Satellite Image Classification using EuroSAT with MobileNetV2

1. Introduction

Satellite image classification is a key component in remote sensing and Earth observation tasks, where land cover types must be automatically identified from aerial or satellite imagery. This project aims to classify satellite images into 10 different land cover classes using the EuroSAT dataset, which contains Sentinel-2 satellite images, and a deep learning model built using MobileNetV2 — a lightweight convolutional neural network architecture pretrained on ImageNet.

By leveraging transfer learning, the project achieves high accuracy with reduced computational requirements, making it suitable for fast and efficient deployment.

2. Approach

The following steps were followed to build a satellite image classifier using the EuroSAT dataset and MobileNetV2:

• Dataset Preparation:

- The EuroSAT dataset containing 27,002 RGB satellite images across 10 land cover classes was used.
- o Images were resized to 128×128 resolution and split into 80% training (21,602 images) and 20% validation (5,400 images).

• Data Normalization:

• A rescaling layer was applied to normalize pixel values to the range [0, 1], improving training stability and model performance.

Model Architecture:

- o A **MobileNetV2** model pretrained on ImageNet was used as the feature extractor.
- The top layers of MobileNetV2 were excluded (include_top=False), and its weights were frozen to prevent updates during training.
- o A custom classifier head was added with:
 - Global Average Pooling
 - Dense(128) with ReLU activation
 - Dense(10) with softmax for multiclass classification

• Training Configuration:

- The model was compiled using the Adam optimizer and sparse categorical crossentropy loss.
- o Training was performed for 5 epochs with a batch size of 32.
- o The model achieved a final training accuracy of approximately 90%.

Model Saving:

 The trained model was saved as satellite_classifier_model.h5 for later deployment and inference.

3. Assumptions

1. All input satellite images are RGB (3-channel) format compatible with pretrained MobileNetV2.

- 2. The 10 classes in the EuroSAT dataset are mutually exclusive and representative of real-world land cover types.
- 3. The input images are at a sufficient resolution (min 128×128) to capture key spatial features.

4. Challenges and Limitations

- 1. Limited Resolution: Some small-scale features may not be distinguishable at 128×128 resolution, reducing classification accuracy for certain classes like Residential vs. Industrial.
- 2. Class Overlap: Certain classes (e.g., Pasture and Permanent Crop, Vegetation and Dessert, etc) share similar textures or colors, making them harder to distinguish without more domain-specific data.
- 3. Model Generalization: Although the model performs well on the EuroSAT dataset, it may not generalize to satellite imagery from different sources or regions without retraining or domain adaptation.

5. Result and Output

The model was trained using 21,602 images from the EuroSAT dataset for 5 epochs. The training results are as follows:

- **Epoch 1**: Accuracy = 79.63%, Loss = 0.6104
- **Epoch 2**: Accuracy = 89.42%, Loss = 0.3115
- **Epoch 3**: Accuracy = 90.56%, Loss = 0.2731
- **Epoch 4**: Accuracy = 90.48%, Loss = 0.2753
- **Epoch 5**: Accuracy = 90.02%, Loss = 0.3129

These results demonstrate that the model quickly converged to a high accuracy in just 5 epochs due to the use of a pretrained MobileNetV2 architecture.

- Validation Dataset: 5,400 images (20% of the original dataset)
- Final Model Accuracy: ~90% (on training data)
- Training Time: ~2 minutes per epoch on GPU

The trained model was successfully saved as satellite classifier model.h5.

This model can now be deployed in a Streamlit-based web application where users can upload a satellite image in .jpg, .png, or .tif format and receive a predicted land cover class with a confidence score.

The final output is efficient, fast, and reliable for classifying EuroSAT images into 10 classes.

Summary: This project demonstrates the effectiveness of transfer learning using MobileNetV2 for satellite image classification. With high accuracy and minimal resource requirements, the system is well-suited for real-world geospatial applications.

EuroSAT Land Cover Classifier

Upload a satellite image and get its predicted land use category based on the EuroSAT dataset and a fine-tuned MobileNetV2 model.

Upload a satellite image (RGB)



Drag and drop file here

Limit 1GB per file • JPG, JPEG, PNG, TIFF, TIF

Browse files



1_1.tif 453.4MB

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The use_column_width parameter has been deprecated and will be removed in a future release. Please utilize the use_container_width parameter instead.



Uploaded Image



Predicted Class: Residential

Confidence: 99.96%

Built with using MobileNetV2 + EuroSAT | Suparna Reddy