TestingModel

April 25, 2025

1 Testing The Bare Model with The Modified Model

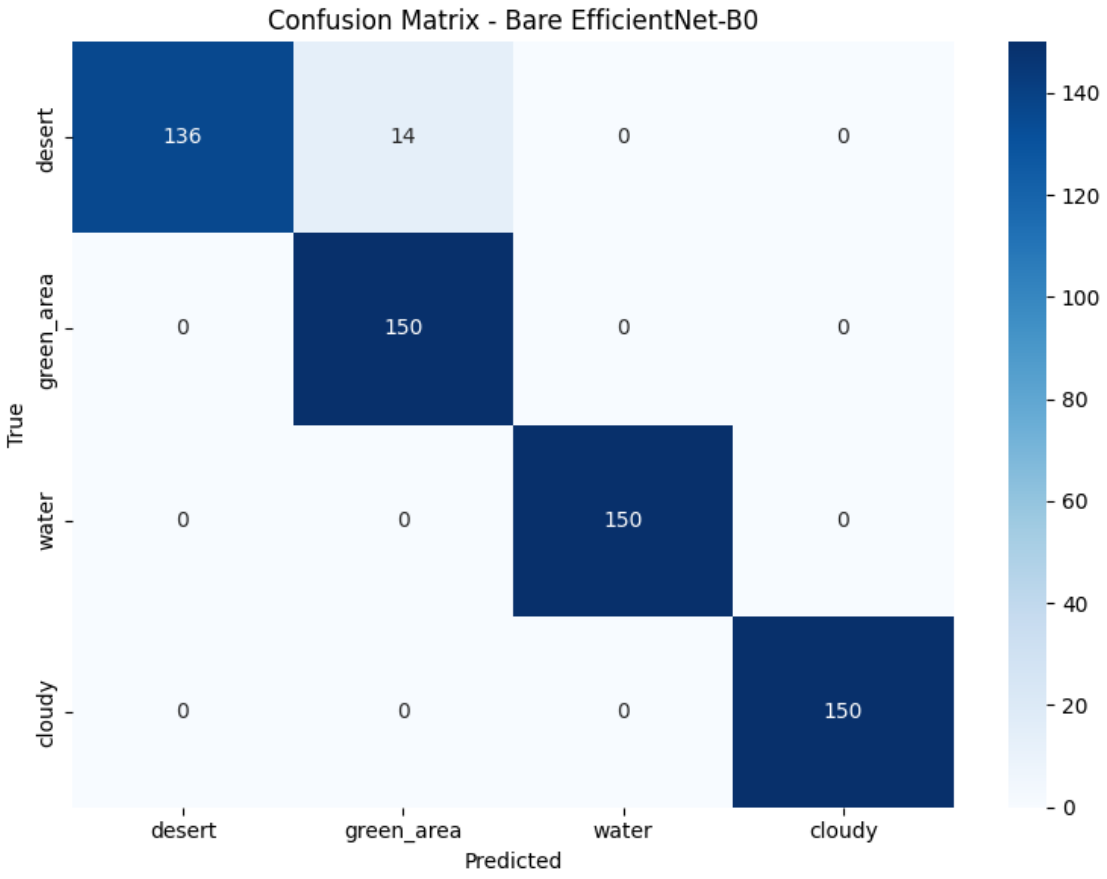
1.1 Bare Model

[30]:
```
import torch
import torch.nn as nn
from torch.utils.data import DataLoader
from torchvision import datasets, transforms
import matplotlib.pyplot as plt
import numpy as np
from sklearn.metrics import classification_report, confusion_matrix
import seaborn as sns
import timm
import os

# Define the BareEfficientNetB0 model class (same as in your training code)
class BareEfficientNetB0(nn.Module):
    def __init__(self, num_classes=4):
        super().__init__()
        self.model = timm.create_model("efficientnet_b0", pretrained=False,␣
 ↪num_classes=num_classes)

    def forward(self, x):
        return self.model(x)

# Set device
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
print(f"Using device: {device}")

# Define test transformations (same as validation in your code)
test_transforms = transforms.Compose([
    transforms.Resize((224, 224)),
    transforms.ToTensor(),
    transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225])
])

# Load test dataset
```

```
test_dataset = datasets.ImageFolder(os.path.join("processed_data", "test"),␣
 ↪transform=test_transforms)
test_loader = DataLoader(test_dataset, batch_size=32, shuffle=False)

# Initialize model
model = BareEfficientNetB0(num_classes=4)
model.load_state_dict(torch.load("efficientnet_b0_bare_2.pth"))
model.to(device)
model.eval()

# Class names (based on your dataset: desert, green_area, water, cloudy)
class_names = ["desert", "green_area", "water", "cloudy"]

# Test the model
correct = 0
total = 0
all_preds = []
all_labels = []

with torch.no_grad():
    for images, labels in test_loader:
        images, labels = images.to(device), labels.to(device)
        outputs = model(images)
        _, predicted = torch.max(outputs, 1)
        total += labels.size(0)
        correct += (predicted == labels).sum().item()

        # Collect predictions and labels for metrics
        all_preds.extend(predicted.cpu().numpy())
        all_labels.extend(labels.cpu().numpy())

# Calculate accuracy
test_accuracy = 100 * correct / total
print(f"Test Accuracy: {test_accuracy:.2f}%")

# Generate classification report
print("\nClassification Report:")
print(classification_report(all_labels, all_preds, target_names=class_names))

# Generate and plot confusion matrix
cm = confusion_matrix(all_labels, all_preds)
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues", xticklabels=class_names,␣
 ↪yticklabels=class_names)
plt.title("Confusion Matrix - Bare EfficientNet-B0")
plt.xlabel("Predicted")
plt.ylabel("True")
```

```
plt.tight_layout()
plt.savefig("confusion_matrix_efficientnet_b0__bare.png")
plt.show()  # Display the plot
plt.close()
print("Confusion matrix saved as 'confusion_matrix_efficientnet_b0_bare.png'")

# Assuming `model` is your trained or defined model
num_params = sum(p.numel() for p in model.parameters())
print(f"Total number of parameters: {num_params}")
```

```
Using device: cuda
Test Accuracy: 97.67%

Classification Report:
              precision    recall  f1-score   support

      desert       1.00      0.91      0.95       150
  green_area       0.91      1.00      0.96       150
       water       1.00      1.00      1.00       150
      cloudy       1.00      1.00      1.00       150

    accuracy                           0.98       600
   macro avg       0.98      0.98      0.98       600
weighted avg       0.98      0.98      0.98       600
```




```
Confusion matrix saved as 'confusion_matrix_efficientnet_b0_bare.png'
Total number of parameters: 4012672
```

1.2 Modified Model

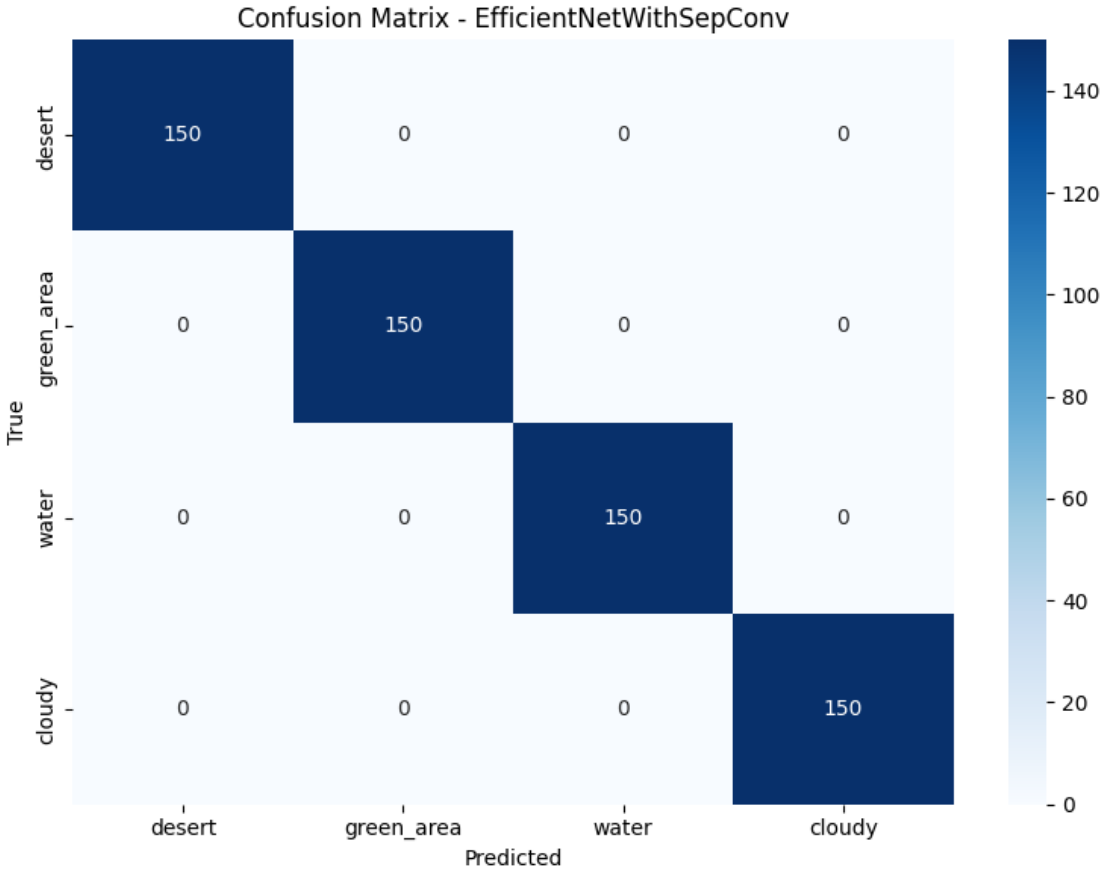
[31]:
```python
import torch
import torch.nn as nn
from torch.utils.data import DataLoader
from torchvision import datasets, transforms
import matplotlib.pyplot as plt
import numpy as np
from sklearn.metrics import classification_report, confusion_matrix
import seaborn as sns
import timm
import os

# Define the EfficientNetWithSepConv model class
class EfficientNetWithSepConv(nn.Module):
    def __init__(self, num_classes=4):
        super().__init__()
```

```
        # Load the base model
        self.base = timm.create_model("efficientnet_b0", pretrained=False,␣
 ↪features_only=False)
        # Extract the features before the classifier
        self.base.classifier = nn.Identity()
        self.base.global_pool = nn.Identity()
        # Define input features for the separable convolution
        in_features = 1280
        self.sep_conv = nn.Sequential(
            nn.Conv2d(in_features, in_features, kernel_size=3,␣
 ↪groups=in_features, padding=1),
            nn.Conv2d(in_features, 256, kernel_size=1),
            nn.ReLU(),
            nn.BatchNorm2d(256),
            nn.AdaptiveAvgPool2d(1),
        )
        self.fc = nn.Linear(256, num_classes)

    def forward(self, x):
        x = self.base(x)
        x = self.sep_conv(x)
        x = x.view(x.size(0), -1)
        x = self.fc(x)
        return x

# Set device
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
print(f"Using device: {device}")

# Define test transformations (same as validation in the bare model code)
test_transforms = transforms.Compose([
    transforms.Resize((224, 224)),
    transforms.ToTensor(),
    transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225])
])

# Load test dataset
test_dataset = datasets.ImageFolder(os.path.join("processed_data", "test"),␣
 ↪transform=test_transforms)
test_loader = DataLoader(test_dataset, batch_size=32, shuffle=False)

# Initialize model
model = EfficientNetWithSepConv(num_classes=4)
# Load saved weights (update the path if the filename differs)
model.load_state_dict(torch.load("efficientnet_b0main_modified.pth"))
model.to(device)
model.eval()
```

```python
# Class names (based on your dataset: desert, green_area, water, cloudy)
class_names = ["desert", "green_area", "water", "cloudy"]

# Test the model
correct = 0
total = 0
all_preds = []
all_labels = []

with torch.no_grad():
    for images, labels in test_loader:
        images, labels = images.to(device), labels.to(device)
        outputs = model(images)
        _, predicted = torch.max(outputs, 1)
        total += labels.size(0)
        correct += (predicted == labels).sum().item()

        # Collect predictions and labels for metrics
        all_preds.extend(predicted.cpu().numpy())
        all_labels.extend(labels.cpu().numpy())

# Calculate accuracy
test_accuracy = 100 * correct / total
print(f"Test Accuracy: {test_accuracy:.2f}%")

# Generate classification report
print("\nClassification Report:")
print(classification_report(all_labels, all_preds, target_names=class_names))

# Generate and plot confusion matrix
cm = confusion_matrix(all_labels, all_preds)
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues", xticklabels=class_names,␣
 ↪yticklabels=class_names)
plt.title("Confusion Matrix - EfficientNetWithSepConv")
plt.xlabel("Predicted")
plt.ylabel("True")
plt.tight_layout()
plt.savefig("confusion_matrix_efficientnet_sepconv.png")
plt.show()  # Display the plot
plt.close()
print("Confusion matrix saved as 'confusion_matrix_efficientnet_sepconv.png'")



# Assuming `model` is your trained or defined model
```

```python
num_params = sum(p.numel() for p in model.parameters())
print(f"Total number of parameters: {num_params}")
```

```
Using device: cuda
Test Accuracy: 100.00%

Classification Report:
              precision    recall  f1-score   support

      desert       1.00      1.00      1.00       150
  green_area       1.00      1.00      1.00       150
       water       1.00      1.00      1.00       150
      cloudy       1.00      1.00      1.00       150

    accuracy                           1.00       600
   macro avg       1.00      1.00      1.00       600
weighted avg       1.00      1.00      1.00       600
```




```
Confusion matrix saved as 'confusion_matrix_efficientnet_sepconv.png'
```

```
Total number of parameters: 4349824
```

[32]:
```python
import torch
import torch.nn as nn
from torch.utils.data import DataLoader
from torchvision import datasets, transforms
import matplotlib.pyplot as plt
import numpy as np
from sklearn.metrics import classification_report, confusion_matrix
import seaborn as sns
import timm
import os

# Define the EfficientNetWithMinimalHead model class
class EfficientNetWithMinimalHead(nn.Module):
    def __init__(self, num_classes=4):
        super().__init__()
        self.base = timm.create_model("efficientnet_b0", pretrained=False,␣
 ↪features_only=False)
        self.base.classifier = nn.Identity()
        self.base.global_pool = nn.Identity()
        in_features = 1280
        self.head = nn.Sequential(
            nn.Conv2d(in_features, 4, kernel_size=1),
            nn.ReLU(),
            nn.BatchNorm2d(4),
            nn.AdaptiveAvgPool2d(1),
            nn.Dropout(0.3),
        )
        self.fc = nn.Linear(4, num_classes)

    def forward(self, x):
        x = self.base(x)
        x = self.head(x)
        x = x.view(x.size(0), -1)
        x = self.fc(x)
        return x

# Set device
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
print(f"Using device: {device}")

# Define test transformations (same as validation in the bare model code)
test_transforms = transforms.Compose([
    transforms.Resize((224, 224)),
    transforms.ToTensor(),
    transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225])
```

```
])

# Load test dataset
test_dataset = datasets.ImageFolder(os.path.join("processed_data", "test"),␣
 ↪transform=test_transforms)
test_loader = DataLoader(test_dataset, batch_size=32, shuffle=False)

# Initialize model
model = EfficientNetWithMinimalHead(num_classes=4)
# Load saved weights (update the path if the filename differs)
model.load_state_dict(torch.load("efficientnet_b0_2_modified.pth"))
model.to(device)
model.eval()

# Class names (based on your dataset: desert, green_area, water, cloudy)
class_names = ["desert", "green_area", "water", "cloudy"]

# Test the model
correct = 0
total = 0
all_preds = []
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with torch.no_grad():
    for images, labels in test_loader:
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        outputs = model(images)
        _, predicted = torch.max(outputs, 1)
        total += labels.size(0)
        correct += (predicted == labels).sum().item()

        # Collect predictions and labels for metrics
        all_preds.extend(predicted.cpu().numpy())
        all_labels.extend(labels.cpu().numpy())

# Calculate accuracy
test_accuracy = 100 * correct / total
print(f"Test Accuracy: {test_accuracy:.2f}%")

# Generate classification report
print("\nClassification Report:")
print(classification_report(all_labels, all_preds, target_names=class_names))

# Generate and plot confusion matrix
cm = confusion_matrix(all_labels, all_preds)
plt.figure(figsize=(8, 6))
```
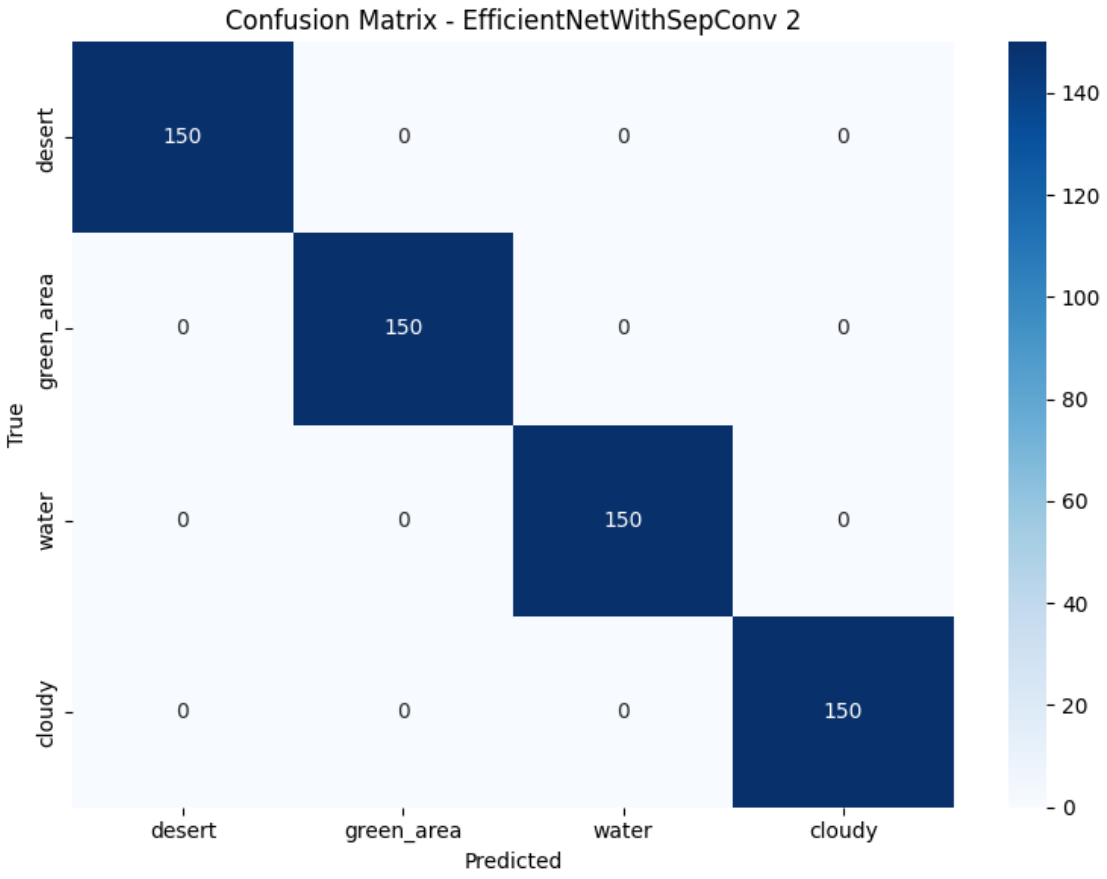

```
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues", xticklabels=class_names,␣
 ↪yticklabels=class_names)
plt.title("Confusion Matrix - EfficientNetWithSepConv 2")
plt.xlabel("Predicted")
plt.ylabel("True")
plt.tight_layout()
plt.savefig("confusion_matrix_efficientnet_sepconv_2.png")
plt.show()  # Display the plot
plt.close()
print("Confusion matrix saved as 'confusion_matrix_efficientnet_sepconv_2.png'")



# Assuming `model` is your trained or defined model
num_params = sum(p.numel() for p in model.parameters())
print(f"Total number of parameters: {num_params}")
```

```
Using device: cuda
Test Accuracy: 100.00%

Classification Report:
              precision    recall  f1-score   support

      desert       1.00      1.00      1.00       150
  green_area       1.00      1.00      1.00       150
       water       1.00      1.00      1.00       150
      cloudy       1.00      1.00      1.00       150

    accuracy                           1.00       600
   macro avg       1.00      1.00      1.00       600
weighted avg       1.00      1.00      1.00       600
```




```
Confusion matrix saved as 'confusion_matrix_efficientnet_sepconv_2.png'
Total number of parameters: 4012700
```

[ ]: