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Roll No: 2018IMT-010

Course: ML-Lab

Course Code: ITIT - 4107

Code Link: https://github.com/aitikgupta/ITIT-4103-2021/tree/main/Assignment%205

Problem Statement

Given iris dataset (https://archive.ics.uci.edu/ml/datasets/iris) with 3 classes and 4 features such as sepals/petals, Length, width etc. for each flower in the dataset. There are 50 instances per class in the dataset. Use Bayes Classifier as your base classifier model. Use 60% samples for training and 40% samples for testing.

1. Perform feature selection on this dataset using forward search.
2. As you select features, until 2 features, plot your right and incorrect classification instances for all classes.
3. For all the set of features selected, plot the accuracies to show the best subset of selected features

Importing libraries

```
import numpy as np
import scipy as sp
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from matplotlib import pyplot as plt
```

Loading Data

```
data_url = 'https://archive.ics.uci.edu/ml/machine-learning-
databases/iris/iris.data'

# creating dataframe
df = pd.read_csv(data_url, header = None)
df.columns = ['sepal_length', 'sepal_width', 'petal_length',
'petal_width', 'species']

X = df.iloc[:, :4].values
y = df['species'].values
df.describe()
```

```
       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
```

```
df.head()
```

```
   sepal_length  sepal_width  petal_length  petal_width      species
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
```

```
# Encode the species type to integers

le = LabelEncoder()
le.fit(df.species)
y = le.transform(df.species)
print(le.classes_)
```

```
['Iris-setosa' 'Iris-versicolor' 'Iris-virginica']
```

```
x_train, x_test, y_train, y_test = train_test_split(X, y,
test_size=0.4, random_state=69)

print(x_train.shape, x_test.shape, y_train.shape, y_test.shape)
```

```
(90, 4) (60, 4) (90,) (60,)
```

Implementing bayesian model

```
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import confusion_matrix, accuracy_score
import seaborn as sns
classifier = GaussianNB()

fig = plt.figure()
```

```
<Figure size 432x288 with 0 Axes>
```

Take each feature individually

Training using sepal_length feature and target variable

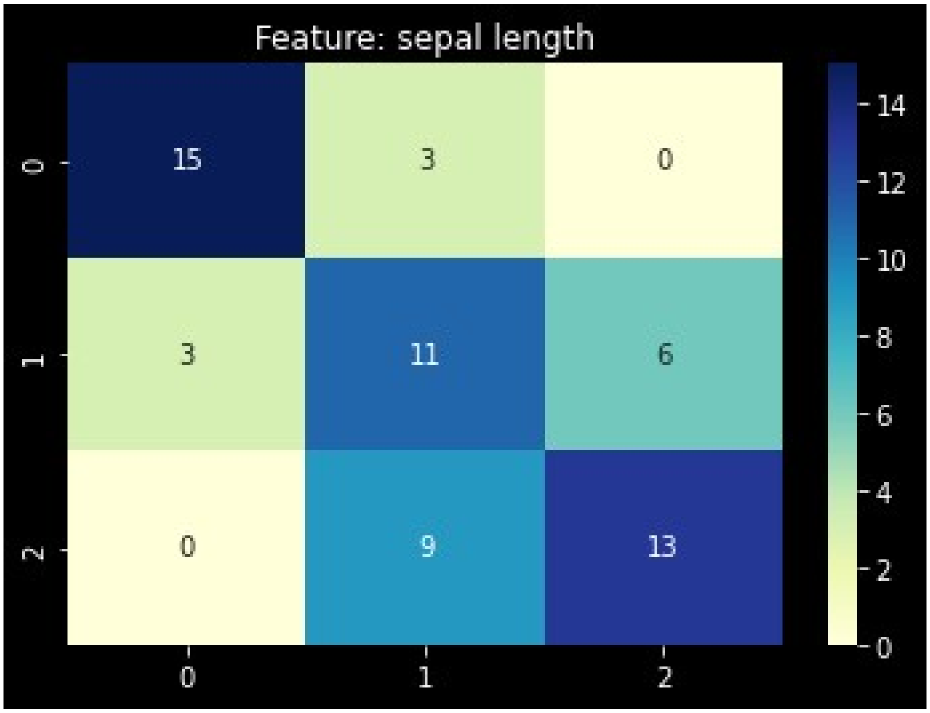
```
classifier.fit(x_train[:, 0].reshape(-1, 1), y_train)
y_pred = classifier.predict(x_test[:, 0].reshape(-1,1))
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when feature: sepal length =>", accuracy_score(y_test,
y_pred))
```

```
sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Feature: sepal length")
```

```
Accuracy when feature: sepal length => 0.65
```

```
Text(0.5, 1.0, 'Feature: sepal length')
```



Training model using sepal_width feature and target variable is used

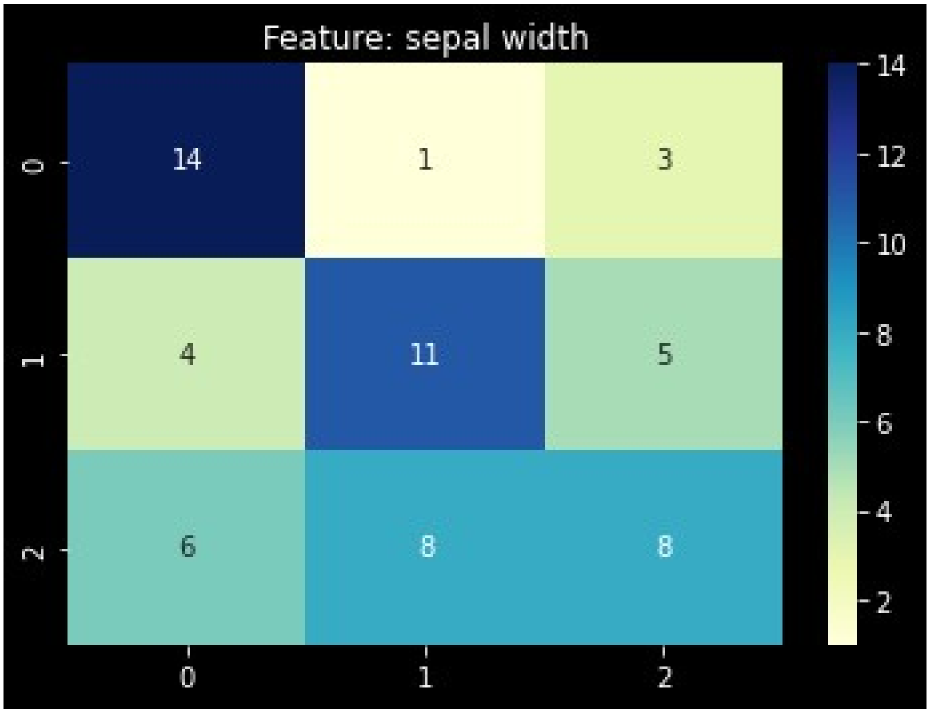
```
classifier.fit(x_train[:, 1].reshape(-1, 1), y_train)
y_pred = classifier.predict(x_test[:, 1].reshape(-1,1))
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when feature: sepal width =>", accuracy_score(y_test,
y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Feature: sepal width")
```

```
Accuracy when feature: sepal width => 0.55
```

```
Text(0.5, 1.0, 'Feature: sepal width')
```



Training model using petal_length feature and target variable is used

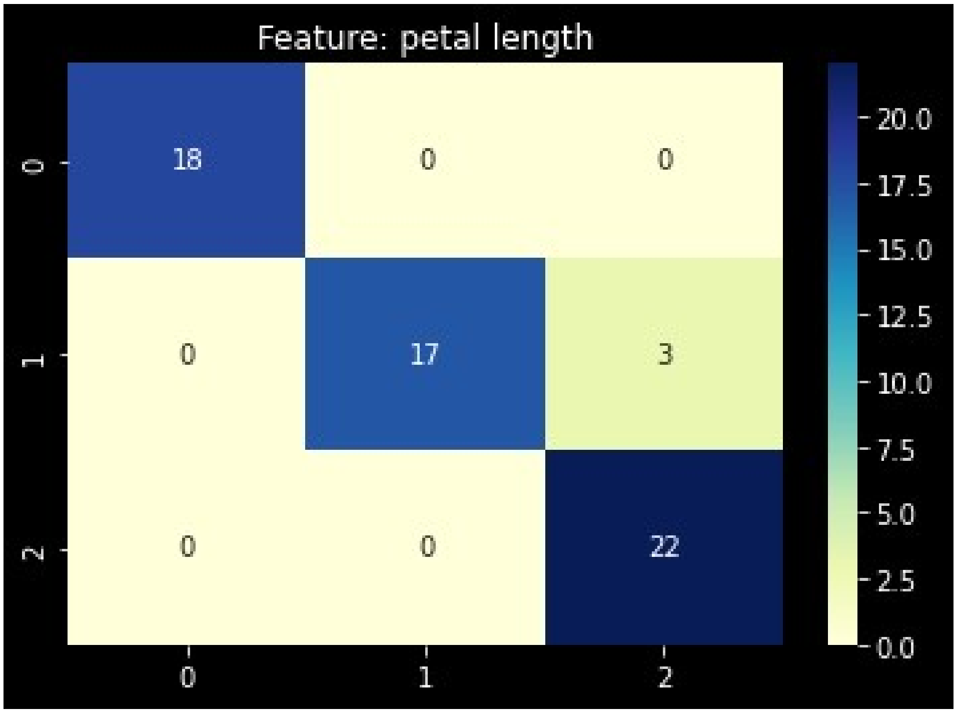
```
classifier.fit(x_train[:, 2].reshape(-1, 1), y_train)
y_pred = classifier.predict(x_test[:, 2].reshape(-1,1))
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when feature: petal length =>", accuracy_score(y_test,
y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Feature: petal length")
```

```
Accuracy when feature: petal length => 0.95
```

```
Text(0.5, 1.0, 'Feature: petal length')
```



Training model using petal_width feature and target variable is used

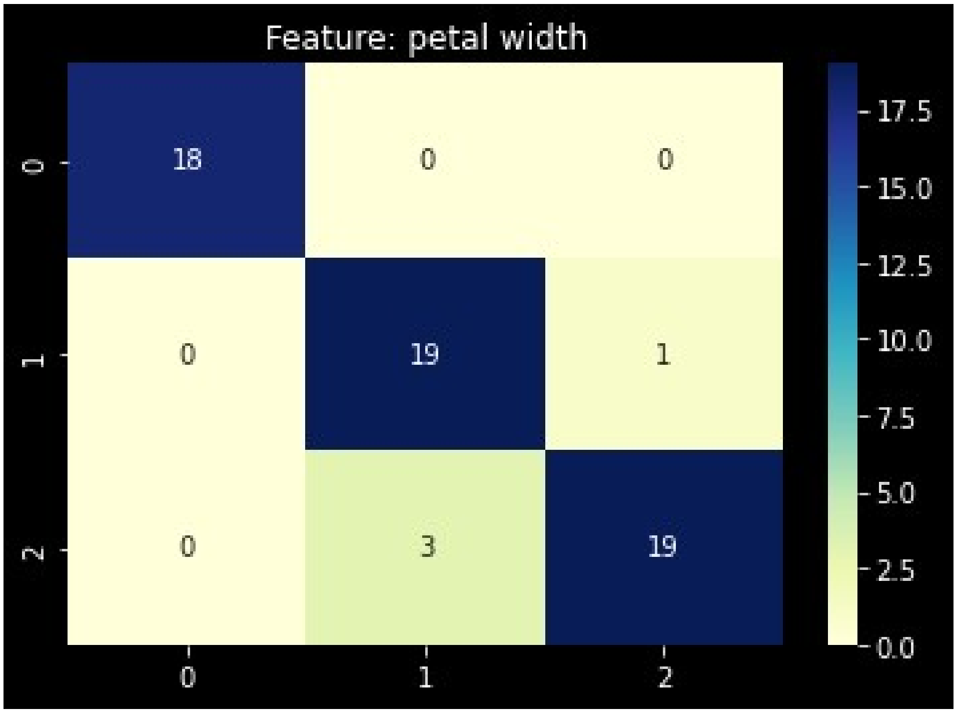
```
classifier.fit(x_train[:, 3].reshape(-1, 1), y_train)
y_pred = classifier.predict(x_test[:, 3].reshape(-1,1))
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when feature: petal width =>", accuracy_score(y_test,
y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Feature: petal width")
```

```
Accuracy when feature: petal width => 0.9333333333333333
```

```
Text(0.5, 1.0, 'Feature: petal width')
```



Take Multiple features into consideration

Will try different combination of the features

Training model using petal_width and sepal_length as input feature and target variable is used

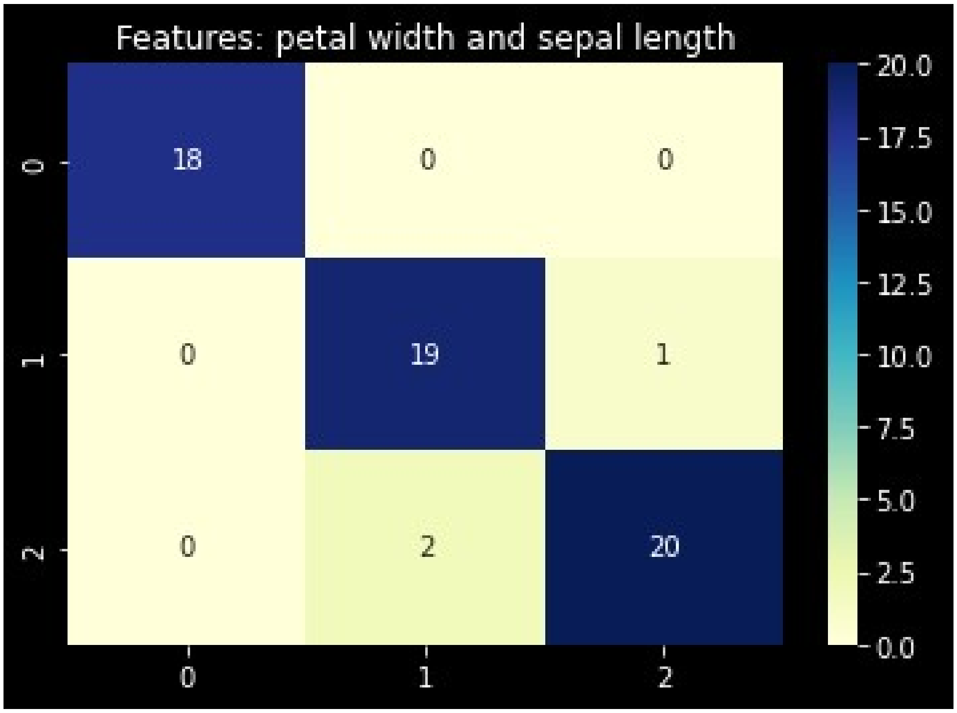
```
x_input1 = np.array([[inp[0], inp[3]] for inp in x_train])
x_te = np.array([[inp[0], inp[3]] for inp in x_test])
classifier.fit(x_input1, y_train)
y_pred = classifier.predict(x_te)
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when features: petal_width and sepal_length =>",
accuracy_score(y_test, y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Features: petal width and sepal length")
```

```
Accuracy when features: petal_width and sepal_length => 0.95

Text(0.5, 1.0, 'Features: petal width and sepal length')
```



Training model using petal_width and sepal_width as input feature and target variable is used

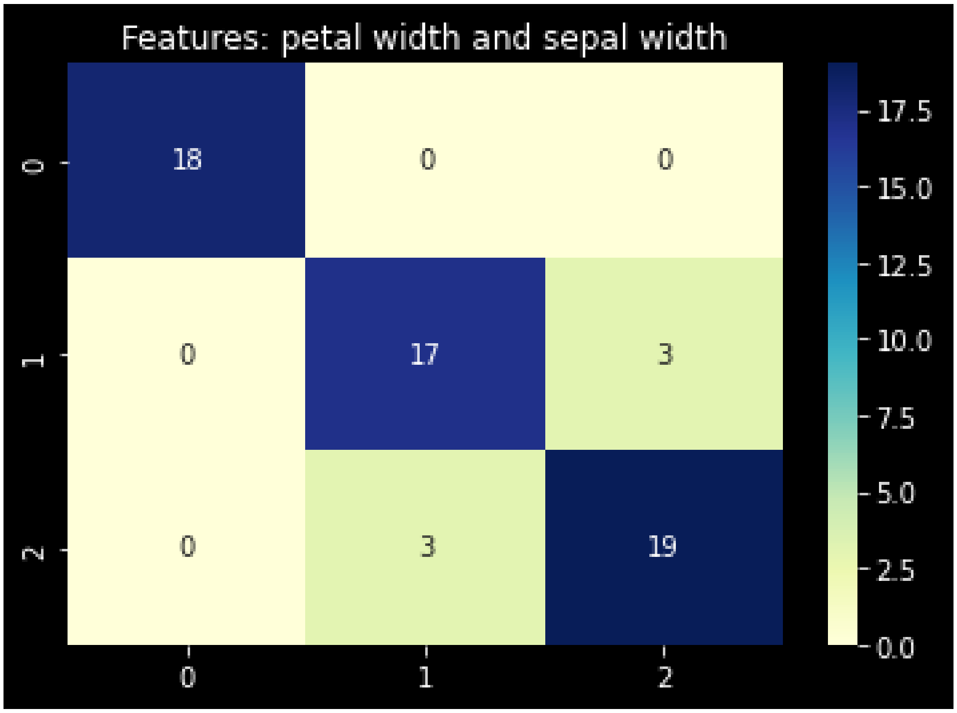
```
x_input2 = np.array([[inp[1], inp[3]] for inp in x_train])
x_te = np.array([[inp[1], inp[3]] for inp in x_test])
classifier.fit(x_input2, y_train)
y_pred = classifier.predict(x_te)
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when features: petal_width and sepal_width =>",
accuracy_score(y_test, y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Features: petal width and sepal width")
```

```
Accuracy when features: petal_width and sepal_width => 0.9

Text(0.5, 1.0, 'Features: petal width and sepal width')
```



Training model using petal_width and petal_length as input feature and target variable is used

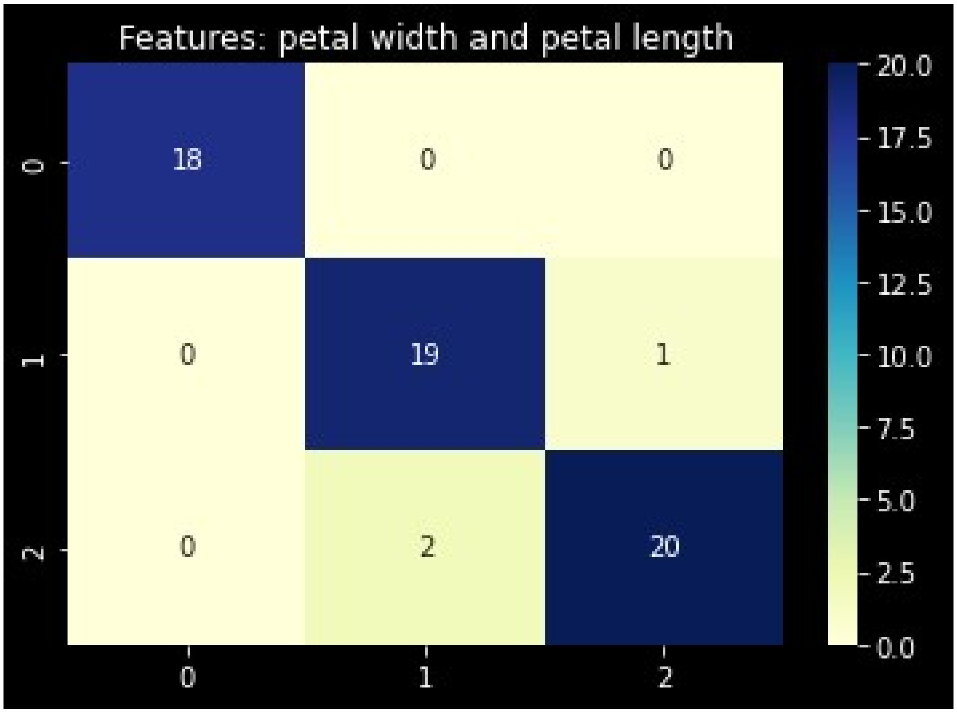
```
x_input3 = np.array([[inp[2], inp[3]] for inp in x_train])
x_te = np.array([[inp[2], inp[3]] for inp in x_test])
classifier.fit(x_input3, y_train)
y_pred = classifier.predict(x_te)
cm = confusion_matrix(y_test, y_pred)

print("Accuracy when features: petal_width and petal_length =>",
accuracy_score(y_test, y_pred))

sns.heatmap(cm, annot=True, cmap="YlGnBu")
plt.title("Features: petal width and petal length")
```

```
Accuracy when features: petal_width and petal_length => 0.95

Text(0.5, 1.0, 'Features: petal width and petal length')
```



Hence, Petal Width + Petal Length seems to be the features producing the best accuracy.

Code Link: https://github.com/aitikgupta/ITIT-4103-2021/tree/main/Assignment%205