HW5. Linear Discriminant Analyis LDA

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In this exercise, we researched Linear Discriminant Analysis as dimension reduction technique,

after that we ran Random Forest and Decision Tree Classifier to test the accuracry of LDA

1. Importing libraries

In [121]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

2. Loading data set

In [122]:
```
url = "https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data"
names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'Class']
dataset = pd.read_csv(url, names=names)
```

Data set description

our data set has 4 features and one target

In [123]:
```
## check the first 5 elements
dataset.head()
```

Out[123]:

	sepal-length	sepal-width	petal-length	petal-width	Class
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

In [124]:
```
## check the last 5 elements
dataset.tail()
```

Out[124]:

	sepal-length	sepal-width	petal-length	petal-width	Class
145	6.7	3.0	5.2	2.3	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
149	5.9	3.0	5.1	1.8	Iris-virginica

3. Data set description

In [125]:
```
dataset.describe()
```

Out[125]:

	sepal-length	sepal-width	petal-length	petal-width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

the data set has 4 numerical values which are the features and one categorical variable called class or target

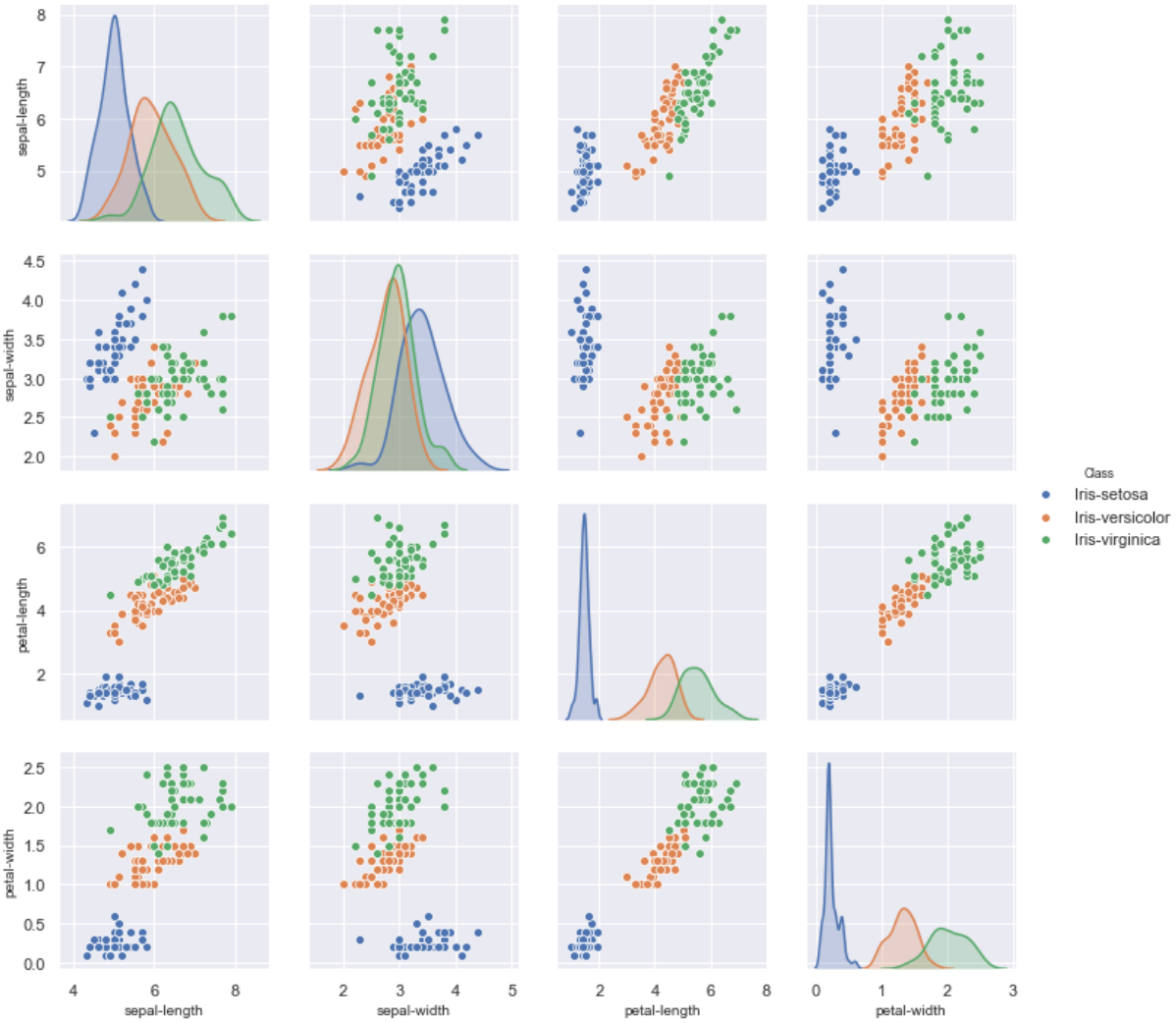
Data visualization

In [143]:
```
# This is a scatterplot for join relationship for univariate distribution

sns.pairplot(dataset, hue='Class')
```

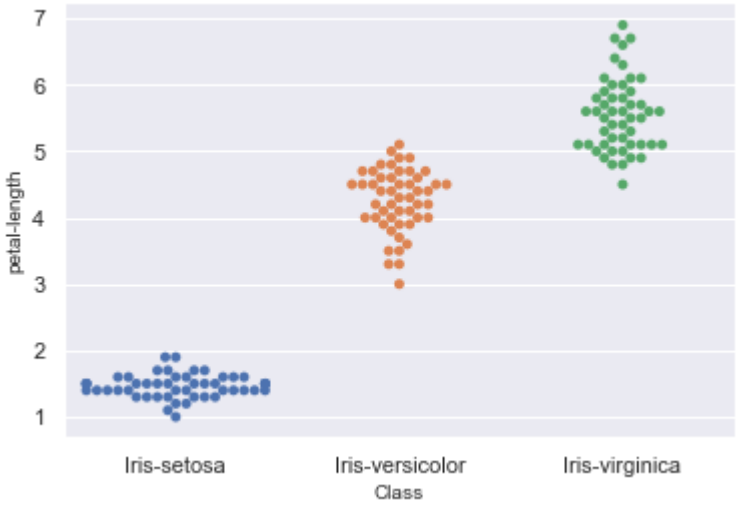
```
c:\users\diall\appdata\local\programs\python\python37\lib\site-packages\scipy
\stats\stats.py:1713: FutureWarning: Using a non-tuple sequence for multidimen
sional indexing is deprecated; use `arr[tuple(seq)]` instead of `arr[seq]`. In
the future this will be interpreted as an array index, `arr[np.array(seq)]`, w
hich will result either in an error or a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```

Out[143]: <seaborn.axisgrid.PairGrid at 0x1ea2df86a90>



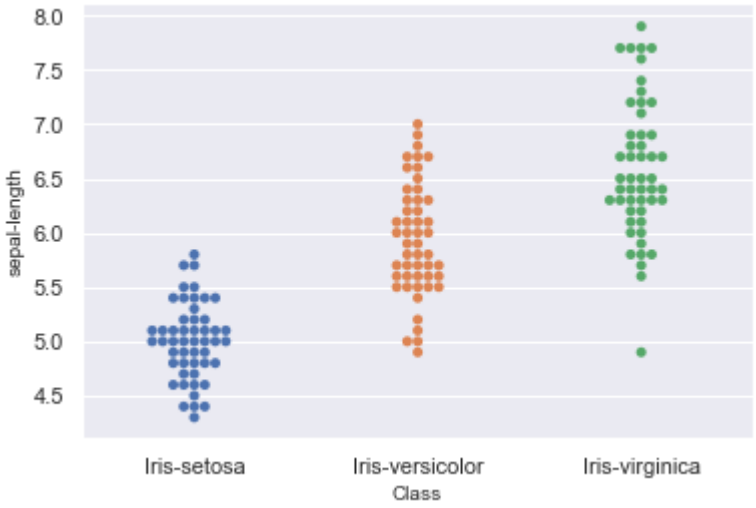
In [127]:
```
sns.swarmplot(x="Class", y="petal-length", data=dataset)
```

Out[127]: <matplotlib.axes._subplots.AxesSubplot at 0x1ea2d91c7f0>



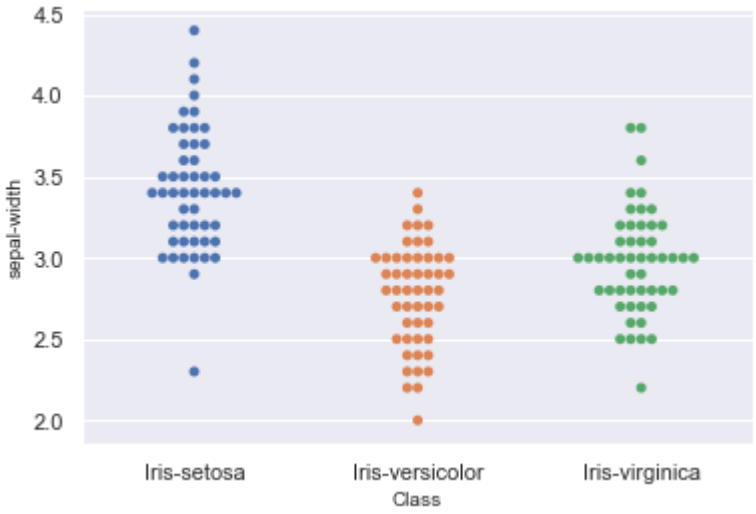
In [128]:
```
sns.swarmplot(x="Class", y="sepal-length", data=dataset)
```

Out[128]: <matplotlib.axes._subplots.AxesSubplot at 0x1ea2de94780>



In [129]:
```
sns.swarmplot(x="Class", y="sepal-width", data=dataset)
```

Out[129]: <matplotlib.axes._subplots.AxesSubplot at 0x1ea2def52b0>



In [130]:
```
sns.swarmplot(x="Class", y="petal-width", data=dataset)
```

Out[130]: <matplotlib.axes._subplots.AxesSubplot at 0x1ea2df3a828>

4. Data preprossesing

In [131]:
```
x =dataset.iloc[:,0:4].values   ## take only the first 4 features
y =dataset.iloc[:,4].values   ## takes only the target
```

In [132]:
```
from sklearn.model_selection import train_test_split
```

In [133]:
```
X_train,X_test,y_train,y_test = train_test_split(x,y,test_size=0.2,random_state=0
```

5. Performing a Linear Discriminant Analysis

In [134]:
```
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA ## imp
lda =LDA(n_components=1)  ## we can choose the number of component whhich determi
```

In [135]:
```
X_train = lda.fit_transform(np.array(X_train), y_train)
X_test = lda.transform(np.array(X_test))
```

6. Training the model and making predictions Using Random Forest

In [136]:
```
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(max_depth=2, random_state=0)

classifier.fit(X_train, y_train)
y_pred = classifier.predict(X_test)
```

```
c:\users\diall\appdata\local\programs\python\python37\lib\sklearn\ensemble\for
est.py:246: FutureWarning: The default value of n_estimators will change from
10 in version 0.20 to 100 in 0.22.
  "10 in version 0.20 to 100 in 0.22.", FutureWarning)
```

7. Testing the performance of the model

In [137]:
```
from sklearn.metrics import confusion_matrix   ## import libraries
from sklearn.metrics import accuracy_score
```

In [138]:
```
confusion_matrix=confusion_matrix(y_test,y_pred)
accuracy =accuracy_score(y_test,y_pred)
```

In [139]:
```
print('The confusion matrix is '+str(confusion_matrix))
print('The accuracy is '+str(accuracy))
```

```
The confusion matrix is [[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
The accuracy is 1.0
```

8. Training the model and making predictions Using Decision Tree Classifier

In [140]:
```
clf = DecisionTreeClassifier()

# Train Decision Tree Classifer
clf = clf.fit(X_train,y_train)
y_pred = clf.predict(X_test)
```

9. Evaluation

In [141]:
```
print("Accuracy:",accuracy_score(y_test, y_pred))
```

```
Accuracy: 1.0
```

10.We use Decision tree against but this time we will give the criterion and max_depth

In [142]:
```
clf = DecisionTreeClassifier(criterion="entropy", max_depth=3)

# Train Decision Tree Classifer
clf = clf.fit(X_train,y_train)

#Predict the response for test dataset
y_pred = clf.predict(X_test)

print("Accuracy:",accuracy_score(y_test, y_pred))
```

```
Accuracy: 1.0
```

References

https://stackabuse.com/implementing-lda-in-python-with-scikit-learn/ (https://stackabuse.com/implementing-lda-in-python-with-scikit-learn/)

https://sebastianraschka.com/Articles/2014_python_lda.html (https://sebastianraschka.com/Articles/2014_python_lda.html)

In [ ]:
```
```