**Experiment NO: 7** **Date:**

**Aim:** To implement K-Nearest Neighbourhood classifier for the given dataset.

**Theory:** The k-Nearest Neighbors (k-NN) algorithm is a simple, yet effective, supervised machine learning algorithm used for classification and regression tasks. It makes predictions based on the majority class (for classification) or the average of the k-nearest neighbors' target values (for regression). Here's the theoretical overview of the k-NN classifier:

**Basics:**

* Data Representation:

The dataset consists of instances, each described by a set of features (attributes) and associated with a class label.

The features are numerical or can be converted into a numerical format.

* Distance Metric:

A distance metric (commonly Euclidean distance) is used to measure the similarity or dissimilarity between instances in the feature space.

**Prediction Process:**

1. Training:

The algorithm stores the entire training dataset in memory.

1. Prediction:

For a new, unseen instance, the algorithm calculates the distances to all instances in the training set.

It identifies the k-nearest neighbors based on the calculated distances.

1. Majority Voting (for Classification):

For a classification task, the algorithm counts the occurrences of each class among the k-nearest neighbors.

The class that appears most frequently is assigned to the new instance.

1. Weighted Average (for Regression):

For a regression task, the algorithm calculates the average of the target values of the k-nearest neighbors, possibly weighted by their distances.

**Hyperparameter:**

* k (Number of Neighbors):

The choice of the value for k is a critical hyperparameter.

A small k may result in noise sensitivity, while a large k might lead to oversmoothing.

**Decision Boundary:**

The decision boundary in a k-NN classifier is non-linear and is determined by the distribution of the instances in the feature space.

**Pros and Cons:**

* Pros:

Simple to understand and implement.

No explicit training phase; the model adapts as new data becomes available.

Effective for both simple and complex decision boundaries.

* Cons:

Computationally expensive for large datasets.

Sensitive to irrelevant or redundant features.

Performance may degrade in high-dimensional spaces ("curse of dimensionality").

**Distance Metrics:**

Besides Euclidean distance, other distance metrics such as Manhattan distance, Minkowski distance, or cosine similarity can be used based on the nature of the data.

**Standardization:**

Standardizing or normalizing the features is often recommended, as it ensures that all features contribute equally to the distance computation.

**Curse of Dimensionality:**

As the number of dimensions (features) increases, the distance between instances tends to increase, leading to sparse data and potentially affecting the performance of k-NN. Dimensionality reduction techniques may be applied to mitigate this issue.

**Application Areas:**

k-NN is commonly used in pattern recognition, image classification, recommendation systems, and anomaly detection.

k-NN is a versatile algorithm suitable for a variety of tasks. Its simplicity and ability to handle complex decision boundaries make it a valuable tool in the machine learning toolkit. However, its performance can be influenced by the choice of distance metric, the number of neighbors (k), and the curse of dimensionality, so careful consideration and tuning are required in practice.

**Code:**

import pandas as pd

from sklearn.model\_selection import train\_test\_split

from sklearn.neighbors import KNeighborsClassifier

from sklearn.preprocessing import LabelEncoder

from sklearn.metrics import accuracy\_score

df = pd.read\_csv('C:\P Jeevesh Naidu\college\honours\sem 5\knn\car\_cleaned.csv')

print("Dataset:\n", df.head())

le = LabelEncoder()

buying = le.fit\_transform(list(df["buying"]))

maint = le.fit\_transform(list(df["maint"]))

doors = le.fit\_transform(list(df["doors"]))

persons = le.fit\_transform(list(df["persons"]))

lug\_boot = le.fit\_transform(list(df["lug\_boot"]))

safety = le.fit\_transform(list(df["safety"]))

decision = le.fit\_transform(list(df["decision"]))

predict = "decision"

X = list(zip(buying, maint, doors, persons, lug\_boot, safety))

y = list(decision)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size = 0.2, random\_state = 42)

model = KNeighborsClassifier(n\_neighbors = 7)

model.fit(X\_train, y\_train)

y\_pred = model.predict(X\_test)

names = ["unacc", "acc", "good", "vgood"]

print("\nPredictions:")

for x in range(len(X\_test)):

print("Predicted: ", names[y\_pred[x]], ", Data: ", X\_test[x], ", Actual: ", names[y\_test[x]])

# n = model.kneighbors([X\_test[x]], n\_neighbors = 7, return\_distance = True)

# print("N: ", n)

acc = accuracy\_score(y\_pred, y\_test)

print("\nAccuracy: ", acc)

**Output:**

C:\P Jeevesh Naidu\webtech\sem5prject\DBMS-Lab-Project>python -u "c:\P Jeevesh Naidu\college\honours\sem 5\knn\tempCodeRunnerFile.py"

Dataset:

buying maint doors persons lug\_boot safety decision

0 vhigh vhigh 2 2 small low unacc

1 vhigh vhigh 2 2 small med unacc

2 vhigh vhigh 2 2 small high unacc

3 vhigh vhigh 2 2 med low unacc

4 vhigh vhigh 2 2 med med unacc

Predictions:

Predicted: good , Data: (0, 0, 2, 0, 1, 0) , Actual: good

Predicted: good , Data: (2, 1, 0, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (0, 0, 3, 0, 0, 2) , Actual: good

Predicted: unacc , Data: (1, 0, 3, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (2, 1, 2, 2, 1, 1) , Actual: good

Predicted: unacc , Data: (2, 3, 2, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 3, 0, 2, 1, 0) , Actual: good

Predicted: good , Data: (0, 1, 3, 0, 0, 2) , Actual: good

Predicted: good , Data: (2, 3, 3, 2, 2, 2) , Actual: good

Predicted: good , Data: (0, 1, 0, 0, 0, 0) , Actual: good

Predicted: vgood , Data: (1, 0, 2, 2, 1, 0) , Actual: vgood

Predicted: unacc , Data: (2, 2, 3, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (3, 1, 0, 2, 2, 0) , Actual: good

Predicted: good , Data: (3, 1, 3, 0, 0, 0) , Actual: good

Predicted: good , Data: (0, 3, 2, 0, 0, 0) , Actual: good

Predicted: good , Data: (3, 2, 3, 0, 2, 2) , Actual: good

Predicted: good , Data: (0, 3, 3, 1, 0, 2) , Actual: good

Predicted: good , Data: (1, 1, 1, 0, 2, 0) , Actual: good

Predicted: good , Data: (2, 1, 0, 0, 2, 0) , Actual: good

Predicted: unacc , Data: (1, 0, 3, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (0, 0, 0, 0, 0, 0) , Actual: good

Predicted: good , Data: (3, 1, 1, 2, 2, 0) , Actual: unacc

Predicted: unacc , Data: (1, 3, 1, 1, 0, 0) , Actual: unacc

Predicted: good , Data: (0, 2, 3, 0, 0, 2) , Actual: good

Predicted: unacc , Data: (3, 2, 1, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (0, 1, 2, 2, 2, 2) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 2, 0) , Actual: good

Predicted: good , Data: (3, 2, 3, 0, 2, 1) , Actual: good

Predicted: good , Data: (2, 1, 0, 0, 1, 0) , Actual: good

Predicted: good , Data: (0, 0, 2, 0, 0, 0) , Actual: good

Predicted: unacc , Data: (2, 3, 2, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 1, 0, 2, 2) , Actual: good

Predicted: good , Data: (3, 0, 2, 1, 2, 0) , Actual: good

Predicted: good , Data: (1, 1, 2, 0, 2, 2) , Actual: good

Predicted: unacc , Data: (2, 0, 3, 2, 0, 2) , Actual: unacc

Predicted: unacc , Data: (1, 1, 0, 1, 1, 2) , Actual: unacc

Predicted: unacc , Data: (1, 2, 3, 2, 1, 2) , Actual: acc

Predicted: good , Data: (1, 1, 1, 2, 0, 1) , Actual: good

Predicted: good , Data: (0, 1, 2, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 0, 1, 0, 2, 1) , Actual: good

Predicted: good , Data: (1, 0, 3, 0, 1, 1) , Actual: good

Predicted: good , Data: (0, 1, 3, 2, 0, 1) , Actual: good

Predicted: unacc , Data: (1, 0, 3, 2, 2, 2) , Actual: unacc

Predicted: good , Data: (0, 2, 1, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (2, 2, 0, 1, 2, 0) , Actual: unacc

Predicted: unacc , Data: (1, 0, 1, 2, 1, 0) , Actual: vgood

Predicted: good , Data: (2, 1, 2, 0, 2, 0) , Actual: good

Predicted: good , Data: (1, 0, 0, 1, 1, 1) , Actual: good

Predicted: good , Data: (2, 3, 1, 0, 0, 2) , Actual: good

Predicted: good , Data: (1, 1, 1, 0, 0, 0) , Actual: good

Predicted: good , Data: (3, 0, 2, 2, 0, 0) , Actual: good

Predicted: good , Data: (0, 1, 2, 0, 0, 0) , Actual: good

Predicted: unacc , Data: (2, 3, 2, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (2, 0, 0, 0, 0, 2) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 1, 2) , Actual: good

Predicted: good , Data: (1, 0, 0, 1, 0, 1) , Actual: good

Predicted: good , Data: (2, 0, 2, 0, 2, 2) , Actual: good

Predicted: good , Data: (1, 1, 3, 0, 0, 1) , Actual: good

Predicted: good , Data: (0, 0, 1, 0, 1, 1) , Actual: good

Predicted: acc , Data: (2, 1, 2, 1, 1, 2) , Actual: acc

Predicted: good , Data: (0, 3, 1, 0, 1, 1) , Actual: good

Predicted: unacc , Data: (0, 2, 2, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 0, 0, 0, 0, 2) , Actual: good

Predicted: good , Data: (2, 0, 0, 2, 2, 1) , Actual: good

Predicted: unacc , Data: (2, 1, 2, 2, 2, 2) , Actual: unacc

Predicted: vgood , Data: (1, 2, 2, 2, 0, 0) , Actual: vgood

Predicted: good , Data: (0, 3, 3, 1, 2, 1) , Actual: good

Predicted: unacc , Data: (0, 0, 0, 1, 0, 0) , Actual: unacc

Predicted: unacc , Data: (0, 2, 2, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (1, 3, 0, 1, 1, 1) , Actual: good

Predicted: good , Data: (2, 1, 1, 0, 1, 0) , Actual: good

Predicted: good , Data: (0, 0, 1, 1, 0, 1) , Actual: good

Predicted: good , Data: (3, 0, 1, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 3, 2, 1, 2, 1) , Actual: good

Predicted: unacc , Data: (2, 2, 0, 1, 1, 0) , Actual: unacc

Predicted: unacc , Data: (1, 2, 1, 2, 1, 0) , Actual: vgood

Predicted: good , Data: (3, 0, 3, 2, 1, 1) , Actual: good

Predicted: good , Data: (0, 0, 3, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 1, 0, 0, 1, 1) , Actual: good

Predicted: good , Data: (3, 3, 1, 2, 1, 2) , Actual: good

Predicted: vgood , Data: (2, 1, 0, 1, 0, 0) , Actual: vgood

Predicted: good , Data: (2, 2, 3, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 1, 3, 1, 2, 1) , Actual: good

Predicted: good , Data: (2, 1, 0, 1, 2, 2) , Actual: unacc

Predicted: vgood , Data: (2, 1, 2, 2, 1, 0) , Actual: vgood

Predicted: unacc , Data: (2, 3, 1, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (1, 0, 0, 0, 2, 1) , Actual: good

Predicted: unacc , Data: (3, 1, 2, 2, 2, 0) , Actual: unacc

Predicted: vgood , Data: (1, 1, 1, 2, 1, 0) , Actual: vgood

Predicted: unacc , Data: (2, 0, 0, 2, 0, 0) , Actual: unacc

Predicted: good , Data: (1, 3, 2, 0, 0, 1) , Actual: good

Predicted: acc , Data: (1, 1, 2, 2, 2, 0) , Actual: acc

Predicted: good , Data: (2, 3, 3, 2, 1, 1) , Actual: good

Predicted: good , Data: (3, 3, 2, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 3, 0, 0, 2) , Actual: good

Predicted: acc , Data: (1, 1, 3, 2, 0, 2) , Actual: acc

Predicted: good , Data: (0, 3, 3, 1, 1, 0) , Actual: good

Predicted: good , Data: (0, 3, 0, 0, 0, 1) , Actual: good

Predicted: good , Data: (0, 2, 0, 0, 1, 1) , Actual: good

Predicted: unacc , Data: (1, 0, 1, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 3, 2, 1, 0, 2) , Actual: good

Predicted: good , Data: (3, 3, 1, 0, 2, 0) , Actual: good

Predicted: good , Data: (1, 2, 1, 0, 2, 2) , Actual: good

Predicted: good , Data: (3, 3, 2, 1, 0, 1) , Actual: good

Predicted: good , Data: (2, 1, 1, 1, 1, 2) , Actual: unacc

Predicted: acc , Data: (1, 1, 1, 2, 2, 0) , Actual: acc

Predicted: good , Data: (1, 0, 1, 2, 2, 2) , Actual: unacc

Predicted: good , Data: (2, 1, 3, 0, 2, 2) , Actual: good

Predicted: good , Data: (1, 3, 1, 0, 1, 0) , Actual: good

Predicted: unacc , Data: (1, 3, 3, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 1, 0, 2, 0) , Actual: good

Predicted: good , Data: (2, 1, 3, 2, 0, 1) , Actual: good

Predicted: good , Data: (3, 0, 2, 2, 1, 0) , Actual: good

Predicted: good , Data: (3, 1, 2, 0, 1, 0) , Actual: good

Predicted: good , Data: (3, 1, 3, 1, 2, 2) , Actual: good

Predicted: unacc , Data: (3, 2, 0, 2, 1, 0) , Actual: unacc

Predicted: unacc , Data: (1, 2, 0, 2, 1, 0) , Actual: acc

Predicted: good , Data: (3, 1, 0, 2, 2, 1) , Actual: good

Predicted: good , Data: (3, 3, 2, 1, 2, 0) , Actual: good

Predicted: good , Data: (2, 1, 1, 2, 2, 1) , Actual: good

Predicted: good , Data: (1, 1, 0, 0, 1, 2) , Actual: good

Predicted: vgood , Data: (2, 1, 1, 1, 1, 0) , Actual: acc

Predicted: good , Data: (1, 1, 1, 1, 0, 1) , Actual: good

Predicted: unacc , Data: (0, 1, 1, 2, 0, 2) , Actual: unacc

Predicted: unacc , Data: (1, 3, 1, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 3, 0, 2, 1) , Actual: good

Predicted: good , Data: (1, 1, 1, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (1, 3, 2, 1, 2, 1) , Actual: good

Predicted: good , Data: (2, 2, 0, 0, 1, 1) , Actual: good

Predicted: good , Data: (0, 3, 1, 0, 1, 0) , Actual: good

Predicted: good , Data: (0, 1, 3, 0, 0, 1) , Actual: good

Predicted: good , Data: (3, 3, 1, 0, 1, 1) , Actual: good

Predicted: good , Data: (2, 1, 0, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (0, 1, 1, 0, 1, 2) , Actual: good

Predicted: good , Data: (3, 1, 3, 0, 0, 1) , Actual: good

Predicted: unacc , Data: (2, 3, 3, 2, 1, 0) , Actual: unacc

Predicted: good , Data: (3, 3, 3, 2, 2, 1) , Actual: good

Predicted: vgood , Data: (2, 1, 3, 2, 1, 0) , Actual: vgood

Predicted: good , Data: (0, 3, 2, 0, 2, 1) , Actual: good

Predicted: good , Data: (3, 2, 0, 0, 1, 2) , Actual: good

Predicted: good , Data: (3, 2, 1, 0, 0, 0) , Actual: good

Predicted: unacc , Data: (2, 1, 3, 2, 2, 2) , Actual: unacc

Predicted: good , Data: (0, 0, 0, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (1, 3, 3, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (0, 2, 0, 1, 1, 1) , Actual: good

Predicted: unacc , Data: (1, 1, 1, 1, 2, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 0, 0, 0, 2) , Actual: good

Predicted: good , Data: (0, 3, 2, 1, 2, 0) , Actual: good

Predicted: good , Data: (3, 1, 0, 1, 0, 1) , Actual: good

Predicted: good , Data: (3, 3, 1, 0, 1, 0) , Actual: good

Predicted: unacc , Data: (2, 2, 1, 1, 2, 0) , Actual: unacc

Predicted: vgood , Data: (1, 2, 3, 1, 0, 0) , Actual: vgood

Predicted: good , Data: (2, 1, 0, 1, 2, 1) , Actual: good

Predicted: good , Data: (0, 0, 0, 1, 1, 1) , Actual: good

Predicted: good , Data: (2, 3, 0, 0, 1, 0) , Actual: good

Predicted: good , Data: (1, 3, 3, 1, 2, 1) , Actual: good

Predicted: good , Data: (0, 3, 0, 2, 1, 1) , Actual: good

Predicted: good , Data: (3, 2, 2, 0, 1, 0) , Actual: good

Predicted: good , Data: (3, 1, 0, 0, 2, 1) , Actual: good

Predicted: good , Data: (3, 3, 1, 1, 0, 0) , Actual: good

Predicted: good , Data: (2, 0, 0, 0, 1, 2) , Actual: good

Predicted: unacc , Data: (0, 1, 0, 2, 0, 0) , Actual: unacc

Predicted: good , Data: (0, 3, 3, 1, 1, 2) , Actual: good

Predicted: good , Data: (0, 1, 3, 0, 1, 2) , Actual: good

Predicted: good , Data: (3, 3, 2, 0, 1, 0) , Actual: good

Predicted: good , Data: (2, 3, 1, 0, 2, 2) , Actual: good

Predicted: unacc , Data: (3, 2, 1, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (0, 1, 2, 0, 1, 1) , Actual: good

Predicted: unacc , Data: (0, 0, 2, 2, 1, 0) , Actual: unacc

Predicted: vgood , Data: (2, 2, 3, 1, 1, 0) , Actual: vgood

Predicted: unacc , Data: (1, 3, 3, 1, 0, 0) , Actual: unacc

Predicted: good , Data: (3, 2, 2, 0, 2, 1) , Actual: good

Predicted: unacc , Data: (0, 2, 3, 1, 1, 0) , Actual: unacc

Predicted: good , Data: (3, 0, 3, 2, 1, 0) , Actual: good

Predicted: good , Data: (0, 0, 2, 2, 0, 1) , Actual: good

Predicted: unacc , Data: (2, 3, 2, 2, 0, 0) , Actual: unacc

Predicted: good , Data: (1, 2, 2, 0, 0, 0) , Actual: good

Predicted: good , Data: (3, 1, 3, 1, 2, 1) , Actual: good

Predicted: good , Data: (3, 1, 3, 1, 0, 1) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 0, 1) , Actual: good

Predicted: unacc , Data: (3, 1, 2, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 2, 2, 0, 2, 2) , Actual: good

Predicted: good , Data: (3, 0, 3, 1, 1, 0) , Actual: good

Predicted: good , Data: (2, 1, 0, 0, 1, 2) , Actual: good

Predicted: acc , Data: (1, 1, 1, 1, 0, 2) , Actual: acc

Predicted: unacc , Data: (2, 0, 2, 1, 1, 0) , Actual: unacc

Predicted: good , Data: (3, 2, 0, 2, 1, 1) , Actual: good

Predicted: good , Data: (3, 1, 2, 0, 1, 1) , Actual: good

Predicted: unacc , Data: (3, 1, 3, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (3, 2, 1, 2, 2, 1) , Actual: good

Predicted: good , Data: (3, 3, 2, 1, 1, 2) , Actual: good

Predicted: good , Data: (1, 3, 3, 0, 0, 1) , Actual: good

Predicted: unacc , Data: (3, 2, 3, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 0, 0, 1, 0, 2) , Actual: good

Predicted: good , Data: (1, 1, 3, 1, 0, 1) , Actual: good

Predicted: good , Data: (1, 0, 0, 0, 2, 2) , Actual: good

Predicted: good , Data: (2, 1, 1, 0, 2, 2) , Actual: good

Predicted: unacc , Data: (0, 0, 0, 1, 1, 0) , Actual: unacc

Predicted: good , Data: (1, 2, 0, 0, 1, 2) , Actual: good

Predicted: good , Data: (1, 3, 1, 0, 0, 2) , Actual: good

Predicted: good , Data: (3, 2, 3, 0, 0, 1) , Actual: good

Predicted: good , Data: (0, 3, 3, 2, 2, 2) , Actual: good

Predicted: good , Data: (3, 0, 2, 0, 2, 1) , Actual: good

Predicted: acc , Data: (1, 2, 1, 2, 0, 2) , Actual: acc

Predicted: good , Data: (3, 2, 1, 0, 1, 2) , Actual: good

Predicted: good , Data: (2, 3, 2, 0, 0, 2) , Actual: good

Predicted: good , Data: (1, 3, 1, 0, 0, 0) , Actual: good

Predicted: acc , Data: (1, 2, 3, 1, 0, 2) , Actual: acc

Predicted: good , Data: (0, 3, 0, 2, 2, 1) , Actual: good

Predicted: good , Data: (1, 0, 0, 1, 2, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 0, 0, 0, 0) , Actual: good

Predicted: good , Data: (0, 2, 1, 0, 0, 2) , Actual: good

Predicted: good , Data: (2, 3, 0, 2, 0, 2) , Actual: unacc

Predicted: good , Data: (0, 2, 2, 0, 2, 0) , Actual: good

Predicted: good , Data: (0, 1, 0, 2, 1, 1) , Actual: good

Predicted: unacc , Data: (2, 2, 2, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (0, 0, 0, 0, 1, 2) , Actual: good

Predicted: good , Data: (3, 0, 2, 0, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 1, 2, 1, 1) , Actual: good

Predicted: acc , Data: (2, 2, 0, 2, 1, 0) , Actual: unacc

Predicted: vgood , Data: (1, 2, 1, 1, 0, 0) , Actual: vgood

Predicted: good , Data: (3, 3, 2, 2, 2, 2) , Actual: good

Predicted: good , Data: (3, 0, 0, 0, 2, 2) , Actual: good

Predicted: unacc , Data: (0, 0, 2, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (0, 1, 1, 2, 0, 1) , Actual: good

Predicted: good , Data: (3, 2, 0, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 2, 0, 2, 0) , Actual: good

Predicted: good , Data: (3, 1, 1, 1, 0, 1) , Actual: good

Predicted: unacc , Data: (2, 0, 1, 1, 1, 0) , Actual: unacc

Predicted: good , Data: (0, 2, 2, 1, 2, 1) , Actual: good

Predicted: good , Data: (3, 2, 3, 2, 2, 2) , Actual: good

Predicted: good , Data: (3, 3, 1, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 0, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (0, 2, 3, 1, 1, 1) , Actual: good

Predicted: unacc , Data: (2, 3, 3, 2, 2, 0) , Actual: unacc

Predicted: good , Data: (3, 3, 2, 2, 1, 2) , Actual: good

Predicted: good , Data: (1, 0, 2, 0, 1, 1) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 1, 0) , Actual: good

Predicted: good , Data: (2, 3, 0, 1, 2, 2) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 0, 0) , Actual: good

Predicted: good , Data: (1, 3, 1, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 3, 2, 1, 1) , Actual: good

Predicted: good , Data: (3, 2, 3, 0, 1, 1) , Actual: good

Predicted: good , Data: (0, 3, 0, 0, 2, 2) , Actual: good

Predicted: good , Data: (3, 0, 0, 1, 0, 1) , Actual: good

Predicted: good , Data: (0, 3, 1, 1, 1, 1) , Actual: good

Predicted: good , Data: (2, 0, 2, 2, 0, 1) , Actual: good

Predicted: good , Data: (1, 3, 3, 0, 2, 0) , Actual: good

Predicted: good , Data: (2, 2, 3, 1, 0, 1) , Actual: good

Predicted: good , Data: (3, 1, 2, 0, 1, 2) , Actual: good

Predicted: good , Data: (2, 3, 3, 0, 1, 2) , Actual: good

Predicted: good , Data: (2, 1, 3, 1, 2, 1) , Actual: good

Predicted: good , Data: (0, 3, 3, 0, 1, 0) , Actual: good

Predicted: good , Data: (2, 0, 1, 0, 0, 1) , Actual: good

Predicted: good , Data: (0, 2, 2, 0, 0, 0) , Actual: good

Predicted: good , Data: (0, 2, 3, 0, 2, 2) , Actual: good

Predicted: good , Data: (1, 3, 3, 1, 1, 1) , Actual: good

Predicted: good , Data: (0, 3, 1, 2, 2, 2) , Actual: good

Predicted: unacc , Data: (3, 1, 3, 1, 0, 0) , Actual: unacc

Predicted: good , Data: (0, 3, 0, 0, 2, 1) , Actual: good

Predicted: unacc , Data: (0, 0, 2, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 0, 1, 0, 0, 1) , Actual: good

Predicted: good , Data: (0, 1, 3, 2, 2, 1) , Actual: good

Predicted: good , Data: (0, 0, 1, 1, 2, 1) , Actual: good

Predicted: good , Data: (1, 2, 3, 2, 2, 1) , Actual: good

Predicted: good , Data: (1, 1, 1, 2, 2, 1) , Actual: good

Predicted: good , Data: (3, 1, 1, 1, 0, 2) , Actual: unacc

Predicted: vgood , Data: (1, 2, 0, 2, 0, 0) , Actual: vgood

Predicted: good , Data: (3, 0, 2, 2, 1, 2) , Actual: good

Predicted: good , Data: (0, 2, 2, 2, 2, 1) , Actual: good

Predicted: good , Data: (3, 2, 1, 0, 2, 2) , Actual: good

Predicted: unacc , Data: (1, 3, 2, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (3, 2, 2, 2, 2, 2) , Actual: good

Predicted: good , Data: (1, 0, 2, 0, 1, 0) , Actual: good

Predicted: unacc , Data: (1, 2, 2, 2, 1, 0) , Actual: vgood

Predicted: good , Data: (2, 0, 0, 0, 2, 0) , Actual: good

Predicted: good , Data: (0, 0, 0, 2, 1, 1) , Actual: good

Predicted: unacc , Data: (1, 2, 0, 1, 1, 2) , Actual: unacc

Predicted: good , Data: (1, 2, 0, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 2, 1, 0, 0, 2) , Actual: good

Predicted: unacc , Data: (3, 1, 3, 2, 2, 0) , Actual: unacc

Predicted: good , Data: (2, 2, 1, 2, 0, 1) , Actual: good

Predicted: unacc , Data: (3, 1, 1, 1, 1, 0) , Actual: unacc

Predicted: unacc , Data: (1, 0, 2, 1, 0, 2) , Actual: unacc

Predicted: good , Data: (0, 1, 1, 2, 2, 2) , Actual: good

Predicted: good , Data: (1, 3, 0, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 2, 2, 1, 1, 2) , Actual: unacc

Predicted: acc , Data: (2, 1, 1, 1, 2, 0) , Actual: acc

Predicted: vgood , Data: (1, 2, 3, 1, 1, 0) , Actual: vgood

Predicted: unacc , Data: (3, 1, 0, 2, 0, 0) , Actual: unacc

Predicted: good , Data: (2, 2, 2, 1, 2, 2) , Actual: unacc

Predicted: good , Data: (3, 0, 2, 0, 0, 0) , Actual: good

Predicted: good , Data: (0, 1, 0, 2, 2, 1) , Actual: good

Predicted: good , Data: (0, 3, 3, 1, 0, 0) , Actual: good

Predicted: good , Data: (3, 1, 3, 2, 1, 1) , Actual: good

Predicted: vgood , Data: (2, 2, 1, 2, 0, 0) , Actual: vgood

Predicted: unacc , Data: (0, 0, 1, 1, 0, 0) , Actual: unacc

Predicted: unacc , Data: (3, 1, 1, 2, 1, 0) , Actual: unacc

Predicted: good , Data: (0, 2, 0, 0, 2, 0) , Actual: good

Predicted: good , Data: (0, 3, 3, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 1, 3, 0, 2, 2) , Actual: good

Predicted: good , Data: (2, 0, 0, 1, 2, 2) , Actual: good

Predicted: vgood , Data: (2, 2, 2, 2, 1, 0) , Actual: vgood

Predicted: good , Data: (0, 3, 3, 0, 2, 2) , Actual: good

Predicted: good , Data: (1, 3, 0, 0, 1, 0) , Actual: good

Predicted: good , Data: (3, 0, 2, 1, 1, 2) , Actual: good

Predicted: good , Data: (2, 2, 0, 0, 0, 0) , Actual: good

Predicted: unacc , Data: (2, 1, 1, 1, 2, 2) , Actual: unacc

Predicted: good , Data: (1, 2, 2, 2, 1, 1) , Actual: good

Predicted: good , Data: (0, 2, 2, 0, 1, 0) , Actual: good

Predicted: vgood , Data: (2, 2, 2, 2, 0, 0) , Actual: vgood

Predicted: unacc , Data: (0, 1, 2, 2, 0, 0) , Actual: unacc

Predicted: unacc , Data: (0, 2, 3, 2, 1, 0) , Actual: unacc

Predicted: good , Data: (3, 0, 3, 1, 2, 1) , Actual: good

Predicted: good , Data: (3, 3, 0, 1, 0, 1) , Actual: good

Predicted: good , Data: (3, 2, 1, 2, 1, 2) , Actual: unacc

Predicted: unacc , Data: (2, 3, 2, 2, 1, 0) , Actual: unacc

Predicted: unacc , Data: (0, 0, 3, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (1, 3, 0, 0, 0, 1) , Actual: good

Predicted: unacc , Data: (0, 0, 2, 2, 0, 0) , Actual: unacc

Predicted: unacc , Data: (1, 3, 1, 2, 1, 2) , Actual: unacc

Predicted: good , Data: (3, 1, 3, 0, 1, 1) , Actual: good

Predicted: good , Data: (2, 1, 2, 0, 0, 2) , Actual: good

Predicted: good , Data: (3, 1, 1, 0, 2, 1) , Actual: good

Predicted: good , Data: (3, 0, 3, 1, 2, 2) , Actual: good

Predicted: good , Data: (0, 2, 1, 0, 2, 0) , Actual: good

Predicted: good , Data: (0, 1, 1, 1, 0, 1) , Actual: good

Predicted: unacc , Data: (1, 0, 2, 1, 2, 0) , Actual: unacc

Predicted: good , Data: (2, 0, 1, 0, 2, 1) , Actual: good

Predicted: good , Data: (0, 2, 0, 0, 0, 1) , Actual: good

Predicted: good , Data: (1, 2, 0, 0, 0, 0) , Actual: good

Predicted: good , Data: (1, 0, 3, 0, 0, 0) , Actual: good

Predicted: unacc , Data: (1, 3, 0, 1, 0, 0) , Actual: unacc

Predicted: good , Data: (1, 1, 3, 0, 1, 2) , Actual: good

Predicted: good , Data: (2, 0, 1, 2, 2, 2) , Actual: good

Predicted: good , Data: (0, 3, 2, 2, 2, 0) , Actual: good

Predicted: good , Data: (3, 3, 2, 0, 2, 0) , Actual: good

Predicted: unacc , Data: (2, 0, 0, 1, 1, 0) , Actual: unacc

Predicted: good , Data: (2, 2, 1, 0, 1, 0) , Actual: good

Predicted: good , Data: (0, 0, 0, 1, 0, 1) , Actual: good

Predicted: good , Data: (3, 3, 1, 1, 0, 2) , Actual: good

Predicted: good , Data: (3, 3, 3, 2, 2, 2) , Actual: good

Predicted: good , Data: (2, 1, 0, 2, 2, 1) , Actual: good

Predicted: good , Data: (3, 3, 3, 2, 2, 0) , Actual: good

Predicted: good , Data: (2, 2, 0, 0, 1, 2) , Actual: good

Accuracy: 0.9248554913294798

**Conclusion:**

KNN was studied and successfully implemented.