```python
!pip install wfdb biosppy scikit-learn matplotlib numpy
```

```
Collecting wfdb
  Downloading wfdb-4.3.0-py3-none-any.whl.metadata (3.8 kB)
Collecting biosppy
  Downloading biosppy-2.2.3-py2.py3-none-any.whl.metadata (6.0 kB)
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Requirement already satisfied: matplotlib in /usr/local/lib/python3.11/dist-packages (3.10.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.11/dist-packages (2.0.2)
Requirement already satisfied: aiohttp>=3.10.11 in /usr/local/lib/python3.11/dist-packages (from wfdb) (3.11.15)
Requirement already satisfied: fsspec>=2023.10.0 in /usr/local/lib/python3.11/dist-packages (from wfdb) (2025.3.2)
Collecting pandas>=2.2.3 (from wfdb)
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Requirement already satisfied: scipy>=1.13.0 in /usr/local/lib/python3.11/dist-packages (from wfdb) (1.14.1)
Requirement already satisfied: soundfile>=0.10.0 in /usr/local/lib/python3.11/dist-packages (from wfdb) (0.13.1)
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Requirement already satisfied: six in /usr/local/lib/python3.11/dist-packages (from biosppy) (1.17.0)
Requirement already satisfied: joblib in /usr/local/lib/python3.11/dist-packages (from biosppy) (1.4.2)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.11/dist-packages (from biosppy) (4.11.0.86)
Collecting pywavelets (from biosppy)
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```

```python
import wfdb
import numpy as np
import matplotlib.pyplot as plt
from scipy.signal import find_peaks
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score


from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```python
import os
import zipfile

# Define the dataset paths as strings within a list
dataset_paths = [
    "/content/drive/MyDrive/Datasets/mit-bih-arrhythmia-database-1.0.0.zip",
    "/content/drive/MyDrive/Datasets/mit-bih-supraventricular-arrhythmia-database-1.0.0.zip"
]
extract_path = "/content/ECG_Data/"
```

```python
# Iterate over the dataset paths and extract each zip file
for dataset_path in dataset_paths:
    with zipfile.ZipFile(dataset_path, 'r') as zip_ref:  # dataset_path is now a string
        zip_ref.extractall(extract_path)

print("All ECG datasets extracted successfully!")
```

➔ All ECG datasets extracted successfully!

```python
record = wfdb.rdrecord('100', pn_dir='mitdb')  # Load full record
```

```python
record_ids = ['100', '101', '102', '103']
all_features = []

for rid in record_ids:
    record = wfdb.rdrecord(rid, sampto=10000, pn_dir='mitdb')
    signal = record.p_signal[:,0]
    feats = extract_features(signal)
    all_features.append(feats)

features = np.vstack(all_features)
print("Total features:", features.shape)
```

➔ Total features: (122, 4)

```python
def extract_features(signal, fs=360):
    peaks, _ = find_peaks(signal, distance=fs*0.6)  # approximate R peaks every 0.6s
    rr_intervals = np.diff(peaks) / fs

    features = []
    for i in range(1, len(rr_intervals)-1):
        rr_current = rr_intervals[i]
        rr_prev = rr_intervals[i-1]
        rr_next = rr_intervals[i+1]
        qrs_width = (peaks[i+1] - peaks[i-1]) / fs

        features.append([rr_current, rr_prev, rr_next, qrs_width])
    return np.array(features)

features = extract_features(signal)
print("Extracted features shape:", features.shape)
```

➔ Extracted features shape: (30, 4)

```python
labels = np.zeros(features.shape[0])
labels[::10] = 1  # Simulated arrhythmia label every 10 beats

from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(
    features, labels, test_size=0.25, stratify=labels, random_state=42)

clf = RandomForestClassifier(n_estimators=100, random_state=42)
clf.fit(X_train, y_train)
y_pred = clf.predict(X_test)


print("Accuracy:", accuracy_score(y_test, y_pred))
print("Classification Report:\n", classification_report(y_test, y_pred))

conf_mat = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(5,4))
plt.imshow(conf_mat, cmap='Blues')
plt.title("Confusion Matrix")
plt.xlabel("Predicted")
plt.ylabel("True")
plt.colorbar()
plt.show()
```

```
Accuracy: 0.875
Classification Report:
              precision    recall  f1-score   support

         0.0       0.88      1.00      0.93         7
         1.0       0.00      0.00      0.00         1

    accuracy                           0.88         8
   macro avg       0.44      0.50      0.47         8
weighted avg       0.77      0.88      0.82         8
```

```
/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))
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  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```


Confusion Matrix