```python
from classifiers import NaiveBayes, LDA, QDA
from generate_data import generate_data_scheme_1,
generate_data_scheme_2
from sklearn.model_selection import train_test_split
import numpy as np
import pandas as pd

rho_list = [0, 0.1, 0.3, 0.5, 0.7, 0.9]
a = 2

models = [NaiveBayes(), LDA(), QDA()]

test_sizes = [0.05, 0.1, 0.2, 0.3, 0.4]

def accuracy(y_true, y_pred):
    accuracy = np.sum(y_true == y_pred) / len(y_true)
    return accuracy
```

Single experiment

```python

for rho in rho_list:
    print(f"Current value of rho = {rho}")

    X, y = generate_data_scheme_2(1000, a, rho)

    X_train, X_test, y_train, y_test = train_test_split(
        X, y, test_size=0.2, random_state=123
    )

    for model in models:
        model.fit(X_train, y_train)
        y_pred = model.predict(X_test)
        acc = accuracy(y_test, y_pred)


        print(f"\tModel {model.name} accuracy: {round(acc*100, 2)}%")
```

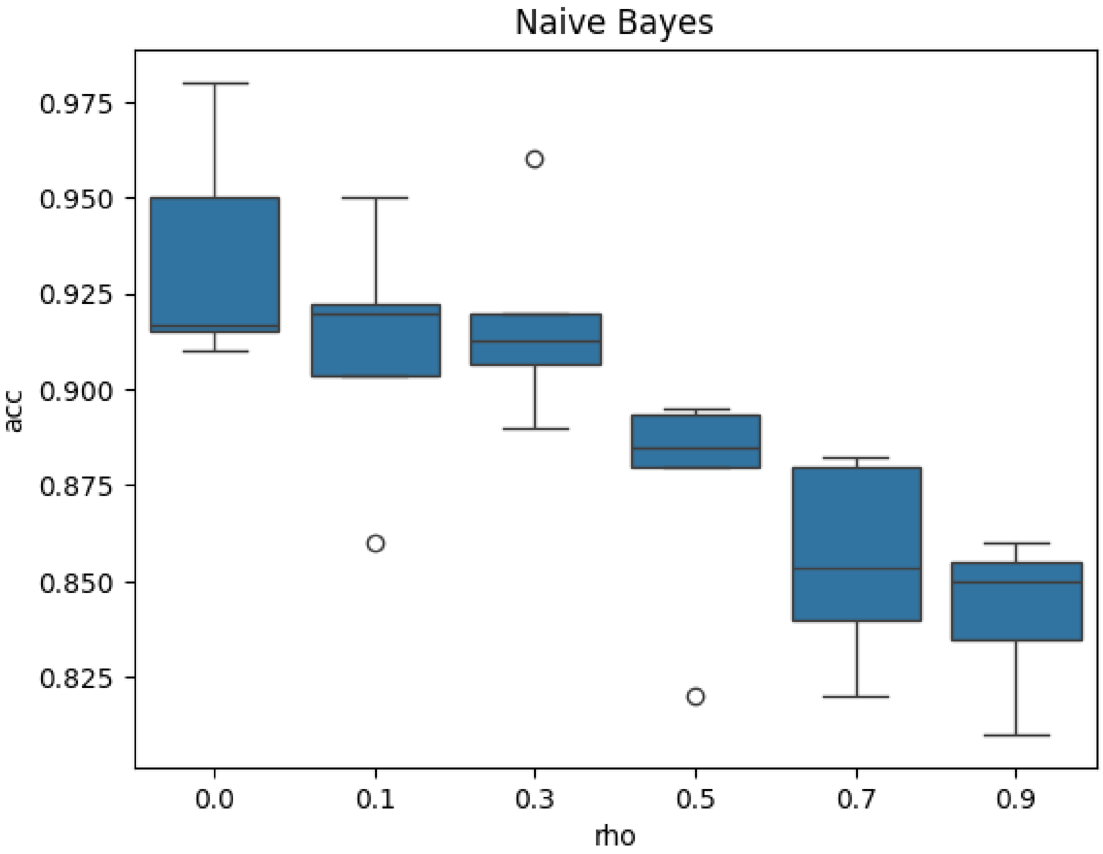
```
Current value of rho = 0
	Model Naive Bayes accuracy: 91.0%
	Model LDA accuracy: 90.5%
	Model QDA accuracy: 91.0%
Current value of rho = 0.1
	Model Naive Bayes accuracy: 91.0%
	Model LDA accuracy: 91.5%
	Model QDA accuracy: 91.0%
Current value of rho = 0.3
	Model Naive Bayes accuracy: 92.5%
	Model LDA accuracy: 92.5%
	Model QDA accuracy: 92.5%
```

```
Current value of rho = 0.5
	Model Naive Bayes accuracy: 85.5%
	Model LDA accuracy: 86.5%
	Model QDA accuracy: 85.0%
Current value of rho = 0.7
	Model Naive Bayes accuracy: 83.0%
	Model LDA accuracy: 82.5%
	Model QDA accuracy: 82.0%
Current value of rho = 0.9
	Model Naive Bayes accuracy: 86.0%

	Model LDA accuracy: 85.0%
	Model QDA accuracy: 86.5%
```

Experiments on multiple test-train splits

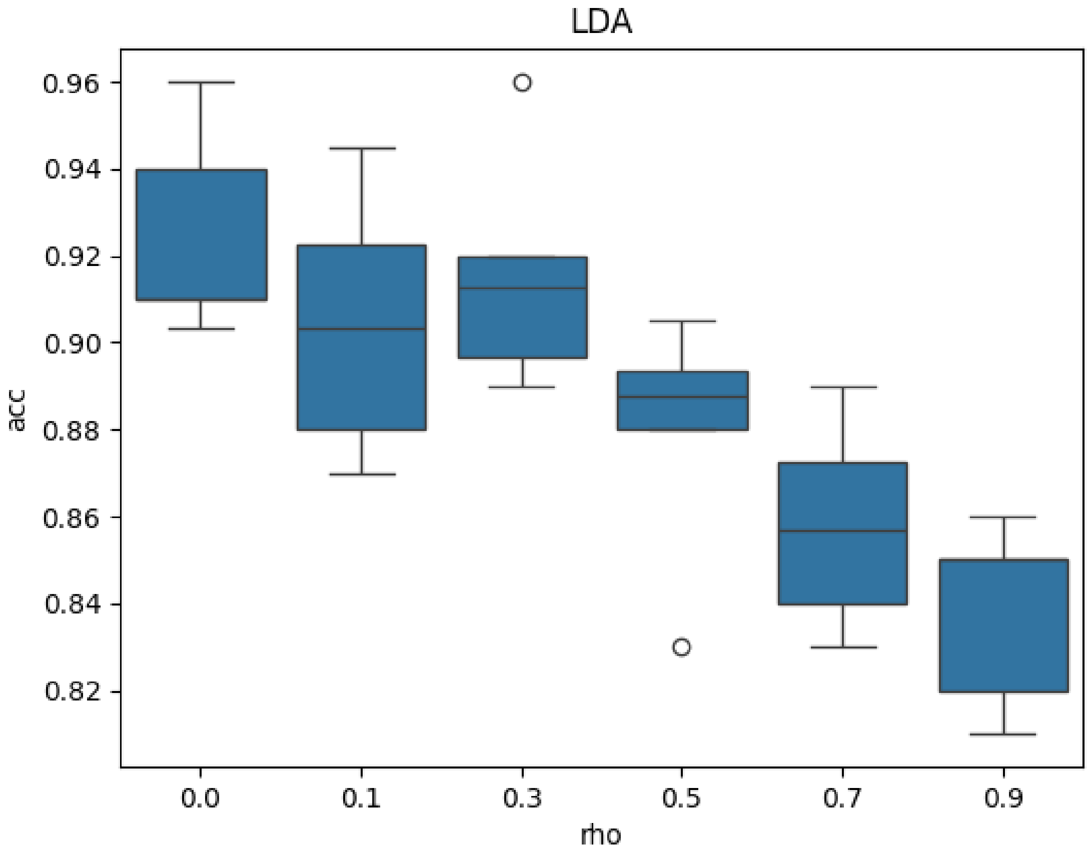
```python
columns = ['model', 'rho', 'acc']
res = []

for test_size in test_sizes:

    for rho in rho_list:
        # print(f"Current value of a = {a}")

        X, y = generate_data_scheme_2(1000, a, rho)

        X_train, X_test, y_train, y_test = train_test_split(
            X, y, test_size=test_size, random_state=123
        )


        for model in models:
            model.fit(X_train, y_train)
            y_pred = model.predict(X_test)
            acc = accuracy(y_test, y_pred)

            res.append([model.name, rho, acc])
            # print(f"\tModel {model.name} accuracy: {round(acc*100, 2)}%")

import seaborn as sns

df = pd.DataFrame(res, columns=columns)

nb_df = df[df['model'] == 'Naive Bayes']
lda_df = df[df['model'] == 'LDA']
qda_df = df[df['model'] == 'QDA']

sns.boxplot(x="rho", y="acc", data=nb_df).set_title("Naive Bayes")
```

```
Text(0.5, 1.0, 'Naive Bayes')
```



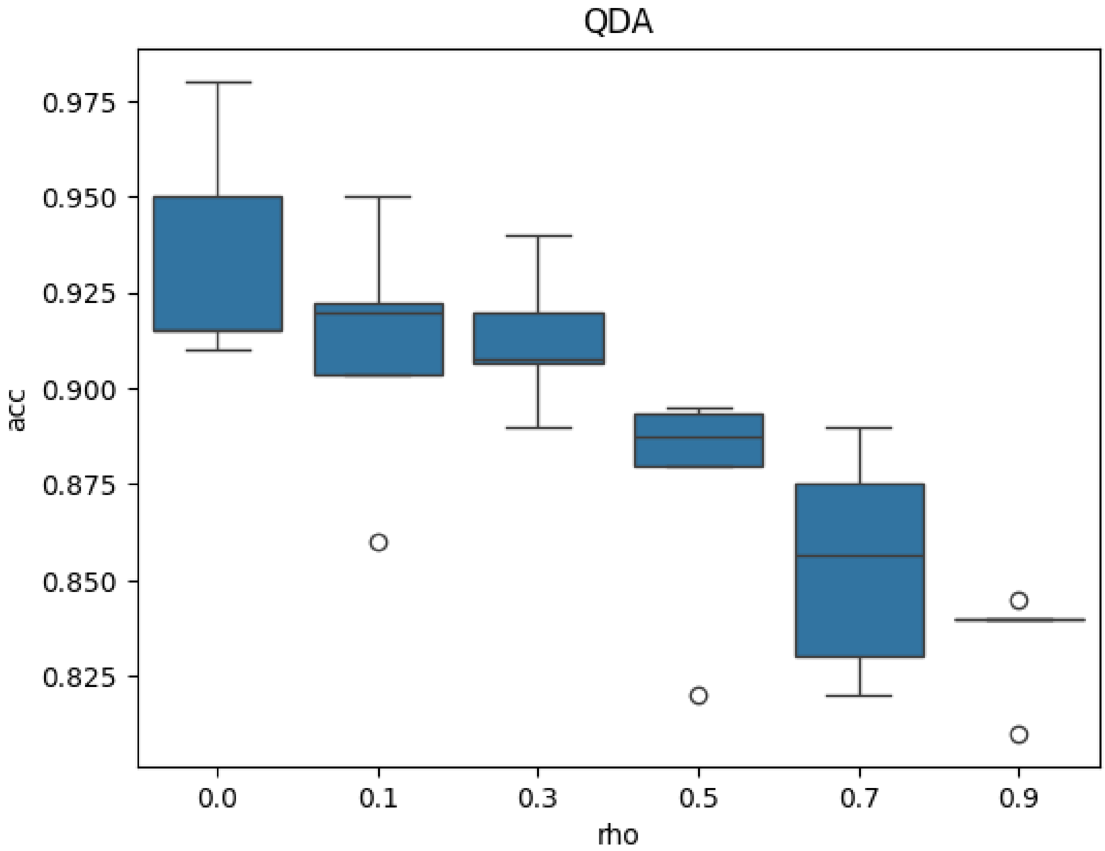
```
sns.boxplot(x="rho", y="acc", data=lda_df).set_title("LDA")
```

```
Text(0.5, 1.0, 'LDA')
```



```
sns.boxplot(x="rho", y="acc", data=qda_df).set_title("QDA")
```

```
Text(0.5, 1.0, 'QDA')
```



It can be clearly seen, that the higher rho value is, the poorer performance is presented by all the models.