Satellite Image Classification

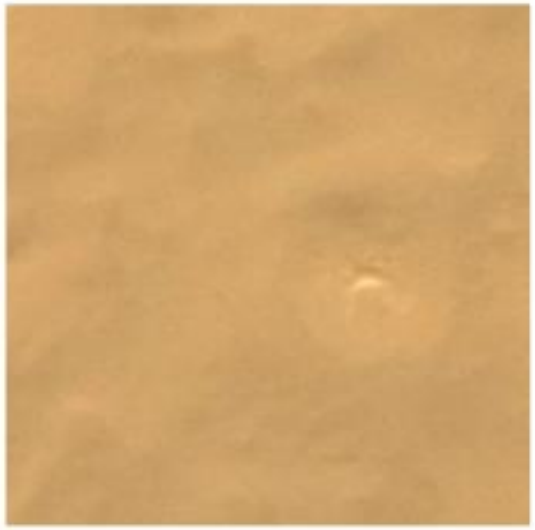
Using CNN & Pretrained Models

What is this Project About ?

Satellite image classification is an important task that enables us to extract valuable information from satellite images. Convolutional Neural Networks (CNNs) have shown great success in image classification tasks, and using them for satellite image classification can result in highly accurate predictions. In this project, we aim to classify satellite images using CNNs and an Pretrained models like VGG19 and MobileNetV2. We will be working with a dataset containing images from four different classes such as (Water - Green Areas – Desert – Clouds), and our goal is to train a model that can accurately classify the images based on their content. The use of an Image Data Generator will allow us to efficiently augment our dataset and improve the robustness of our model.

Samples

desert



water

cloudy

green_area

Dataset

Our Data have 5631 samples.
Classified into 4 classes

cloudy	1500
green_area	1500
water	1500
desert	1131

Link: Satellite Image Classification | Kaggle

Splitting Data

```
Number of training samples:  4504
Number of validation samples:  563
Number of testing samples:  564
```

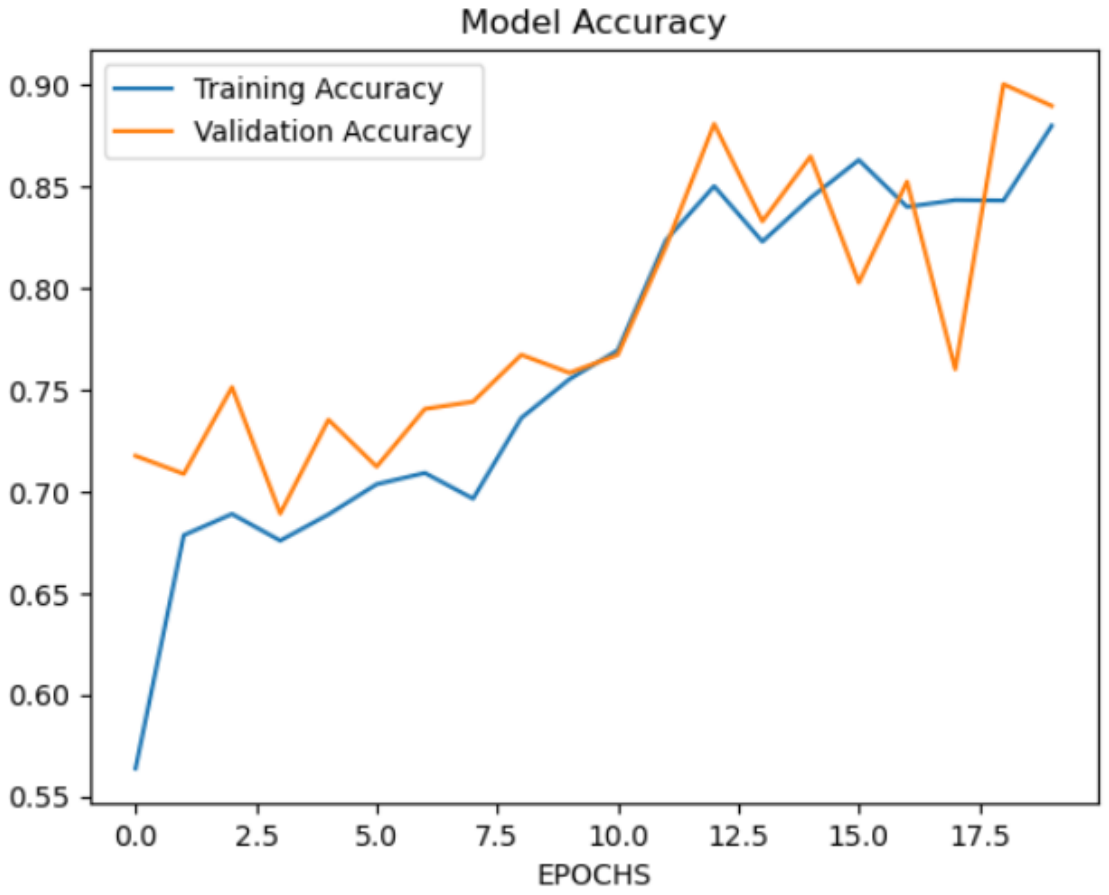
Image Augmentation

- The ImageDataGenerator is a powerful tool for image augmentation in machine learning projects. In this specific code snippet, we are setting up an ImageDataGenerator object with various parameters that will be used to augment our image dataset.
- The first parameter, "rescale=1./255", is used to rescale the pixel values of our images to a range between 0 and 1, which is a common normalization technique in image processing.
- The "shear_range" and "zoom_range" parameters are used to randomly apply shear and zoom transformations to the images during training, which can help improve the model's ability to generalize to new data.
- The "horizontal_flip" and "vertical_flip" parameters are used to randomly flip the images horizontally and vertically, respectively, which can also help improve the model's ability to generalize.
- The "rotation_range" parameter is used to randomly apply rotations to the images during training, which can help the model become more robust to orientation changes.
- Finally, the "fill_mode" parameter is used to specify how to fill in any empty areas that may be created during the augmentation process.

CNN Model

- The first few layers of our model are convolutional layers, which are responsible for extracting features from the input images. In this specific model, there are three convolutional layers with different filter sizes and activation functions. Each convolutional layer is followed by a max pooling layer, which reduces the spatial dimensions of the output from the convolutional layer.
- After the convolutional layers, the output is flattened into a one-dimensional vector using the Flatten layer. This allows the output to be fed into fully connected layers, which are responsible for making the final classification decision.
- The fully connected layers consist of several dense layers with different numbers of neurons and dropout layers, which are added to prevent overfitting. The final layer of the model is a dense layer with four neurons and a softmax activation function, which outputs the probability distribution of the input image belonging to each of the four classes.

CNN Model Loss and Accuracy



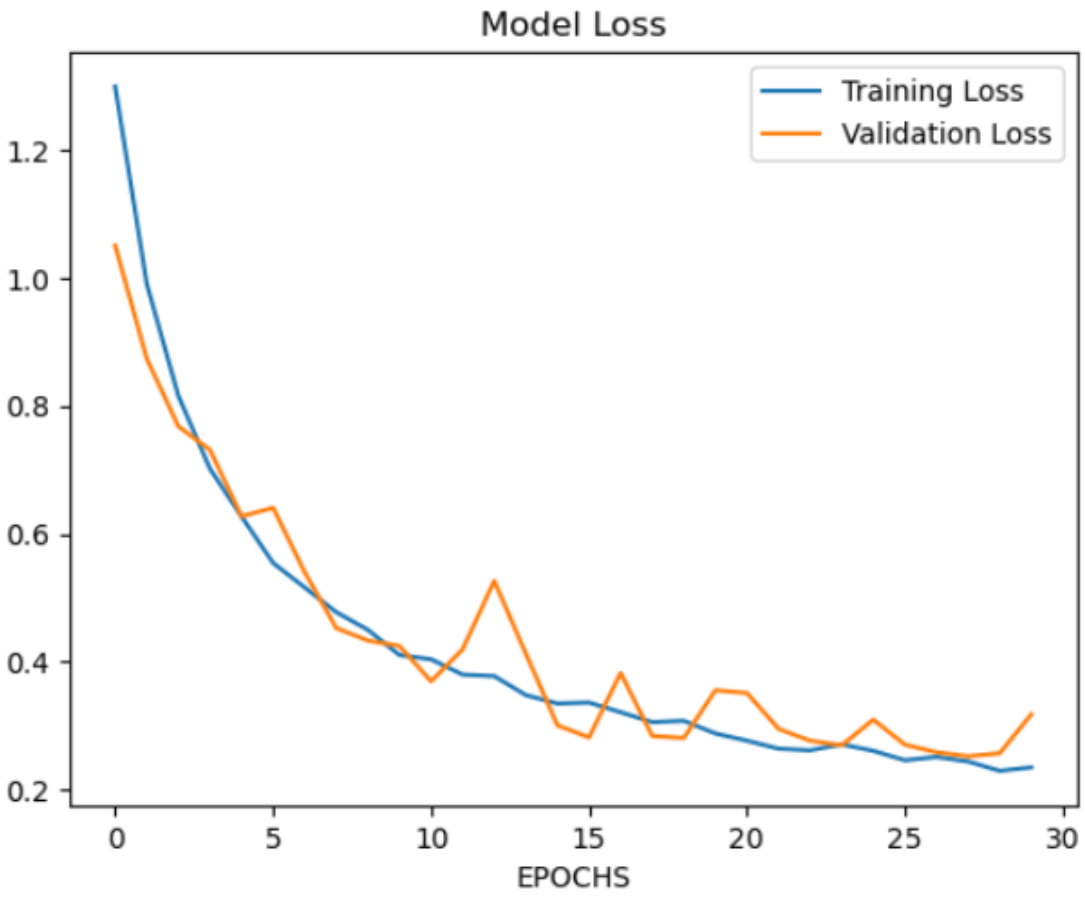

```
score = model.evaluate(test_generator)
```

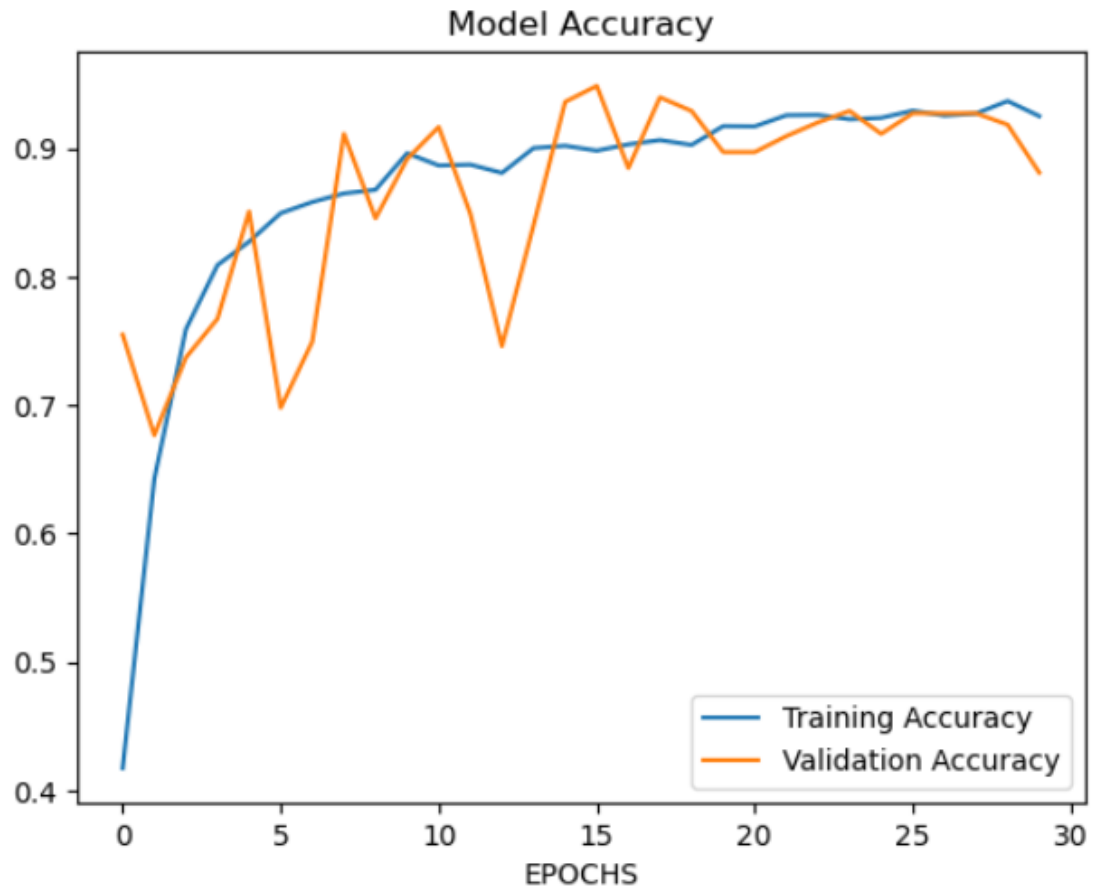
```
18/18 [==============================] - 1s 74ms/step - loss: 0.3219 - accuracy: 0.8706
```

What is VGG-19 ?

- The VGG-19 model is a convolutional neural network architecture that was developed by the Visual Geometry Group (VGG) at the University of Oxford. It was one of the top-performing models in the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) 2014, which is a benchmark dataset for image classification.
- The VGG-19 model consists of 19 layers, including 16 convolutional layers and 3 fully connected layers. It uses small 3x3 filters throughout the network, which allows it to capture more fine-grained details in the input images. The model also uses max pooling layers to reduce the spatial resolution of the feature maps and increase the receptive field of the neurons.

VGG-19 Model Loss and Accuracy





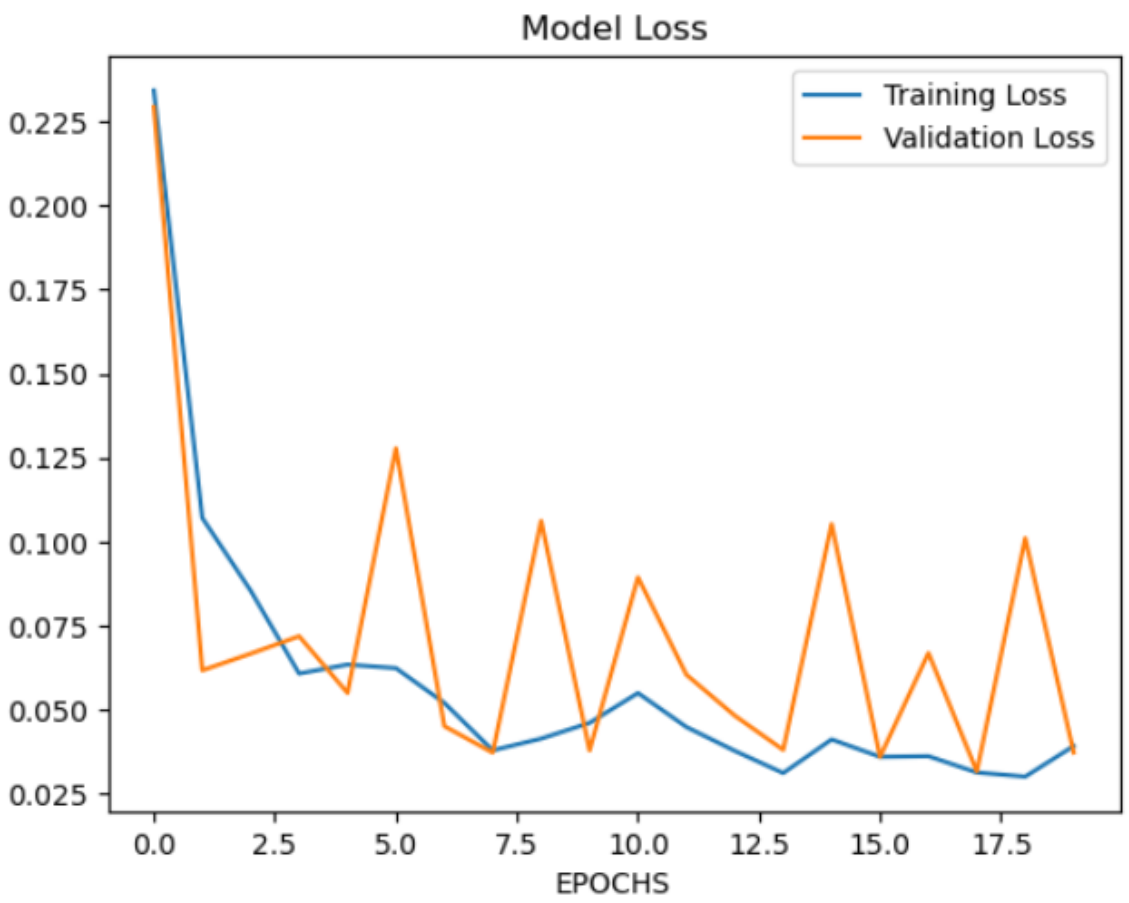

```
model.evaluate(test_generator_vgg)
```

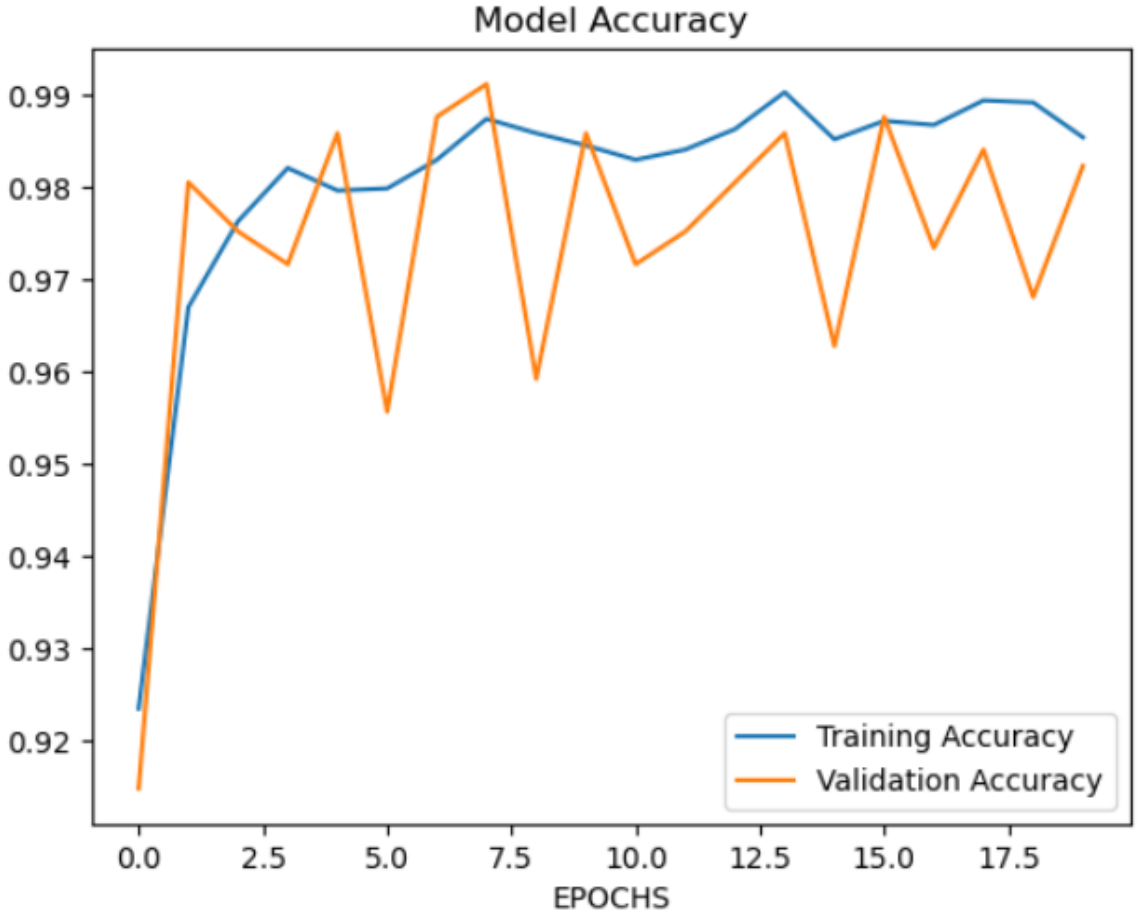
```
18/18 [==============================] - 4s 210ms/step - loss: 0.3613 - accuracy: 0.8688
```

What is MobileNet V2 ?

- The MobileNet V2 model is a convolutional neural network architecture that was designed by Google researchers for efficient computer vision on mobile and embedded devices. It is a follow-up to the original MobileNet model, which was introduced in 2017.
- MobileNet-v2 is 53 layers deep. You can load a pretrained version of the network trained on more than a million images from the ImageNet database, The pretrained network can classify images into 1000 object categories.

MobileNet V2 Model Loss and Accuracy






```
mnv2_model.evaluate(test_generator_vgg)
```

```
18/18 [==============================] - 2s 100ms/step - loss: 0.0380 - accuracy: 0.9876
```