```
import os
import zipfile

os.environ['KAGGLE_CONFIG_DIR'] = "/content"
!kaggle competitions download -c plant-pathology-2020-fgvc7

# Unzip the dataset
with zipfile.ZipFile("plant-pathology-2020-fgvc7.zip", 'r') as zip_ref:
    zip_ref.extractall("plant_data")
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix this, you can run 'chmod 600 /content/kaggle.json'
Downloading plant-pathology-2020-fgvc7.zip to /content
 99% 774M/779M [00:04<00:00, 136MB/s]
100% 779M/779M [00:04<00:00, 201MB/s]
```

```
import pandas as pd
import numpy as np
import os
import cv2
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
from sklearn.svm import SVC
from sklearn.metrics import classification_report, confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
```

```
df = pd.read_csv("/content/plant_data/train.csv")
df.head()
```

	image_id	healthy	multiple_diseases	rust	scab
0	Train_0	0	0	0	1
1	Train_1	0	1	0	0
2	Train_2	1	0	0	0
3	Train_3	0	0	1	0
4	Train_4	1	0	0	0

Next steps: Generate code with df View recommended plots New interactive sheet

```
df['label'] = df[['healthy', 'multiple_diseases', 'rust', 'scab']].idxmax(axis=1)
df = df[['image_id', 'label']]
df.head()
```

	image_id	label
0	Train_0	scab
1	Train_1	multiple_diseases
2	Train_2	healthy
3	Train_3	rust
4	Train_4	healthy

Next steps: Generate code with df View recommended plots New interactive sheet

```
def extract_features(image_path):
    image = cv2.imread(image_path)
    image = cv2.resize(image, (128, 128))  # Resize for consistency
    image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

    hist_features = []
    for i in range(3):  # RGB channels
        hist = cv2.calcHist([image], [i], None, [32], [0, 256])
        hist = cv2.normalize(hist, hist).flatten()
        hist_features.extend(hist)

    return hist_features

# Call the function with a valid image path
features = extract_features('/content/plant_data/images/Test_0.jpg')
```

```
print(features[:5])  # show first 5 features
```

```
[np.float32(0.0), np.float32(0.002053484), np.float32(0.06853503), np.float32(0.3277874), np.float32(0.43995896)]
```

```
# Build feature Dataset
features = []
labels = []

image_folder = "/content/plant_data/images"

for i, row in df.iterrows():
  image_id = row["image_id"]
  label = row["label"]
  image_path = os.path.join(image_folder, image_id + '.jpg')

  feats = extract_features(image_path)
  features.append(feats)
  labels.append(label)

X = np.array(features)
y = np.array(labels)
```

```
# Encode Labels and Split data
le = LabelEncoder()
y_encoded = le.fit_transform(y)

X_train, X_test, y_train, y_test = train_test_split(
    X, y_encoded, test_size=0.2, random_state=42, stratify=y_encoded
)
```

Double-click (or enter) to edit

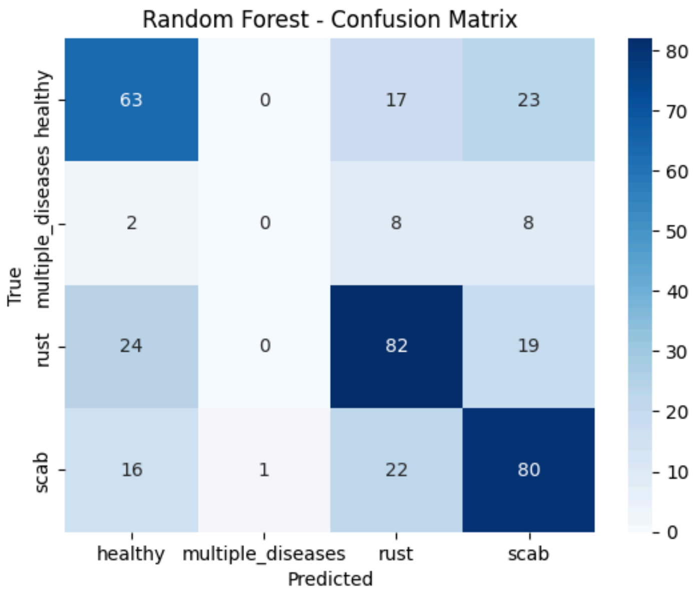
```
# Train ML models
# A. Random Forest
rf = RandomForestClassifier(n_estimators=100, random_state=42)
rf.fit(X_train, y_train)
rf_preds = rf.predict(X_test)
```

```
# B. SVM
svm = SVC(kernel = 'rbf', probability=True)
svm.fit(X_train, y_train)
svm_preds = svm.predict(X_test)
```

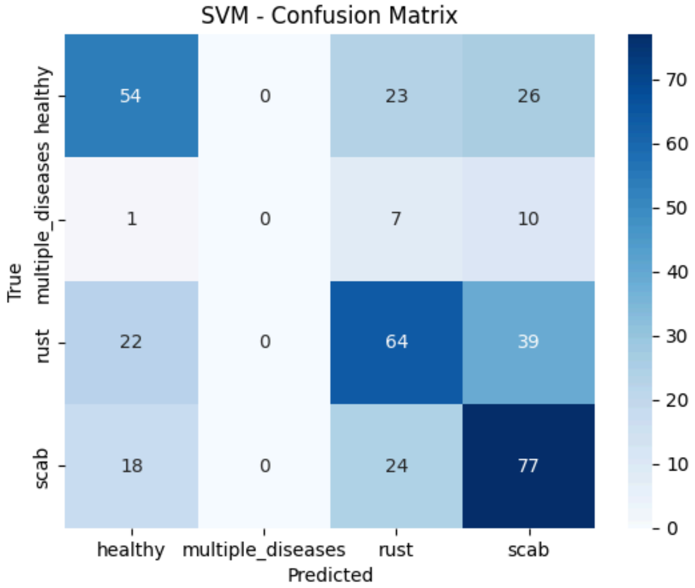
```
# C. Gradient Boosting
gbm = GradientBoostingClassifier(n_estimators=100)
gbm.fit(X_train, y_train)
gbm_preds = gbm.predict(X_test)
```

```
# Evaluate Models
def evaluate_model(y_true, y_pred, model_name):
  print(f"----- {model_name} Evaluation -----")
  print("Classification Report:\n", classification_report(y_true, y_pred, target_names=le.classes_))
  cm = confusion_matrix(y_true, y_pred)
  sns.heatmap(cm, annot=True, fmt='d', xticklabels=le.classes_, yticklabels=le.classes_, cmap='Blues')
  plt.title(f"{model_name} - Confusion Matrix")
  plt.xlabel('Predicted')
  plt.ylabel('True')
  plt.show()

evaluate_model(y_test, rf_preds, "Random Forest")
evaluate_model(y_test, svm_preds, "SVM")
evaluate_model(y_test, gbm_preds, "Gradient Boosting")
```

```
----- Random Forest Evaluation -----
Classification Report:
                    precision    recall  f1-score   support

          healthy       0.60      0.61      0.61       103
multiple_diseases       0.00      0.00      0.00        18
             rust       0.64      0.66      0.65       125
             scab       0.62      0.67      0.64       119

         accuracy                           0.62       365
        macro avg       0.46      0.48      0.47       365
     weighted avg       0.59      0.62      0.60       365
```

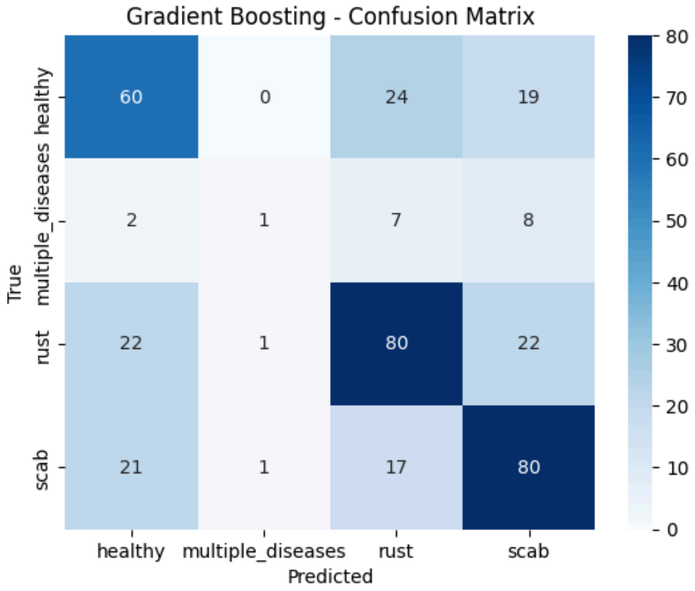


```
----- SVM Evaluation -----
Classification Report:
                    precision    recall  f1-score   support

          healthy       0.57      0.52      0.55       103
multiple_diseases       0.00      0.00      0.00        18
             rust       0.54      0.51      0.53       125
             scab       0.51      0.65      0.57       119

         accuracy                           0.53       365
        macro avg       0.40      0.42      0.41       365
     weighted avg       0.51      0.53      0.52       365

/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined ar
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined ar
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565: UndefinedMetricWarning: Precision is ill-defined ar
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

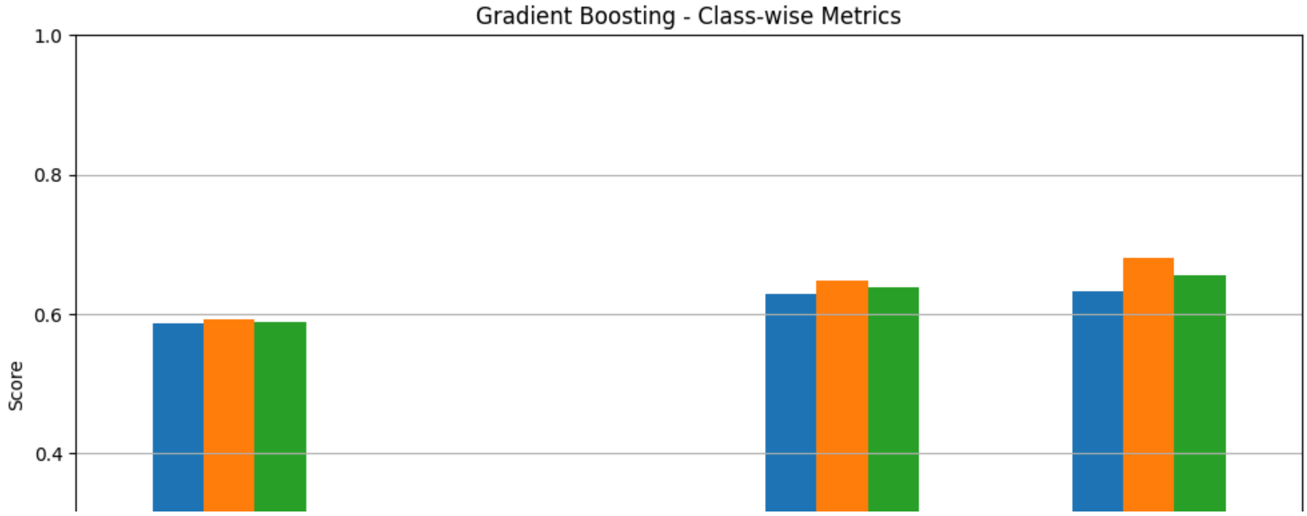


```
----- Gradient Boosting Evaluation -----
Classification Report:
                    precision    recall  f1-score   support

          healthy       0.57      0.58      0.58       103
multiple_diseases       0.33      0.06      0.10        18
```

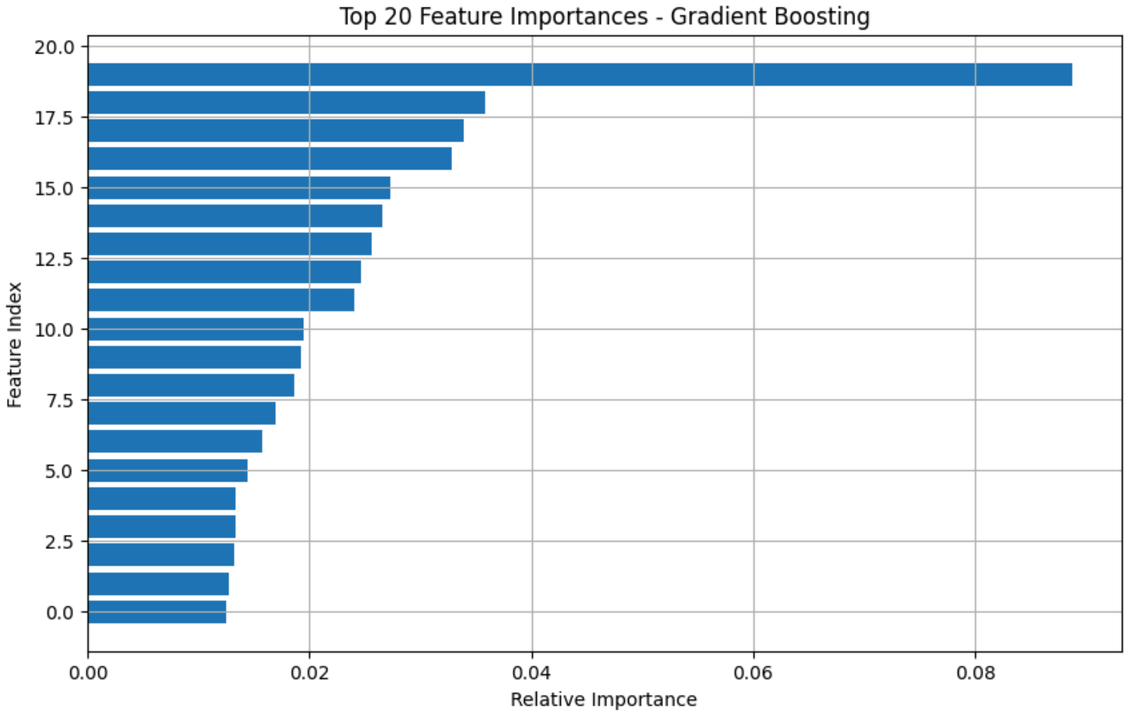
```
             rust       0.62      0.64      0.63       125
             scab       0.62      0.67      0.65       119

         accuracy                           0.61       365
        macro avg       0.54      0.49      0.49       365
     weighted avg       0.59      0.61      0.59       365
```



```
# 1. Train the Gradient Boosting model
from sklearn.ensemble import GradientBoostingClassifier

gbm = GradientBoostingClassifier()
gbm.fit(X_train, y_train)

# 2. Predict
y_pred_gbm = gbm.predict(X_test)

# 3. Visualize Classification Report as Bar Plot
from sklearn.metrics import classification_report
import pandas as pd
import matplotlib.pyplot as plt

# If you used LabelEncoder for y labels:
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
le.fit(y_train)  # or y, if not split yet
labels = le.classes_

report = classification_report(y_test, y_pred_gbm, target_names=labels, output_dict=True)
df_report = pd.DataFrame(report).transpose()

# Filter class-wise metrics
df_classes = df_report.iloc[:-3][['precision', 'recall', 'f1-score']]

# Plot
df_classes.plot(kind='bar', figsize=(10, 6))
plt.title('Gradient Boosting - Class-wise Metrics')
plt.ylabel('Score')
plt.ylim(0, 1)
plt.grid(axis='y')
plt.xticks(rotation=45)
plt.legend(loc='lower right')
plt.tight_layout()
plt.show()
```



```
# Feature importnace plot
import numpy as np

# Assuming model is named `gbm`
importances = gbm.feature_importances_
indices = np.argsort(importances)[-20:]  # top 20 important features

plt.figure(figsize=(10, 6))
plt.title('Top 20 Feature Importances - Gradient Boosting')
plt.barh(range(len(indices)), importances[indices], align='center')
plt.xlabel('Relative Importance')
plt.ylabel('Feature Index')
plt.grid()
plt.show()
```



Start coding or generate with AI.