessively relied on human factors such as emotion could lead to either unconstant or incorrect performance. Fortunately, by implementing deep learning into the medical background, the aforementioned issue is addressed almost thoroughly. In order to enhance the performance of Convolutional Neural Networks, the paper proposes a myriad of combined architectures between based CNNs, BatchNormalizaiton, and Dropout along with adjusted parameters and methods. Eventual experimental results prove that the proposed approaches outperform the state-of-the-art paper works on the same benchmark brain tumor database.

Introduction

Nowadays, brain tumor classification has been studied widely in computer vision in literature, which means more and more robust brain tumor classification models with high performance and diverse classifiers are proposing by researchers from all over the world day by day. Jun Cheng et al. [2] proposed a method to enhance the classification performance by applying three means (i.e., intensity histogram, GLCM, and raw patch-based BoW model) features to verify the effectiveness of the recommended method, namely Direct use of GLCM as features, Pipeline of BoW - based tissue classification, and Tumor region augmentation and partition. The ultimate outcomes were relatively objective, over 90% of assortment for each type of brain tumor. Biller et al. [3] introduced SodiumMR imaging data of sufferers with treatment-na¨ıve glioma WHO grades I–IV acquired using a 7T MR system. For the acquisition of sodium-MR images, they utilized density-adapted 3D radial projection reconstruction pulse sequences. Proton-MR imaging data were obtained by using 3T whole-body usage. Next, Muhammad Sajjad et al. [4] presented a novel Convolutional Neural Network (CNN) based on

a multi-grade brain tumor classification system and extensive data development for avoiding lack of data query for multi-grade tumor distribution. A Tumor segmentation using a deep learning strategy was also formed. This research proved that validation accuracy would be declined slightly instead of the suggested one without using their data augmentation. J. Seetha and S. Selvakumar Raja [5] proposed an automatic brain tumor detection by using based Convolutional Neural Networks (CNN) division, and the more in-depth architecture design was performed by using small kernels.

Proposed Approach

Database Preparation

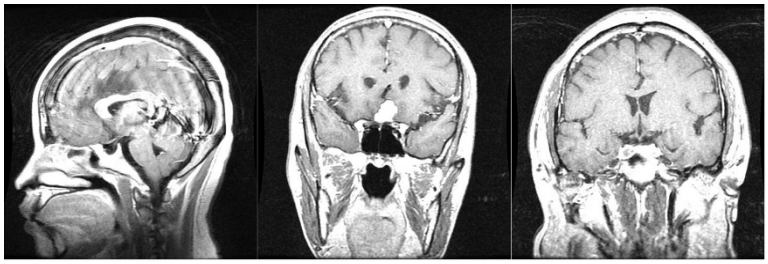

Figure 1. 3 classes of brain tumor MRI images

Parameters

Table 1. Suggested set-value parameters for improving the proposition.

CNNs		Train/Val/Test	Optimizer	ReLR	Augmentation
AlexNet		4/1/5	Adam(lr=1e-4)	No	Yes
VGG	VGG16	4/1/5	Adam(lr=1e-4)	No	Yes
	VGG19	4/1/5	Adam(lr=1e-4)	No	Yes
Inception	Inception v3	4/1/5	Adam(lr=1e-4)	No	No
	Inception-ResNet v2	4/1/5	Adam(lr=1e-4)	No	No
MobileNet		4/1/5	Adam(lr=1e-4)	No	Yes
DenseNet	DenseNet121	4/1/5	Adam(lr=1e-4)	1e-4	Yes
	DenseNet169	4/1/5	Adam(lr=1e-4)	1e-4	Yes
	DenseNet201	4/1/5	Adam(lr=1e-4)	1e-4	Yes
ResNet	ResNet50	4/1/5	Adam(lr=1e-4)	1e-4	No
	ResNet50 v2	4/1/5	Adam(lr=1e-4)	1e-4	No
	ResNet101	4/1/5	Adam(lr=1e-4)	1e-4	No
	ResNet101 v2	4/1/5	Adam(lr=1e-4)	1e-4	No
	ResNet152	4/1/5	Adam(lr=1e-4)	1e-4	No
	ResNet152 v2	4/1/5	Adam(lr=1e-4)	1e-4	No

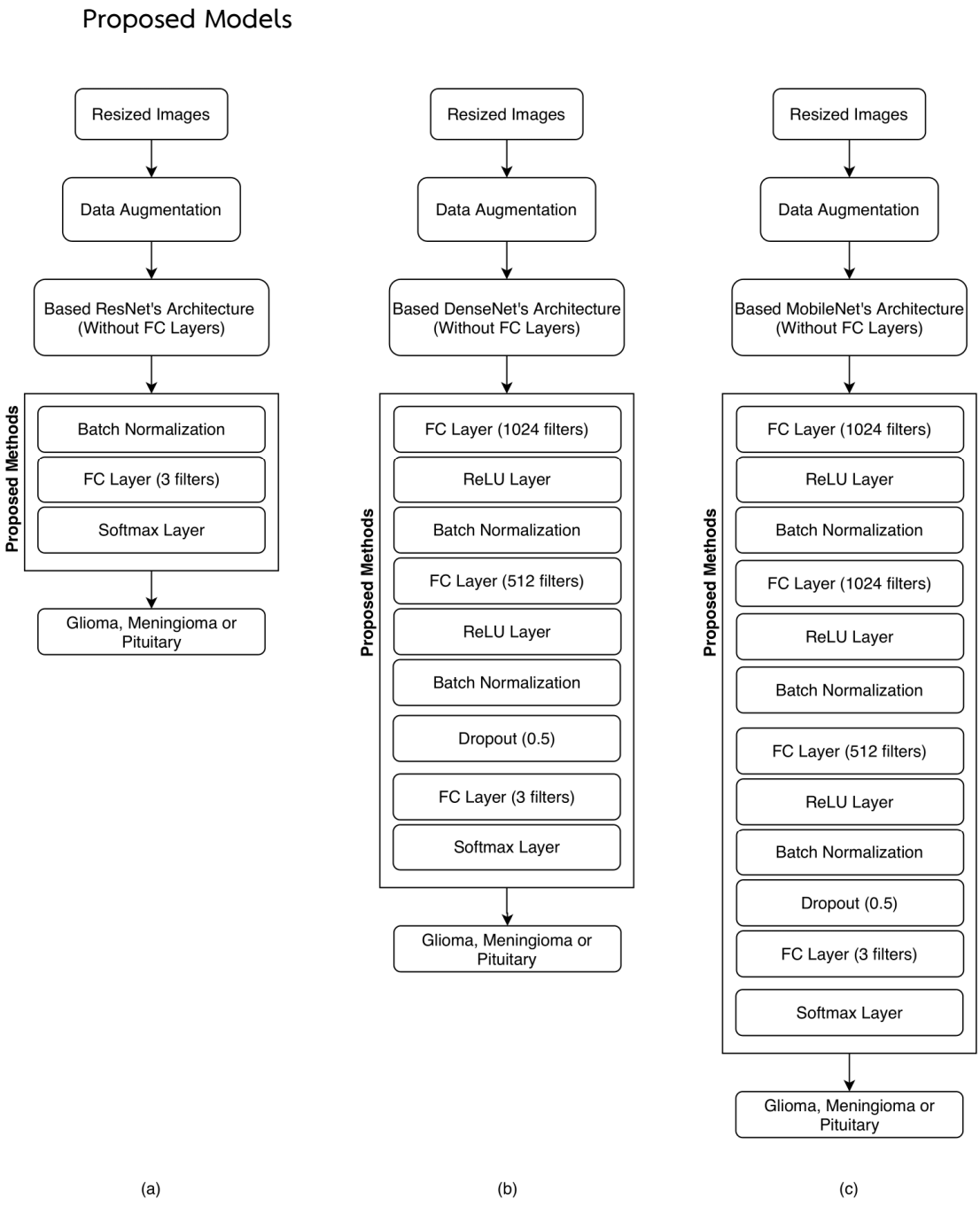

Figure 2. ResNet (a), DenseNet (b), MobileNet (c).

References

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