Project – Classification or Clustering Task

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Importing the requirements: if not satisfied use !pip install command to install:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import classification_report, confusion_matrix
```

Loading the data and removing unneccessary index colomns:

```
train_data = pd.read_csv('/content/train.csv')
test_data = pd.read_csv('/content/test.csv')
```

for dataset in [train_data, test_data]:

```
    dataset['Arrival Delay in Minutes'].fillna(dataset['Arrival Delay in Minutes'].mean(), inplace=True)


categorical_cols = ['Gender', 'Customer Type', 'Type of Travel', 'Class']
numerical_cols = [col for col in train_data.columns if col not in categorical_cols + ['satisfaction', 'id']]
```

Preprocessor for numeric and categorical data:

```
preprocessor = ColumnTransformer(
    transformers=[
```

```
        ('num', StandardScaler(), numerical_cols),
        ('cat', OneHotEncoder(handle_unknown='ignore'), categorical_cols)
    ])
```

Pipeline for Decision tree and naive bayes:

```
tree_pipeline = Pipeline([
    ('preprocessor', preprocessor),
    ('classifier', DecisionTreeClassifier(random_state=42))
])


nb_pipeline = Pipeline([
    ('preprocessor', preprocessor),
    ('classifier', GaussianNB())
])
```

Train the model:

```
y_train = train_data['satisfaction']
X_train = train_data.drop(['satisfaction', 'id'], axis=1)
y_test = test_data['satisfaction']
X_test = test_data.drop(['satisfaction', 'id'], axis=1)


tree_pipeline.fit(X_train, y_train)
nb_pipeline.fit(X_train, y_train)
```

Evaluate the models:

```
tree_predictions = tree_pipeline.predict(X_test)
nb_predictions = nb_pipeline.predict(X_test)


print("Decision Tree Classification Report:\n", classification_report(y_test,
tree_predictions))
```

```
print("Decision Tree Confusion Matrix:\n", confusion_matrix(y_test, tree_predictions))
print("Naive Bayes Classification Report:\n", classification_report(y_test, nb_predictions))
print("Naive Bayes Confusion Matrix:\n", confusion_matrix(y_test, nb_predictions))
```

Complete Code:

```
# Import necessary libraries
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import classification_report, confusion_matrix

# Load the datasets
train_data = pd.read_csv('/content/train.csv')
test_data = pd.read_csv('/content/test.csv')

# Remove unnecessary index columns
train_data.drop('Unnamed: 0', axis=1, inplace=True)
test_data.drop('Unnamed: 0', axis=1, inplace=True)

# Fill missing values for 'Arrival Delay in Minutes'
for dataset in [train_data, test_data]:
    dataset['Arrival Delay in Minutes'].fillna(dataset['Arrival Delay in Minutes'].mean(),
inplace=True)
```

```
# Define categorical and numerical columns
categorical_cols = ['Gender', 'Customer Type', 'Type of Travel', 'Class']
numerical_cols = [col for col in train_data.columns if col not in categorical_cols + ['satisfaction', 'id']]

# Preprocessor for numeric and categorical data
preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), numerical_cols),
        ('cat', OneHotEncoder(handle_unknown='ignore'), categorical_cols)
    ])

# Pipelines for Decision Tree and Naive Bayes
tree_pipeline = Pipeline([
    ('preprocessor', preprocessor),
    ('classifier', DecisionTreeClassifier(random_state=42))
])

nb_pipeline = Pipeline([
    ('preprocessor', preprocessor),
    ('classifier', GaussianNB())
])

# Separate features and target variable
y_train = train_data['satisfaction']
X_train = train_data.drop(['satisfaction', 'id'], axis=1)
y_test = test_data['satisfaction']
X_test = test_data.drop(['satisfaction', 'id'], axis=1)
```

Train the models

tree_pipeline.fit(X_train, y_train)

nb_pipeline.fit(X_train, y_train)

Evaluate the models

tree_predictions = tree_pipeline.predict(X_test)

nb_predictions = nb_pipeline.predict(X_test)

Print classification reports and confusion matrices

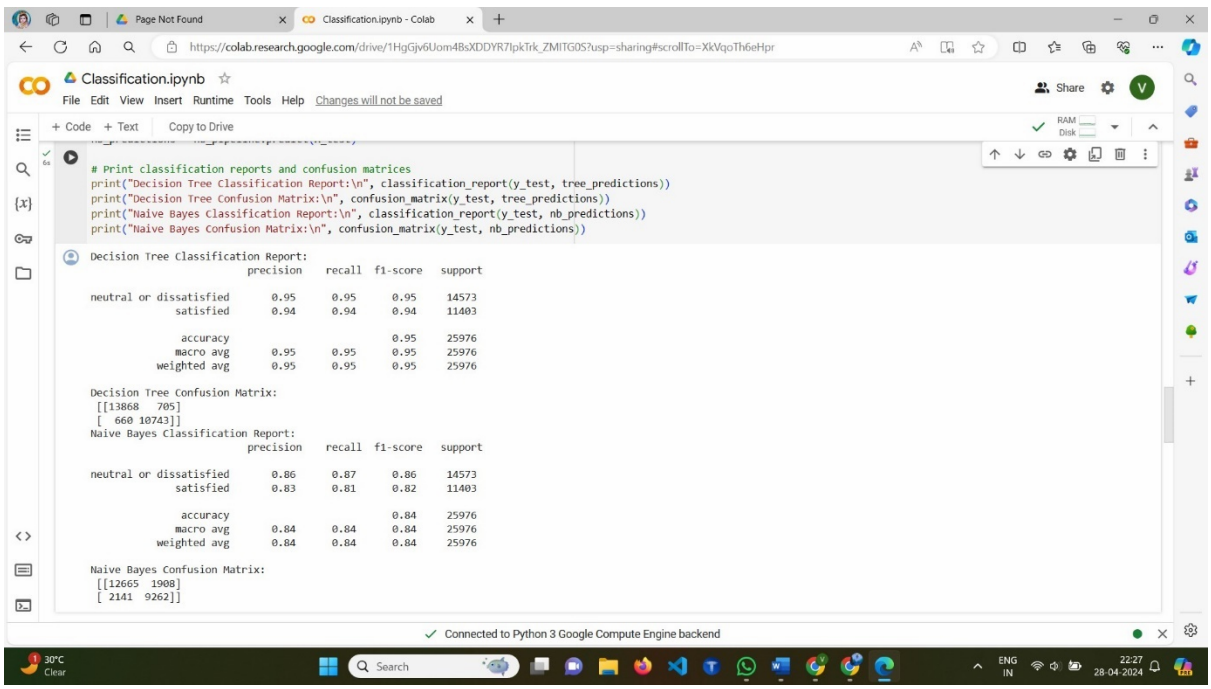
print("Decision Tree Classification Report:\n", classification_report(y_test, tree_predictions))

print("Decision Tree Confusion Matrix:\n", confusion_matrix(y_test, tree_predictions))

print("Naive Bayes Classification Report:\n", classification_report(y_test, nb_predictions))

print("Naive Bayes Confusion Matrix:\n", confusion_matrix(y_test, nb_predictions))

Output:

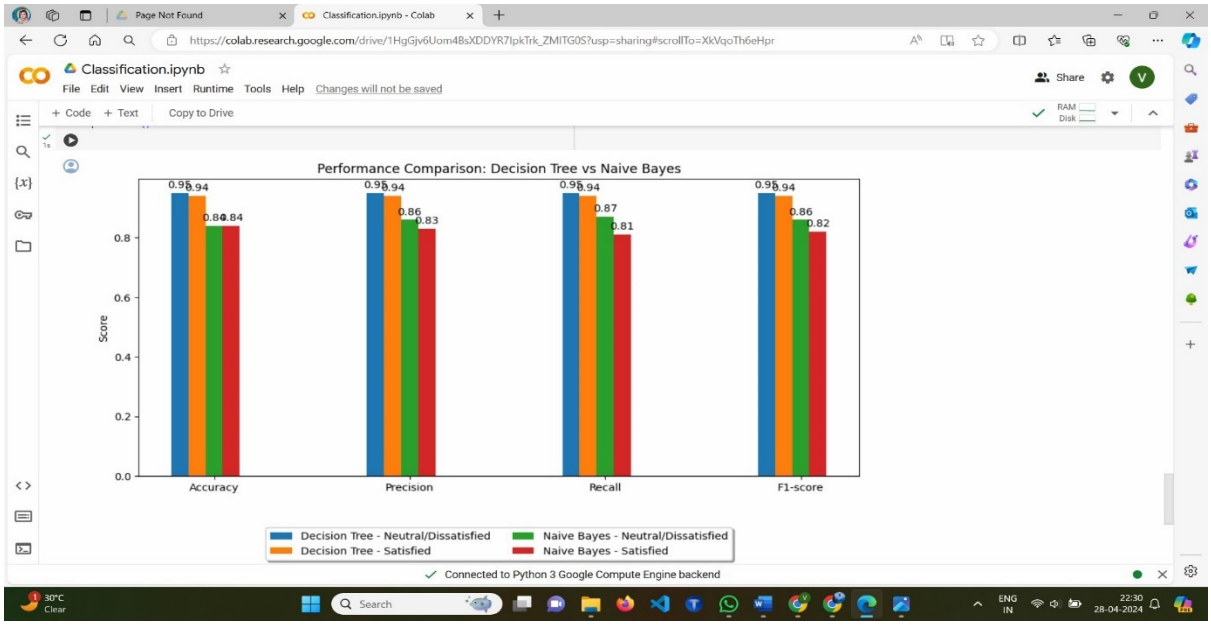


import matplotlib.pyplot as plt

```
import numpy as np


# Define the metrics for Decision Tree and Naive Bayes

metrics = ['Accuracy', 'Precision', 'Recall', 'F1-score']

decision_tree_neutral = [0.95, 0.95, 0.95, 0.95]  # Values obtained from the Decision Tree classification report for "neutral or dissatisfied"

decision_tree_satisfied = [0.94, 0.94, 0.94, 0.94]  # Values obtained from the Decision Tree classification report for "satisfied"

naive_bayes_neutral = [0.84, 0.86, 0.87, 0.86]  # Values obtained from the Naive Bayes classification report for "neutral or dissatisfied"

naive_bayes_satisfied = [0.84, 0.83, 0.81, 0.82]  # Values obtained from the Naive Bayes classification report for "satisfied"


# Plotting the bar graph

x = np.arange(len(metrics))  # Generate evenly spaced values for x-axis

width = 0.35


fig, ax = plt.subplots(figsize=(10, 6))

rects1 = ax.bar(x - width/2, decision_tree_neutral, width/4, label='Decision Tree - Neutral/Dissatisfied')

rects2 = ax.bar(x - width/4, decision_tree_satisfied, width/4, label='Decision Tree - Satisfied')

rects3 = ax.bar(x, naive_bayes_neutral, width/4, label='Naive Bayes - Neutral/Dissatisfied')

rects4 = ax.bar(x + width/4, naive_bayes_satisfied, width/4, label='Naive Bayes - Satisfied')


# Adding values on top of the bars

def add_values(rects, values, offset):

   for rect, value in zip(rects, values):

      height = rect.get_height()

      ax.annotate('{}'.format(value),

               xy=(rect.get_x() + rect.get_width() / 2, height),
```

```
            xytext=(0, offset),  # Adjusting the text position
            textcoords="offset points",
            ha='center', va='bottom')

add_values(rects1, decision_tree_neutral, 3)  # Increase offset for Decision Tree - Neutral/Dissatisfied
add_values(rects2, decision_tree_satisfied, 3)  # Increase offset for Decision Tree - Satisfied
add_values(rects3, naive_bayes_neutral, 3)
add_values(rects4, naive_bayes_satisfied, 3)

# Adding labels, title, and legend
ax.set_ylabel('Score')
ax.set_title('Performance Comparison: Decision Tree vs Naive Bayes')
ax.set_xticks(x)
ax.set_xticklabels(metrics)

# Moving the legend to lower center
ax.legend(loc='lower center', bbox_to_anchor=(0.5, -0.3), shadow=True, ncol=2)

plt.tight_layout()
plt.show()
```

Output:



Google Colab Link:

https://colab.research.google.com/drive/1smPd_s7q8fHC4MrtoRD-qOn_BUGK1Jyp