

Documentation

In the code, we are using two models for image classification:

1. A CNN (Convolutional Neural Network) model: This is a custom-built model that consists of several convolutional and pooling layers, followed by two fully connected layers. The model is trained from scratch on the dataset of images with multiple classes.

The CNN model has the following convolutional and pooling layers:

- Conv2D layer with 32 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 64 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 128 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2

These layers are responsible for extracting features from the input images.

2. A VGG16 model with transfer learning: This is a pre-trained model that has already been trained on a large dataset of images (ImageNet) and is known to perform well on image classification tasks. We use the pre-trained weights of this model as initial weights for our own model, which consists of the VGG16 model followed by a few additional layers for classification. This allows us to take advantage of the powerful feature extraction capabilities of the VGG16 model, while still fine-tuning the model for our specific task.

The VGG16 model has the following convolutional and pooling layers:

- Conv2D layer with 64 filters and a kernel size of 3x3
- Conv2D layer with 64 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 128 filters and a kernel size of 3x3
- Conv2D layer with 128 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 256 filters and a kernel size of 3x3
- Conv2D layer with 256 filters and a kernel size of 3x3
- Conv2D layer with 256 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 512 filters and a kernel size of 3x3
- Conv2D layer with 512 filters and a kernel size of 3x3
- Conv2D layer with 512 filters and a kernel size of 3x3
- MaxPooling2D layer with a pool size of 2x2
- Conv2D layer with 512 filters and a kernel size of 3x3
- Conv2D layer with 512 filters and a kernel size of 3x3
- Conv2D layer with 512 filters and a kernel size of 3x3

- MaxPooling2D layer with a pool size of 2x2

These layers are also responsible for extracting features from the input images. The VGG16 model has a much deeper architecture than the CNN model and uses smaller filter sizes with more filters in each layer, which allows it to learn more complex and abstract features from the input images.

3. Data Loading

In the `train_generator` and `test_generator` are created using the `flow_from_directory` method from `ImageDataGenerator` class.

When creating these generators, we pass the directory paths (`train_dir` and `test_dir`) as arguments. The `flow_from_directory` method then automatically infers the labels for each image based on the directory structure. Specifically, it assumes that each subdirectory within the directory path corresponds to a different class, and that the images within that subdirectory all belong to that class.

For example, if the directory structure of `train_dir` is as follows:

```
train_dir/  
  class1/  
    image1.jpg  
    image2.jpg  
    ...  
  class2/  
    image1.jpg  
    image2.jpg  
    ...  
  class3/  
    image1.jpg  
    image2.jpg  
    ...  
  ...
```

Conclusion

Both models are trained and evaluated on the same dataset of images with multiple classes, using image augmentation and normalization techniques to improve performance. The performance of the two models is then compared to determine which one performs better on the task of image classification.