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T&T LAB ASSIGNMENT 13

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[ ]:
```
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn import preprocessing
import seaborn as sns
import pandas as pd
import numpy as np

from sklearn.svm import SVC
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import AdaBoostClassifier
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB

from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.metrics import recall_score
from sklearn.metrics import precision_score
from sklearn.metrics import f1_score
```

[ ]:
```
df_main = pd.read_csv("Social_Network_Ads.csv")
df_main.head()
```

[ ]:
```
   Age  EstimatedSalary  Purchased
0   19            19000          0
1   35            20000          0
2   26            43000          0
3   27            57000          0
4   19            76000          0
```

[ ]:

```
df = df_main.copy()
print(df.head())
print(df.shape)
```

```
   Age  EstimatedSalary  Purchased
0   19            19000          0
1   35            20000          0
2   26            43000          0
3   27            57000          0
4   19            76000          0
(400, 3)
```

[ ]:

```
df.isnull().mean().round(5).mul(100).sort_values(ascending=False)
```

[ ]:

```
Age                0.0
EstimatedSalary    0.0
Purchased          0.0
dtype: float64
```

[ ]:

```
cols = ['Age', 'EstimatedSalary', 'Purchased']

for col in cols:
    le = preprocessing.LabelEncoder()
    df[col] = le.fit_transform(df[col])
```

[ ]:

```
df.head()
```

[ ]:

```
   Age  EstimatedSalary  Purchased
0    1                4          0
1   17                5          0
2    8               26          0
3    9               39          0
4    1               57          0
```

[ ]:

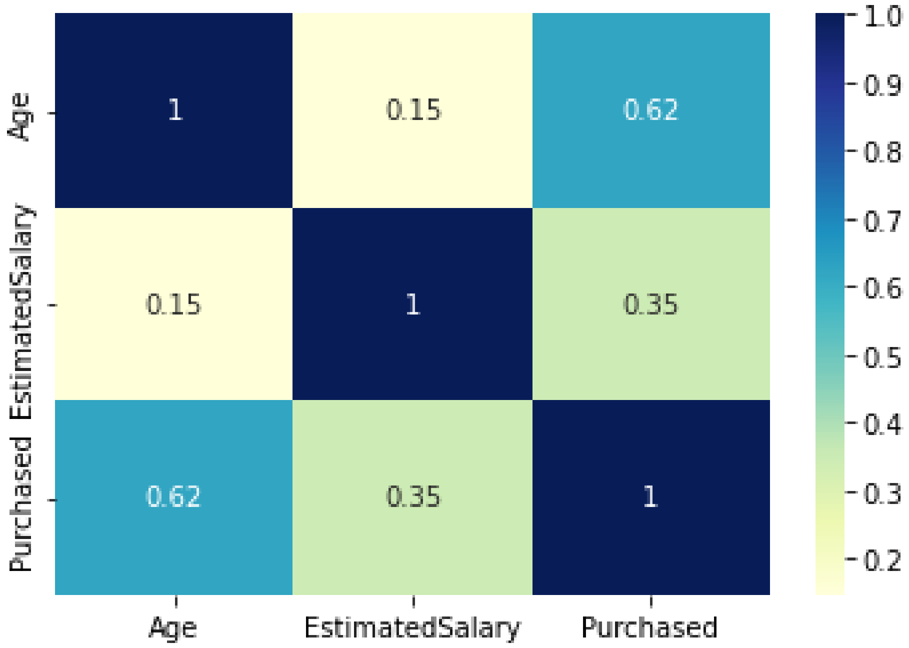
```
x_train, x_test, y_train, y_test = train_test_split(df.drop(columns =␣
 ↪['Purchased']), df['Purchased'], train_size = 0.8)
x_train.shape, y_train.shape, x_test.shape, y_test.shape
```

[ ]:

```
((320, 2), (320,), (80, 2), (80,))
```

[ ]:

```
corr = df.corr()
sns.heatmap(corr, cmap="YlGnBu", annot=True)
plt.show()
```



[ ]:

```
algos = []
accuracy = []
recall = []
precision = []
f1Score = []
Specificity =[]
```

1. Logistic Regression

[ ]:

```
LogReg = LogisticRegression()
LogReg.fit(x_train, y_train)
y_pred = LogReg.predict(x_test)

print("Logistic Regression")
accLogReg = accuracy_score(y_test, y_pred) * 100
recLogReg = recall_score(y_test, y_pred) * 100
preLogReg = precision_score(y_test, y_pred) * 100
f1sLogReg = f1_score(y_test, y_pred) * 100
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
spc = (tn / (tn+fp))*100
print('Accuracy:', accLogReg)
print('Recall:', recLogReg)
print('Precision:', preLogReg)
print('F score:', f1sLogReg)
print('Specificity:', spc)

algos.append("Logistic Regression")
accuracy.append(accLogReg)
recall.append(recLogReg)
precision.append(preLogReg)
f1Score.append(f1sLogReg)
Specificity.append(spc)
```

```
Logistic Regression
Accuracy: 83.75
Recall: 70.37037037037037
Precision: 79.16666666666666
F score: 74.50980392156865
Specificity: 90.56603773584906
```

2. SVM

[ ]:

```
algo = "Support Vector Machine"
model = SVC(kernel='rbf')
model.fit(x_train, y_train)
y_pred = model.predict(x_test)
print(algo)
acc = accuracy_score(y_test, y_pred) * 100
print('Accuracy:', acc)
rec = recall_score(y_test, y_pred) * 100
print('Recall:', rec)
pre = precision_score(y_test, y_pred) * 100
print('Precision:', pre)
f1s = f1_score(y_test, y_pred) * 100
print('F score:', f1s)
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
spc = (tn / (tn+fp))*100
print('Specificity:', spc)

algos.append(algo)
accuracy.append(acc)
recall.append(rec)
precision.append(pre)
f1Score.append(f1s)
Specificity.append(spc)
```

```
Support Vector Machine
Accuracy: 92.5
Recall: 92.5925925925926
Precision: 86.20689655172413
F score: 89.28571428571429
```

```
Specificity: 92.45283018867924
```

3. KNN

[ ]:

```
KNN = KNeighborsClassifier()
KNN.fit(x_train, y_train)
y_pred = KNN.predict(x_test)

print("K Nearest Neighbour")
accKNN = accuracy_score(y_test, y_pred) * 100
recKNN = recall_score(y_test, y_pred) * 100
preKNN = precision_score(y_test, y_pred) * 100
f1sKNN = f1_score(y_test, y_pred) * 100
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
spc = (tn / (tn+fp))*100
print('Accuracy:', accKNN)
print('Recall:', recKNN)
print('Precision:', preKNN)
print('F score:', f1sKNN)
print('Specificity:', spc)

algos.append("K Nearest Neighbour")
accuracy.append(accKNN)
recall.append(recKNN)
precision.append(preKNN)
f1Score.append(f1sKNN)
Specificity.append(spc)
```

```
K Nearest Neighbour
Accuracy: 91.25
Recall: 88.88888888888889
Precision: 85.71428571428571
F score: 87.27272727272727
Specificity: 92.45283018867924
```

4. Discision Tree

[ ]:

```
DecTreeReg = DecisionTreeClassifier()
DecTreeReg.fit(x_train, y_train)
y_pred = DecTreeReg.predict(x_test)
print("Decision Tree")
accDecTreeReg = accuracy_score(y_test, y_pred) * 100
recDecTreeReg = recall_score(y_test, y_pred) * 100
preDecTreeReg = precision_score(y_test, y_pred) * 100
f1sDecTreeReg = f1_score(y_test, y_pred) * 100
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
```

```
spc = (tn / (tn+fp))*100
print('Accuracy:', accDecTreeReg)
print('Recall:', recDecTreeReg)
print('Precision:', preDecTreeReg)
print('F score:', f1sDecTreeReg)
print('Specificity:', spc)

algos.append("Decision Tree")
accuracy.append(accDecTreeReg)
recall.append(recDecTreeReg)
precision.append(preDecTreeReg)
f1Score.append(f1sDecTreeReg)
Specificity.append(spc)
```

```
Decision Tree
Accuracy: 86.25
Recall: 85.18518518518519
Precision: 76.66666666666667
F score: 80.7017543859649
Specificity: 86.79245283018868
```

5. Naive Bayes

[ ]:

```
NB = GaussianNB()
NB.fit(x_train, y_train)
y_pred = NB.predict(x_test)
print("Naive Bayes")
accNB = accuracy_score(y_test, y_pred) * 100
recNB = recall_score(y_test, y_pred) * 100
preNB = precision_score(y_test, y_pred) * 100
f1sNB = f1_score(y_test, y_pred) * 100
tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
spc = (tn / (tn+fp))*100
print('Accuracy:', accNB)
print('Recall:', recNB)
print('Precision:', preNB)
print('F score:', f1sNB)
print('Specificity:', spc)

algos.append("Naive Bayes")
accuracy.append(accNB)
recall.append(recNB)
precision.append(preNB)
f1Score.append(f1sNB)
Specificity.append(spc)
```

```
Naive Bayes
```

```
Accuracy: 86.25
Recall: 74.07407407407408
Precision: 83.33333333333334
F score: 78.43137254901961
Specificity: 92.45283018867924
```

Q1) From dataset 'social ad':

Calculate performance metric

1. Accuracy
2. Sensitivity/Recall
3. Specificity
4. F-score
5. Precision

[ ]:

```
algoTable = pd.DataFrame(list(zip(algos, accuracy, recall, precision, f1Score, Specificity)), columns=["Algorithms", "Accuracy", "Recall", "Precision", "F1 Score", 'Specificity'])
algoTable
```

[ ]:

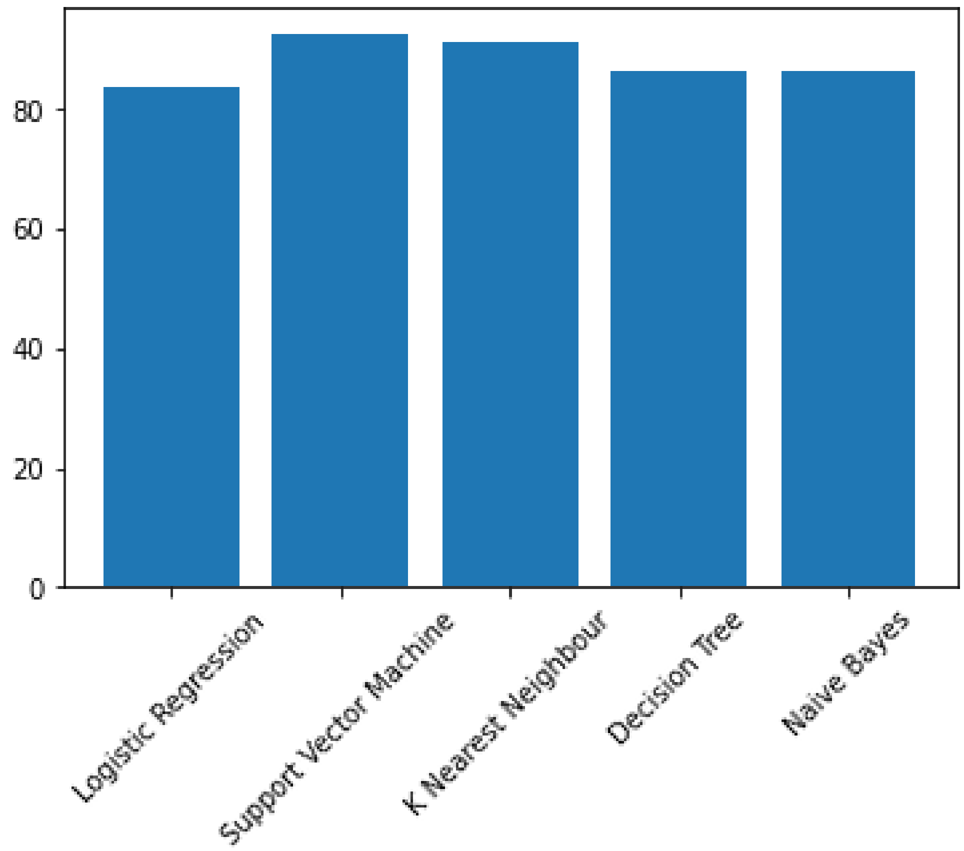
```
                Algorithms  Accuracy     Recall  Precision   F1 Score  \
0      Logistic Regression     83.75  70.370370  79.166667  74.509804
1   Support Vector Machine     92.50  92.592593  86.206897  89.285714
2      K Nearest Neighbour     91.25  88.888889  85.714286  87.272727
3            Decision Tree     86.25  85.185185  76.666667  80.701754
4              Naive Bayes     86.25  74.074074  83.333333  78.431373

   Specificity
0    90.566038
1    92.452830
2    92.452830
3    86.792453
4    92.452830
```

8 Q3) Plot a bar graph and compare the accuracy obtained in each case.

[ ]:

```
plt.bar(algos, accuracy)
plt.xticks(rotation = 45)
plt.show()
```


0
20
40
60
80
Logistic Regression
Support Vector Machine
K Nearest Neighbour
Decision Tree
Naive Bayes

[ ]: