Experiment No. 6

Aim:Classification modelling

- a. Choose classifier for classification problem.
- b. Evaluate the performance of classifier.

Theory:

Classification Modeling:

Classification is a **supervised machine learning** technique used to predict categorical labels based on input features. It is widely used in **medical diagnosis**, **spam detection**, **fraud detection**, and **more**.

Several classifiers can be used for classification tasks, each with its advantages and limitations:

1. K-Nearest Neighbors (KNN):

- A non-parametric, instance-based learning algorithm.
- Classifies data based on the majority label of its K nearest neighbors.
- Works well for structured and small datasets but slower for large datasets.

2. Naïve Bayes:

- A probabilistic classifier based on Bayes' Theorem.
- Assumes independence between features, making it efficient for large datasets.
- Performs well in **text classification** but struggles when features are highly correlated.

3. Support Vector Machine (SVM):

- A powerful classifier that finds the **optimal hyperplane** for separating classes.
- Works well for high-dimensional datasets.
- Sensitive to **noisy data** and computationally expensive for large datasets.

4. Decision Tree:

- A tree-structured model that splits data based on feature values.
- Easy to interpret and requires minimal data preprocessing.
- Prone to **overfitting**, which can reduce generalization performance.

1.Load the dataset -

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score, classification_report

df = pd.read_csv("/content/Loan_default.csv")
df = df.head()
```

∓ +		LoanID	Age	Income	LoanAmou	nt Credit	Score	MonthsEmploye	ed \	
	θ	9	56	85994	505	87	520		30	
	1	8	69	50432	1244	40	458	1	15	
	2	3	46	84208	1291	88	451		26	
	3	12	32	31713	447	99	743		0	
	4	5	60	20437	91	39	633		8	
		NumCred	itLin	es Int	erestRate	LoanTerm	DTIRa	tio Education	1 \	
	θ			4	15.23	36	0	.44 ()	
	1			1	4.81	60	0	.68	2	
	2			3	21.17	24	0	.31	2	
	3			3	7.07	24	0	.23 1	ĺ	
	4			4	6.51	48	0	.73)	
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	0			0	0		1	1	4	3
	1			0	1		0	9	4	î.
	2			3	0		1	1	Ø	
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	θ		1		9					
	1		1		9					
	2		0		1					
	3		0		9					

2. Splitting data into training and testing sets

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

3.KNN

```
# Classifiers
def train_and_evaluate(model, name):
    model.fit(X_train, y_train)
    y_pred = model.predict(X_test)
    print(f"\n{name} Classifier:\n")
    print(f"Accuracy: {accuracy_score(y_test, y_pred):.2f}")
    print("Classification Report:\n", classification_report(y_test, y_pred))

# KNN
knn = KNeighborsClassifier(n_neighbors=3)
train_and_evaluate(knn, "K-Nearest Neighbors")
```

```
₹
   K-Nearest Neighbors Classifier:
   Accuracy: 0.80
   Classification Report:
                precision recall f1-score support
                          1.00
             0
                  0.75
                                     0.86
                                                3
             1
                   1.00
                            0.50
                                    0.67
                                                2
                                                5
       accuracy
                                     0.80
                  0.88
                            0.75
                                     0.76
                                                5
      macro avg
   weighted avg
                   0.85
                            0.80
                                     0.78
                                                5
```

```
Confusion Matrix:
[[4 0]
[1 0]]
```

4. Naive Bayes

```
# Naive Bayes
nb = GaussianNB()
train_and_evaluate(nb, "Naive Bayes")
```

```
Naive Bayes Classifier:
Accuracy: 0.60
Classification Report:
            precision recall f1-score support
         0
               0.60 1.00
                                 0.75
                                             3
         1
               0.00
                       0.00
                                             2
                                 0.00
                                 0.60
                                             5
   accuracy
                                             5
  macro avg
                0.30
                         0.50
                                 0.38
                                             5
                                 0.45
weighted avg
                0.36
                         0.60
```

```
Confusion Matrix:
[[4 0]
[0 1]]
```

5. Support Vector Machine

```
# SVM
svm = SVC(kernel='linear')
train_and_evaluate(svm, "Support Vector Machine")
```

```
Support Vector Machine Classifier:
Accuracy: 0.60
Classification Report:
             precision recall f1-score
                                           support
                 0.60
                                    0.75
          0
                         1.00
                                                3
          1
                 0.00
                         0.00
                                   0.00
                                                2
                                               5
                                    0.60
   accuracy
                0.30
                          0.50
                                   0.38
  macro avg
weighted avg
                 0.36
                          0.60
                                    0.45
                                                5
```

```
Confusion Matrix:
[[4 0]
[0 1]]
```

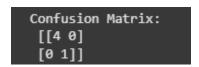
6. Decision Tree

```
# Decision Tree

dt = DecisionTreeClassifier()

train_and_evaluate(dt, "Decision Tree")
```

```
Decision Tree Classifier:
Accuracy: 0.80
Classification Report:
              precision recall f1-score
                                             support
                           1.00
          0
                  0.75
                                     0.86
                                                 3
                  1.00
                           0.50
          1
                                     0.67
                                                 2
                                     0.80
                                                 5
   accuracy
  macro avg
                  0.88
                           0.75
                                     0.76
                                                 5
                  0.85
                                                 5
weighted avg
                           0.80
                                     0.78
```



Conclusion:

Conclusion for Loan Default Prediction Models

- •KNN and Decision Tree achieved 80% accuracy, making them effective for loan default prediction.
- •Naïve Bayes and SVM had lower accuracy (60%), indicating weaker performance.
- •KNN and Decision Tree balanced precision and recall well, making them suitable for further tuning.

Improvements can be made with class balancing, feature selection, and hyperparameter optimization.