```
Lab Assignment 6
Aim : 1. Implement Simple Naïve Bayes classification algorithm using
Python/R on iris.csv dataset.
2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error
rate, Precision, Recall
on the given dataset

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score, precision_score,
recall_score, confusion_matrix

url =
"https://raw.githubusercontent.com/mwaskom/seaborn-data/master/iris.cs
v"
data = pd.read_csv(url)

data.head()
```

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

```
X = data.drop('species', axis=1)
y = data['species']

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.3, random_state=42)

gaussian = GaussianNB()

gaussian.fit(X_train, y_train)

GaussianNB()

y_pred = gaussian.predict(X_test)

y_pred[:5]

array(['versicolor', 'setosa', 'virginica', 'versicolor',
'versicolor'],
      dtype='<U10')

accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy:.2f}")
```

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Accuracy: 0.98
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```
precision = precision_score(y_test, y_pred, average='micro')
recall = recall_score(y_test, y_pred, average='micro')

print(f"Precision: {precision:.2f}")
print(f"Recall: {recall:.2f}")
```

```
Precision: 0.98
Recall: 0.98
```

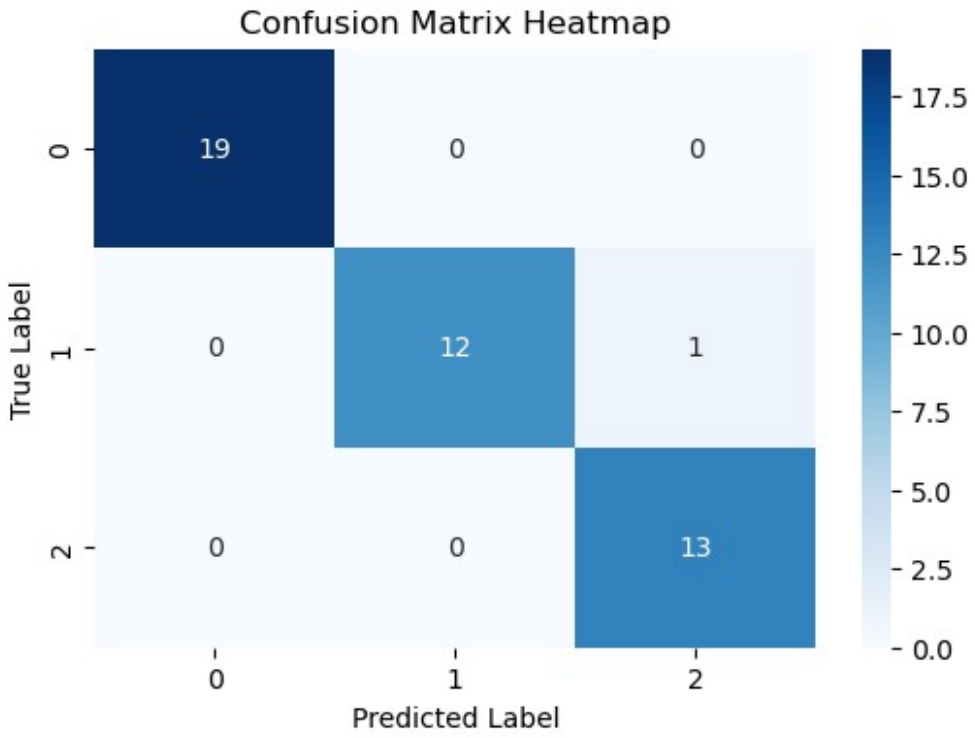
```
# Calculate confusion matrix
cm = confusion_matrix(y_test, y_pred)

# Display confusion matrix
print("Confusion Matrix:\n", cm)
```

```
Confusion Matrix:
 [[19  0  0]
 [ 0 12  1]
 [ 0  0 13]]
```

```
import seaborn as sns
import matplotlib.pyplot as plt

# Plot confusion matrix
plt.figure(figsize=(6, 4))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues")
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.title('Confusion Matrix Heatmap')
plt.show()
```




```
from sklearn.metrics import classification_report

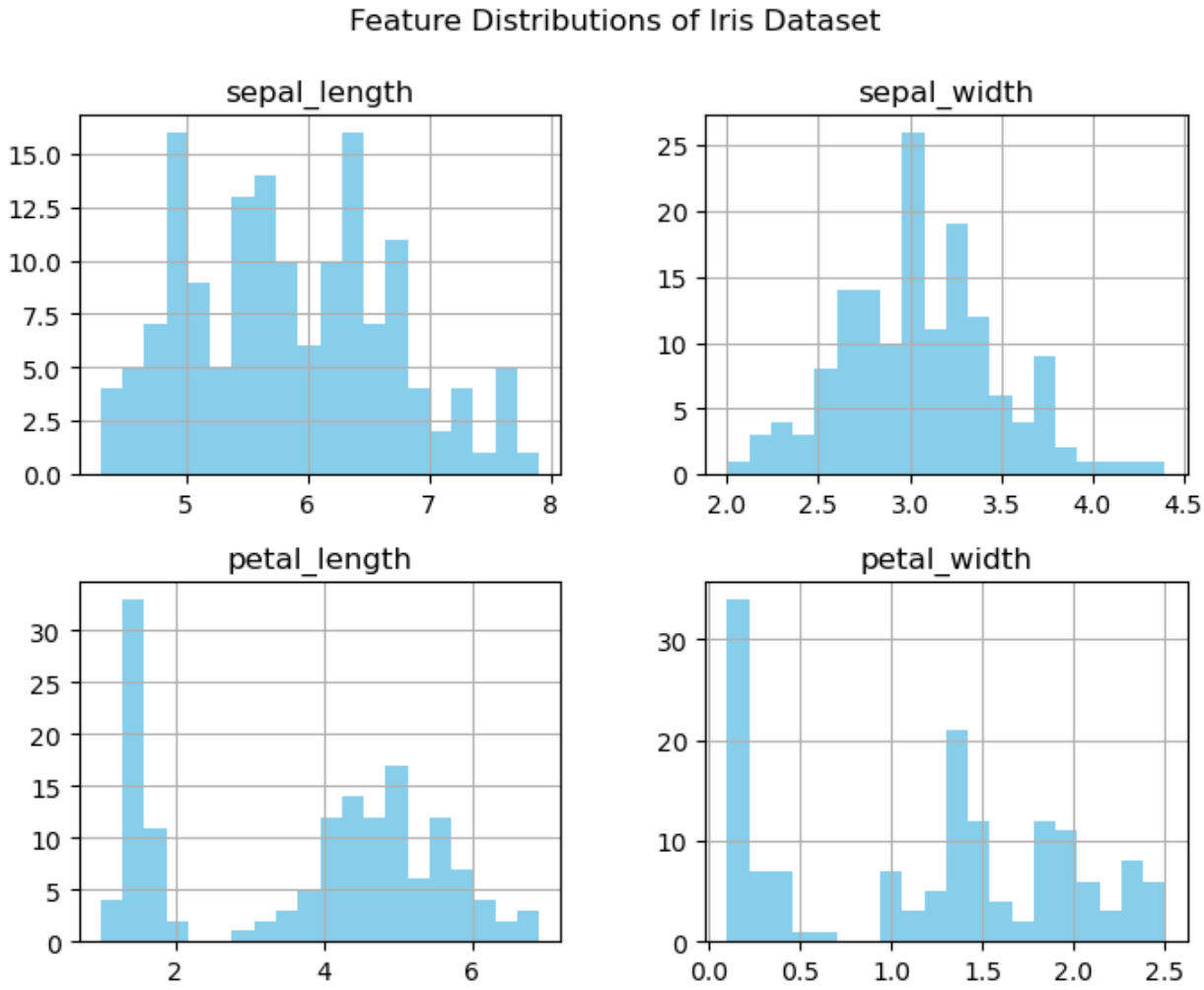
# Print classification report
report = classification_report(y_test, y_pred)
print("Classification Report:\n", report)
```

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

      setosa       1.00      1.00      1.00        19
  versicolor       1.00      0.92      0.96        13
   virginica       0.93      1.00      0.96        13

    accuracy                           0.98        45
   macro avg       0.98      0.97      0.97        45
weighted avg       0.98      0.98      0.98        45
```

```
# Plot feature distributions
data.hist(figsize=(8, 6), bins=20, color='skyblue')
plt.suptitle('Feature Distributions of Iris Dataset')
plt.show()
```




```
from sklearn.model_selection import cross_val_score

# Perform 5-fold cross-validation
cv_scores = cross_val_score(gaussian, X, y, cv=5)

# Print average accuracy
print(f"Average Accuracy using Cross-Validation:
{cv_scores.mean():.2f}")
```

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Average Accuracy using Cross-Validation: 0.95
```

```
FP = cm.sum(axis=0) - np.diag(cm)
FN = cm.sum(axis=1) - np.diag(cm)
TP = np.diag(cm)
TN = cm.sum() - (FP+FN+TP)
cm_values = TP, FP, FN, TN

df = pd.DataFrame(data=cm_values,
columns=['setosa','versicolor','virginica'],
```

```
index=['TP','FP','FN','TN'])
df
```

	setosa	versicolor	virginica
TP	19	12	13
FP	0	0	1
FN	0	1	0
TN	26	32	31

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