Imports

```
from sklearn.model_selection import train_test_split
import pandas as pd

from sklearn.ensemble import AdaBoostClassifier
from sklearn.linear_model import Perceptron
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.base import BaseEstimator, ClassifierMixin
from sklearn.utils import resample
import numpy as np
from sklearn.neural_network import MLPClassifier
```

Part1 - Hearth Disease Dataset

```
#Load the dataset from a CSV file
url = 'https://archive.ics.uci.edu/ml/machine-learning-databases/heart-disease/processed.cleveland.data'
column_names = ['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg', 'thalach', 'exang', 'oldpeak', 'slope', 'ca', 'thal', 'target']
heart_data = pd.read_csv(url, names=column_names)
```

```
# Preprocess the data
heart_data = heart_data.replace('?', pd.NA).dropna()  # Handling missing values
X = heart_data.drop('target', axis=1)
y = heart_data['target']
```

```
X
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	63.0	1.0	1.0	145.0	233.0	1.0	2.0	150.0	0.0	2.3	3.0	0.0	6.0
1	67.0	1.0	4.0	160.0	286.0	0.0	2.0	108.0	1.0	1.5	2.0	3.0	3.0
2	67.0	1.0	4.0	120.0	229.0	0.0	2.0	129.0	1.0	2.6	2.0	2.0	7.0
3	37.0	1.0	3.0	130.0	250.0	0.0	0.0	187.0	0.0	3.5	3.0	0.0	3.0
4	41.0	0.0	2.0	130.0	204.0	0.0	2.0	172.0	0.0	1.4	1.0	0.0	3.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...
297	57.0	0.0	4.0	140.0	241.0	0.0	0.0	123.0	1.0	0.2	2.0	0.0	7.0
298	45.0	1.0	1.0	110.0	264.0	0.0	0.0	132.0	0.0	1.2	2.0	0.0	7.0
299	68.0	1.0	4.0	144.0	193.0	1.0	0.0	141.0	0.0	3.4	2.0	2.0	7.0
300	57.0	1.0	4.0	130.0	131.0	0.0	0.0	115.0	1.0	1.2	2.0	1.0	7.0
301	57.0	0.0	2.0	130.0	236.0	0.0	2.0	174.0	0.0	0.0	2.0	1.0	3.0

297 rows × 13 columns

Sonraki adımlar: Xile kod oluşturun Önerilen grafikleri göster

```
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
print(X_train.shape)
print(y_train.shape)
print(X_test.shape)
print(y_test.shape)
```

```
(237, 13)
(237,)
(60, 13)
(60,)
```

EDA

8 hücre gizli

Part2 - Multi Layer Perceptron

```
#Perceptron definiton to base_clf and fitting
base_clf = Perceptron(random_state=42, max_iter=2500)
base_clf.fit(X_train, y_train)
```

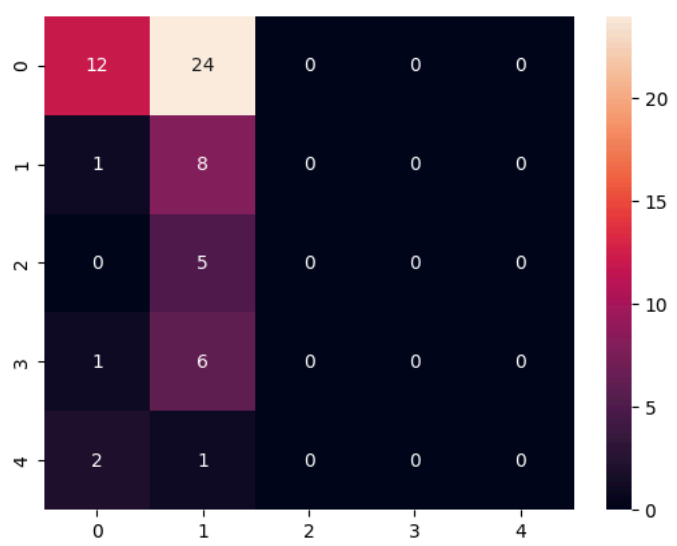
```
Perceptron(max_iter=2500, random_state=42)
```

```
#Prediction to preceptron fitting element
y_pred = base_clf.predict(X_test)
```

```
#Print accuracy
accuracy = accuracy_score(y_test, y_pred)
print(f"Perceptron: Accuracy = {accuracy}")
```

```
Perceptron: Accuracy = 0.3333333333333333
```

```
#Plot confusion matrix with heatmap
cm = confusion_matrix(y_test, y_pred)
sns.heatmap(cm, annot=True, fmt='d')
plt.show()
```




```
#Adaboost classifier, that use Perseptron that we fitted and Samme algorithm. And adaboots fitting
adaBoost = AdaBoostClassifier(estimator=base_clf, random_state=42, algorithm='SAMME')
adaBoost.fit(X_train, y_train)
```

```
AdaBoostClassifier
estimator: Perceptron
Perceptron
```

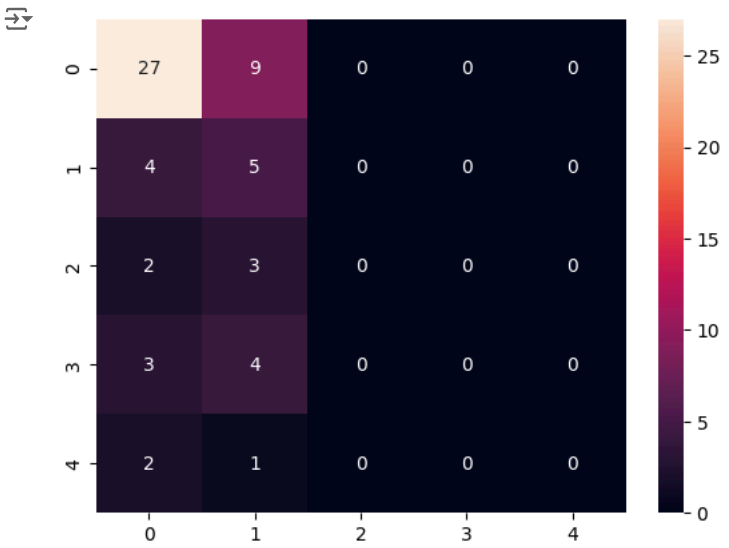
```
#Adaboost fitting predict
y_pred = adaBoost.predict(X_test)
```

```
#Print accuracy
accuracy = accuracy_score(y_test, y_pred)
print(f"AdaBoost with MLP as base classifier: Accuracy = {accuracy}")
```

```
AdaBoost with MLP as base classifier: Accuracy = 0.5333333333333333
```

```
# draw confusion matrix

cm = confusion_matrix(y_test, y_pred)
sns.heatmap(cm, annot=True, fmt='d')
plt.show()
```



Part3 - Random Decision Forest

```
#Implementation of perceptron
class TrainablePerceptron(BaseEstimator, ClassifierMixin):
    def __init__(self, max_iterations=100):
        self.max_iterations = max_iterations
        self.perceptron = MLPClassifier(hidden_layer_sizes=(10,), random_state=42,  max_iter=2500)

    def fit(self, X, y):
        self.perceptron.fit(X, y)

    def predict(self, X):
        return self.perceptron.predict(X)


#Implementation of random decision forest with Perceptron
class RandomDecisionForest(BaseEstimator, ClassifierMixin):
    def __init__(self, n_estimators=10, max_iterations=100, random_state=None):
        self.n_estimators = n_estimators
        self.max_iterations = max_iterations
        self.random_state = random_state
        self.estimators = []

    def fit(self, X, y):
        for _ in range(self.n_estimators):
            X_resampled, y_resampled = resample(X, y, random_state=self.random_state)
            perceptron = TrainablePerceptron(max_iterations=self.max_iterations)
            perceptron.fit(X_resampled, y_resampled)
            self.estimators.append(perceptron)

    def predict(self, X):
        predictions = []
        for estimator in self.estimators:
            predictions.append(estimator.predict(X))
        return np.mean(predictions, axis=0)


#Calling random decision forest class and fitting this
random_forest = RandomDecisionForest(n_estimators=20, max_iterations=2500, random_state=42)
random_forest.fit(X_train, y_train)
```

```
#Predict fitted random forest
y_pred = random_forest.predict(X_test)


#Print accuracy value
accuracy = accuracy_score(y_test, y_pred)
print(f"Random Decision Forest with Trainable Perceptrons: Accuracy = {accuracy}")
```

```
Random Decision Forest with Trainable Perceptrons: Accuracy = 0.5666666666666667
```

```
#Plot confusion matrix with heatmap
cm = confusion_matrix(y_test, y_pred)
sns.heatmap(cm, annot=True, fmt='d')
plt.show()
```