• Naïve Bayes algorithm is a supervised learning algorithm, which is based on Bayes theorem and used for solving classification problems. • It is mainly used in text classification that includes a high-dimensional training dataset.

Bayes' Theorem: • Bayes' theorem is also known as Bayes' Rule or Bayes' law, which is used to determine the probability of a hypothesis with prior knowledge. It depends on the conditional probability.

```
import pandas as pd
import  seaborn as sns
df = sns.load_dataset('iris')

df
```

	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
...	...	...	...	...	...
145	6.7	3.0	5.2	2.3	virginica
146	6.3	2.5	5.0	1.9	virginica
147	6.5	3.0	5.2	2.0	virginica
148	6.2	3.4	5.4	2.3	virginica
149	5.9	3.0	5.1	1.8	virginica

150 rows × 5 columns

Next steps: View recommended plots

```
 #input data
x=df.drop('species',axis=1)

#output data
y=df['species']
```

```
y.value_counts()
```

```
setosa        50
versicolor    50
virginica     50
Name: species, dtype: int64
```

```
#cross validation
from sklearn.model_selection import train_test_split
x_train ,x_test,y_train,y_test=train_test_split(x,y,random_state=0,test_size=0.25)
```

```
x_train.shape
```

```
(112, 4)
```

```
x_test.shape
```

```
(38, 4)
```

```
 #import the class
from sklearn.naive_bayes import GaussianNB
#create the object
clf= GaussianNB()
```

```
#train the algorithm
clf.fit(x_train,y_train)
```

```
▾ GaussianNB ⓘ ?
GaussianNB()
```

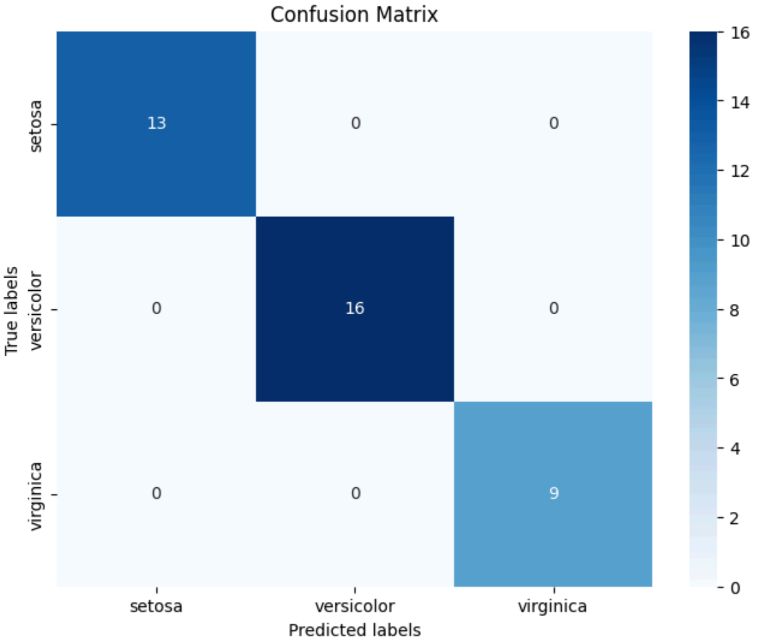
```
y_pred=clf.predict(x_test)
```

```
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score

# Plot confusion matrix
conf_matrix = confusion_matrix(y_test, y_pred)
conf_matrix = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, cmap="Blues", fmt="d", xticklabels=clf.classes_, yticklabels=clf.classes_)
plt.xlabel('Predicted labels')
plt.ylabel('True labels')
plt.title('Confusion Matrix')
plt.show()

# Compute accuracy
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)

# Classification report
print("Classification Report:")
print(classification_report(y_test, y_pred))
```



```
Accuracy: 1.0
Classification Report:
              precision    recall  f1-score   support

      setosa       1.00      1.00      1.00        13
  versicolor       1.00      1.00      1.00        16
   virginica       1.00      1.00      1.00         9

    accuracy                           1.00        38
   macro avg       1.00      1.00      1.00        38
weighted avg       1.00      1.00      1.00        38
```

```
clf.predict_proba(x_test)
```

```
array([[2.05841140e-233, 1.23816844e-006, 9.99998762e-001],
       [1.76139943e-084, 9.99998414e-001, 1.58647449e-006],
       [1.00000000e+000, 1.48308613e-018, 1.73234612e-027],
       [6.96767669e-312, 5.33743814e-007, 9.99999466e-001],
       [1.00000000e+000, 9.33944060e-017, 1.22124682e-026],
       [4.94065646e-324, 6.57075840e-011, 1.00000000e+000],
       [1.00000000e+000, 1.05531886e-016, 1.55777574e-026],
       [2.45560284e-149, 7.80950359e-001, 2.19049641e-001],
       [4.01160627e-153, 9.10103555e-001, 8.98964447e-002],
       [1.46667004e-094, 9.99887821e-001, 1.12179234e-004],
       [5.29999917e-215, 4.59787449e-001, 5.40212551e-001],
       [4.93479766e-134, 9.46482991e-001, 5.35170089e-002],
       [5.23735688e-135, 9.98906155e-001, 1.09384481e-003],
       [4.97057521e-142, 9.50340361e-001, 4.96596389e-002],
       [9.11315109e-143, 9.87982897e-001, 1.20171030e-002],
       [1.00000000e+000, 7.81797826e-019, 1.29694954e-028],
       [3.86310964e-133, 9.87665084e-001, 1.23349155e-002],
       [2.27343573e-113, 9.99940331e-001, 5.96690955e-005],
       [1.00000000e+000, 1.80007196e-015, 9.14666201e-026],
       [1.00000000e+000, 1.30351394e-015, 8.42776899e-025],
       [4.66537803e-188, 1.18626155e-002, 9.88137385e-001],
       [1.02677291e-131, 9.92205279e-001, 7.79472050e-003],
       [1.00000000e+000, 6.61341173e-013, 1.42044069e-022],
       [1.00000000e+000, 9.98321355e-017, 3.50690661e-027],
       [2.27898063e-170, 1.61227371e-001, 8.38772629e-001],
       [1.00000000e+000, 2.29415652e-018, 2.54202512e-028],
       [1.00000000e+000, 5.99780345e-011, 5.24260178e-020],
       [1.62676386e-112, 9.99340062e-001, 6.59938068e-004],
       [2.23238199e-047, 9.99999965e-001, 3.47984452e-008],
       [1.00000000e+000, 1.95773682e-013, 4.10256723e-023],
       [3.52965800e-228, 1.15450262e-003, 9.98845497e-001],
       [3.20480410e-131, 9.93956330e-001, 6.04366979e-003],
       [1.00000000e+000, 1.14714843e-016, 2.17310302e-026],
       [3.34423817e-177, 8.43422262e-002, 9.15657774e-001],
       [5.60348582e-264, 1.03689515e-006, 9.99998963e-001],
       [7.48035097e-091, 9.99950155e-001, 4.98452400e-005],
       [1.00000000e+000, 1.80571225e-013, 1.83435499e-022],
       [8.97496247e-182, 5.65567226e-001, 4.34432774e-001]])
```

```
newl=[[4.5,2.9,3.1,0.4]]
clf.predict(newl)[0]
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:493: UserWarning: X does not have valid
  warnings.warn(
'versicolor'
```

```
newl=[[5.5,3.1,1.0,0.8]]
clf.predict(newl)[0]
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:493: UserWarning: X does not have valid feature names, but GaussianNB was fitted with featu
  warnings.warn(
'setosa'
```

```
newl=[[6.5,3.3,4.9,1.8]]
clf.predict(newl)[0]
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:493: UserWarning: X does not have valid feature names, but GaussianNB was fitted with featu
  warnings.warn(
'virginica'
```

```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

      setosa       1.00      1.00      1.00        13
  versicolor       1.00      1.00      1.00        16
   virginica       1.00      1.00      1.00         9

    accuracy                           1.00        38
   macro avg       1.00      1.00      1.00        38
weighted avg       1.00      1.00      1.00        38
```