Team #:

Project Team 19

Team Members:

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Date of Submission:

4/18/2022

Abstract:

For this project, I planned to design and implement a CNN model to detect brain tumor from MRI images. Specifically, I used the idea of data augmentation and preprocessing, pre-trained Inception-V3 model, and transfer learning to train the model. There are 3000 images for the training and validation set. In the end, the accuracy of the model on validation set ranged from 0.8182 to 1.0000, with an average of 0.9156.

Introduction -

Overview:

For this project, I used pre-trained Inception-V3 model and transfer learning to train a CNN model that can detect brain tumor from MRI images. Before deciding to use the Inception-V3, I tried a few other pretrained networks for medical image classification and manually adjusted parameters to compare multiple results. It turned out the Inception-V3 would produce the best result. Thus, I continued the project and adjust its parameters to see the best performance it made.

Motivations:

A lot of research has been done to detect brain tumor from MRI images using pre-trained CNN models and transfer learning. Researchers believe that CNN model with transfer learning have the potential to reach the level of performance of human observer. Thus, for this project, I aim to implement a CNN model from a pre-trained model, which can effectively predict the label of a brain image.

Significance:

Today, image processing and analysis is an important part of the diagnostics of disease, including brain tumor. Thus, research in CNN model can make a positive impact on health sciences and industries. For this project, I use different pre-trained models, such as Inception-V3, VGG-16 and ResNet50, with adjusted parameters for transfer learning. It turned out the

Inception-V3 has the best result over all other models. Therefore, I decided to use Inception-V3 with adjusted parameters and tried to see the best result it returned.

Related Works:

Some researchers proved that their accuracy of CNN model for image classification is generally over 90 percent.

(https://www.nature.com/articles/s41598-021-90428-8

https://www.frontiersin.org/articles/10.3389/fnins.2021.679847/full)

Some programmer have posted a similar project on GitHub. I took it as baseline project.

https://github.com/slowy07/brain-tumor-detection

Method –

Data:

The original dataset contains 3600 MRI brain images. The images are JPG files and they have been classified into 3 folders. One folder contains 1500 images of which the patients do have a tumor. One folder contains 1500 images of which the patients do not have a tumor. The remaining images are unlabeled. For this project, I will only use 1500 labeled images from the first folder and 1500 labeled images from the second folder. I will partition 3000 images into training and validation. For image preprocessing, Keras is the tool turn images into preprocessed tensors and fit them to our model.

Algorithm and Program:

The core concept of the project is use image augmentation, image cropping, pretrained Inception-V3 model with new parameter, and transfer learning. Image augmentation allowed me to make more samples and image cropping improved the accuracy by letting the model focus on the image part which has most of the information. For the choice of pretrained mode, I tried different pretrained models and decided to use Inception-V3. Also, I manually adjusted the parameters of training to get the best possible result.

Platform:

I used Google Colab as a platform with its GPU to host and run Jupyter notebooks. Then, it was posted on GitHub.

How to Conduct Experiments:

I firstly used data augmentation to create more samples for training. Then, I cropped the image so that model could have high accuracy by looking at the most important part of the image. Afterwards, I trained the model with pretrained Inception-V3 and adjusted parameters. Then, I tested it on validation set and evaluated its results.

What Are the Results:

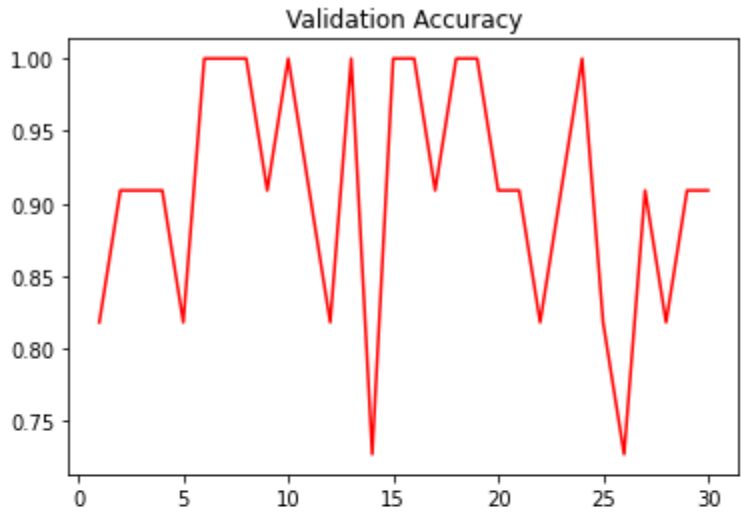
Generally, the accuracy of the model on validation set ranged from 0.7273 to 1.0000, with an average of 0.9090.

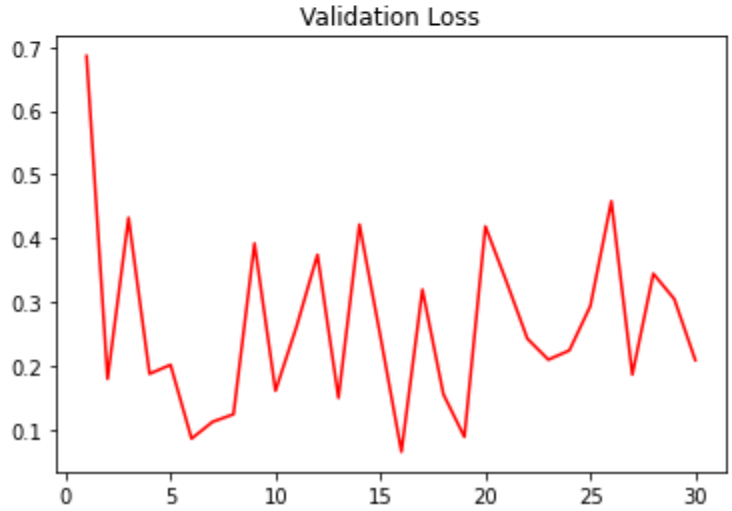
How to Evaluate Results:

We evaluated results by looking at its accuracy rate and compared it to that of the related GitHub project - baseline result.

Results -

I looked at the accuracy rate of my model and compared it with baseline result. Their accuracy rate is 91% and ours is 90.90%. Though we used totally different models, we reached similar level of performance.



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Average Validation Accuracy:  0.9090909202893575
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Discussion –

The model reached a good level of performance. With a pre-trained model, it got to a high accuracy rate within the first few epochs, compared to the fact that the GitHub model increase from a relatively low rate to a high rate in the last few epochs.

References –

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