random_forest

December 9, 2023

1 Image Classification Using Random Forests

1.1 Imports

[1]:
```
# First, let's import the required packages as follows

import os
import numpy as np
from skimage import io, transform
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
from sklearn.preprocessing import LabelEncoder
```

[2]:
```
# Assuming you have downloaded and extracted the dataset locally
data_dir = "../data/trash_images"

# Function to load and preprocess images
# We will resize the images to 64x64 pixels and flatten them to a 1-D numpy␣
 ↪array
def load_images(folder):
    images = []
    labels = []
    for subdir, _, files in os.walk(folder):
        for file in files:
            img_path = os.path.join(subdir, file)
            label = os.path.basename(subdir)
            img = io.imread(img_path)
            img = transform.resize(img, (64, 64))  # Resize images to a␣
 ↪consistent size
            images.append(img.flatten())  # Flatten the image
            labels.append(label)
    return np.array(images), np.array(labels)
```

1.2 Data PreProcessing

[3]:
```
# Function to train and evaluate a random forest classifier
# Load images and labels
images, labels = load_images(data_dir)

# Encode labels into numerical values
label_encoder = LabelEncoder()
encoded_labels = label_encoder.fit_transform(labels)



# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(images, encoded_labels,␣
 ↪test_size=0.2, random_state=42)
```

2 Implementing a Random Forest Classifier

Let's build a Random Forest Classifier to classify the images.

[4]:
```
# Train and evaluate a random forest classifier

# Initialize the Random Forest Classifier
rf_classifier = RandomForestClassifier(n_estimators=100, random_state=42)

# Train the classifier
rf_classifier.fit(X_train, y_train)

# Make predictions on the test set
y_pred = rf_classifier.predict(X_test)

# Evaluate the accuracy
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy * 100:.2f}%")
```

```
Accuracy: 68.97%
```

[5]:
```
# Test with an image
test_image_path = "../data/trash_images/cardboard/cardboard_015.jpg"
test_image = io.imread(test_image_path)
img = transform.resize(test_image, (64, 64))  # Resize images to a consistent␣
 ↪size
img = img.flatten()
img = img.reshape(1, -1)
prediction = rf_classifier.predict(img)
label = label_encoder.inverse_transform(prediction)
print(f'The predicted class for the given image is: {label}')
```

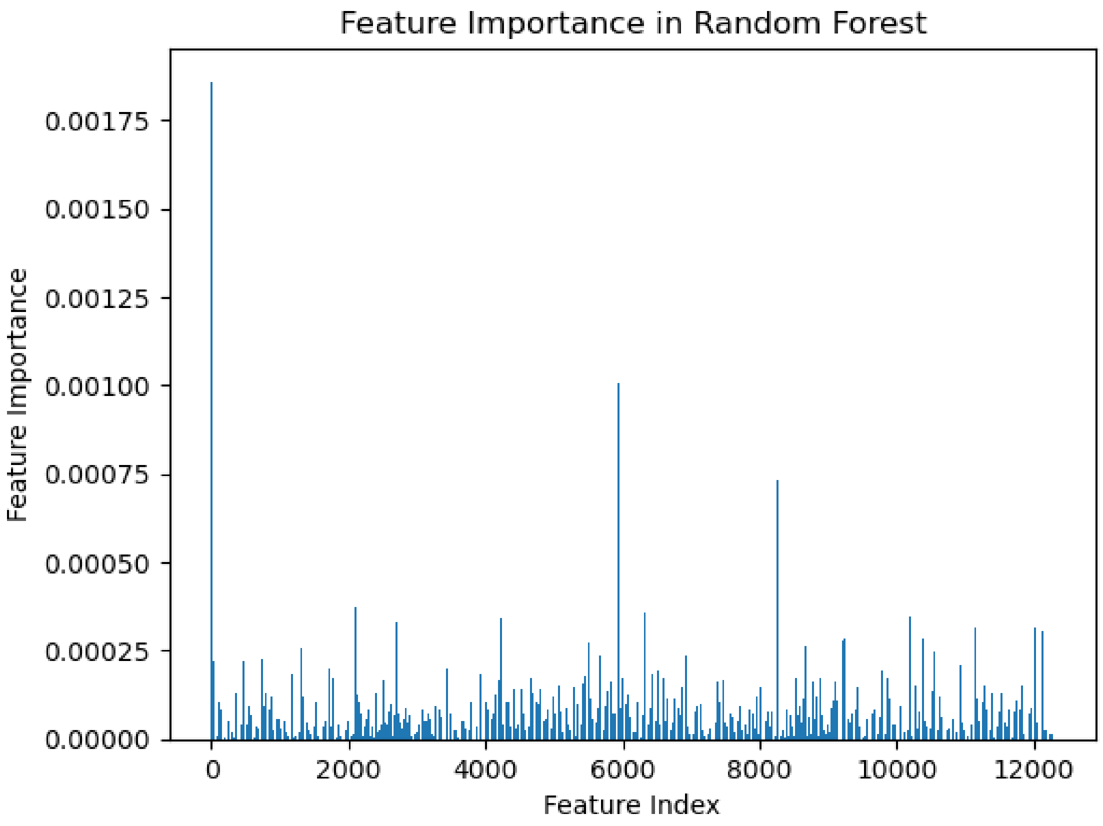
```
The predicted class for the given image is: ['cardboard']
```

```
[6]: # test with another image
     test_image_path = "../data/trash_images/metal/metal_003.jpg"
     test_image = io.imread(test_image_path)
     img = transform.resize(test_image, (64, 64))  # Resize images to a consistent␣
      ↪size
     img = img.flatten()
     img = img.reshape(1, -1)
     prediction = rf_classifier.predict(img)
     label = label_encoder.inverse_transform(prediction)
     print(f'The predicted class for the given image is: {label}')
```

```
The predicted class for the given image is: ['metal']
```

```
[9]: import matplotlib.pyplot as plt
     # Assuming 'clf' is your trained Random Forest classifier
     feature_importances = rf_classifier.feature_importances_

     # Visualize feature importances
     plt.bar(range(len(feature_importances)), feature_importances)
     plt.xlabel('Feature Index')
     plt.ylabel('Feature Importance')
     plt.title('Feature Importance in Random Forest')
     plt.show()
     plt.savefig('random_forest_feature_importance.png')
```



```
<Figure size 640x480 with 0 Axes>
```

[14]:
```
from sklearn.inspection import PartialDependenceDisplay

features = [0, 1, 2, 3, 4, 5]
X_train_features = labels
# Visualize partial dependence plots
PartialDependenceDisplay(rf_classifier, feature_names=X_train_features,␣
↪features=features, target_idx=1, deciles=features)
plt.show()
```

[ ]:
```

```