University Institute of Engineering

Department of Computer Science & Engineering

Experiment: 2.1

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Branch: Computer Science & Engineering **Section/Group: 212-C**

Semester: 1st **Date of Performance: 09/11/22**

Subject Name: Disruptive technology-1

Subject Code: 22ECH-102

1. Aim of the practical:

Machine learning model using PyCaret

2. Tool Used:

Google Colab

3. Code Used:

DT PRACTICAL - 2

Installing pycaret

```
!pip install pycaret &> /dev/null
print ("Pycaret installed sucessfully!!")
```

```
Pycaret installed sucessfully!!
```

Get pycaret version

```
from pycaret.utils import version
version()
```

```
' 2.3.10 '
```

Classification: Basics

Loading Dataset - Loading dataset from pycaret

```
from pycaret.datasets import get_data
```

Get the list of datasets available in pycaret (55)

```
dataSets = get_data('index')

# instances = number of rows
# attributes/features = number of columns
```

	Dataset	Data Types	Default Task	Target Variable 1	Target Variable
0	anomaly	Multivariate	Anomaly Detection	None	

1	france	Multivariate	Association Rule Mining	InvoiceNo	Description
2	germany	Multivariate	Association Rule Mining	InvoiceNo	Description
3	bank	Multivariate	Classification (Binary)	deposit	
4	blood	Multivariate	Classification (Binary)	Class	
5	cancer	Multivariate	Classification (Binary)	Class	
6	credit	Multivariate	Classification (Binary)	default	
7	diabetes	Multivariate	Classification (Binary)	Class variable	
8	electrical_grid	Multivariate	Classification (Binary)	stabf	
9	employee	Multivariate	Classification (Binary)	left	
10	heart	Multivariate	Classification (Binary)	DEATH	
11	heart_disease	Multivariate	Classification (Binary)	Disease	
12	hepatitis	Multivariate	Classification (Binary)	Class	
13	income	Multivariate	Classification (Binary)	income >50K	
14	juice	Multivariate	Classification (Binary)	Purchase	
15	nba	Multivariate	Classification (Binary)	TARGET_5Yrs	
16	wine	Multivariate	Classification (Binary)	type	
17	telescope	Multivariate	Classification (Binary)	Class	
18	titanic	Multivariate	Classification (Binary)	Survived	
19	us_presidential_election_results	Multivariate	Classification (Binary)	party_winner	
20	glass	Multivariate	Classification (Multiclass)	Type	
21	iris	Multivariate	Classification (Multiclass)	species	

22	poker	Multivariate	Classification (Multiclass)	CLASS
23	questions	Multivariate	Classification (Multiclass)	Next_Question
24	satellite	Multivariate	Classification (Multiclass)	Class
25	CTG	Multivariate	Classification (Multiclass)	NSP
26	asia_gdp	Multivariate	Clustering	None
27	elections	Multivariate	Clustering	None
28	facebook	Multivariate	Clustering	None
29	ipl	Multivariate	Clustering	None
30	jewellery	Multivariate	Clustering	None
31	mice	Multivariate	Clustering	None
32	migration	Multivariate	Clustering	None
33	perfume	Multivariate	Clustering	None
34	pokemon	Multivariate	Clustering	None
35	population	Multivariate	Clustering	None
36	public_health	Multivariate	Clustering	None
37	seeds	Multivariate	Clustering	None
38	wholesale	Multivariate	Clustering	None
39	tweets	Text	NLP	tweet
40	amazon	Text	NLP / Classification	reviewText
41	kiva	Text	NLP /	en

Get diabetes dataset

```
juiceDataSet = get_data("juice")
```

```
print(type(juiceDataSet))
```

	Id	Purchase	WeekofPurchase	StoreID	PriceCH	PriceMM	DiscCH	DiscMM	SpecialC
0	1	CH	237	1	1.75	1.99	0.00	0.0	
1	2	CH	239	1	1.75	1.99	0.00	0.3	
2	3	CH	245	1	1.86	2.09	0.17	0.0	
3	4	MM	227	1	1.69	1.69	0.00	0.0	

3	4	MM	227	1	1.69	1.69	0.00	0.0
4	5	CH	228	7	1.69	1.69	0.00	0.0

```
<class 'pandas.core.frame.DataFrame'>
```

```
juiceDataSet.columns
```

```
Index(['Id', 'Purchase', 'WeekofPurchase', 'StoreID', 'PriceCH',
'PriceMM',
       'DiscCH', 'DiscMM', 'SpecialCH', 'SpecialMM', 'LoyalCH',
'SalePriceMM',
       'SalePriceCH', 'PriceDiff', 'Store7', 'PctDiscMM', 'PctDiscCH',
       'ListPriceDiff', 'STORE'],
      dtype='object')
```

```
juiceDataSet.describe()
```

	Id	WeekofPurchase	StoreID	PriceCH	PriceMM	
count	1070.000000	1070.000000	1070.000000	1070.000000	1070.000000	1070.00
mean	535.500000	254.381308	3.959813	1.867421	2.085411	
std	309.026698	15.558286	2.308984	0.101970	0.134386	
min	1.000000	227.000000	1.000000	1.690000	1.690000	
25%	268.250000	240.000000	2.000000	1.790000	1.990000	
50%	535.500000	257.000000	3.000000	1.860000	2.090000	
75%	802.750000	268.000000	7.000000	1.990000	2.180000	
max	1070.000000	278.000000	7.000000	2.090000	2.290000	

```
print("type(juiceDataSet)-->",type(juiceDataSet))
```

```
type(juiceDataSet)--> <class 'pandas.core.frame.DataFrame'>
```

```
print("juiceDataSet.shape -->", diabetesDataSet.shape)
print("Rows     -->", diabetesDataSet.shape[0])  ##axis 0---row
print("Columns  -->", diabetesDataSet.shape[1])
```

```
juiceDataSet.shape --> (1070, 19)
Rows     --> 1070
Columns  --> 19
```

```
juiceDataSet.head()
juiceDataSet.head()
```

	Id	Purchase	WeekofPurchase	StoreID	PriceCH	PriceMM	DiscCH	DiscMM	SpecialC
0	1	CH	237	1	1.75	1.99	0.00	0.0	
1	2	CH	239	1	1.75	1.99	0.00	0.3	
2	3	CH	245	1	1.86	2.09	0.17	0.0	
3	4	MM	227	1	1.69	1.69	0.00	0.0	
4	5	CH	228	7	1.69	1.69	0.00	0.0	

```
juiceDataSet.loc[10:20 , ['WeekofPurchase','StoreID']]
```

	WeekofPurchase	StoreID
10	240	7
11	263	7
12	276	7
13	268	7
14	278	7
15	278	7
16	240	1
17	268	2
18	269	2
19	254	7
20	257	7

```
diabetesDataSet.max()
```

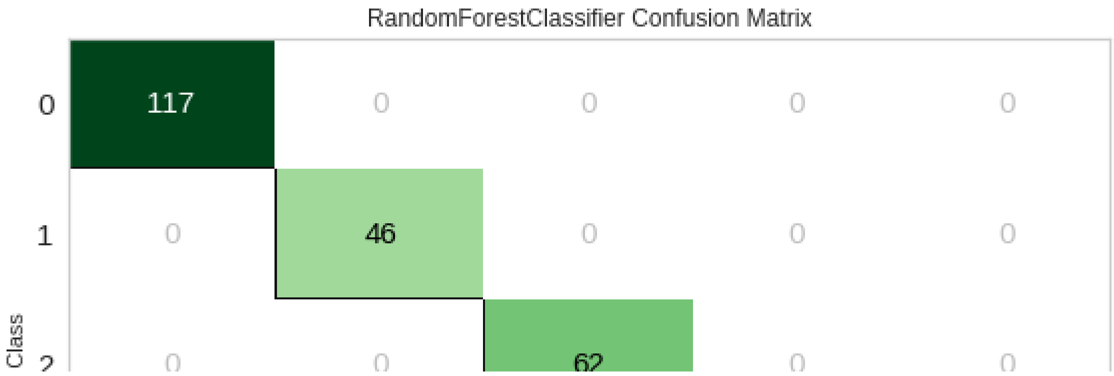
```
Id                1070
Purchase            MM
WeekofPurchase     278
StoreID              7
PriceCH           2.09
PriceMM           2.29
DiscCH             0.5
DiscMM             0.8
SpecialCH            1
SpecialMM            1
LoyalCH       0.999947
SalePriceMM       2.29
SalePriceCH       2.09
PriceDiff         0.64
PriceDiff          0.64
Store7              Yes
PctDiscMM       0.40201
PctDiscCH      0.252688
ListPriceDiff      0.44
STORE                 4
dtype: object
```

```
juiceDataSet.isnull().sum()
```

```
Id                0
Purchase          0
WeekofPurchase    0
StoreID           0
PriceCH           0
PriceMM           0
DiscCH            0
DiscMM            0
SpecialCH         0
SpecialMM         0
LoyalCH           0
SalePriceMM       0
SalePriceCH       0
PriceDiff         0
Store7            0
PctDiscMM         0
PctDiscCH         0
ListPriceDiff     0
STORE             0
dtype: int64
```

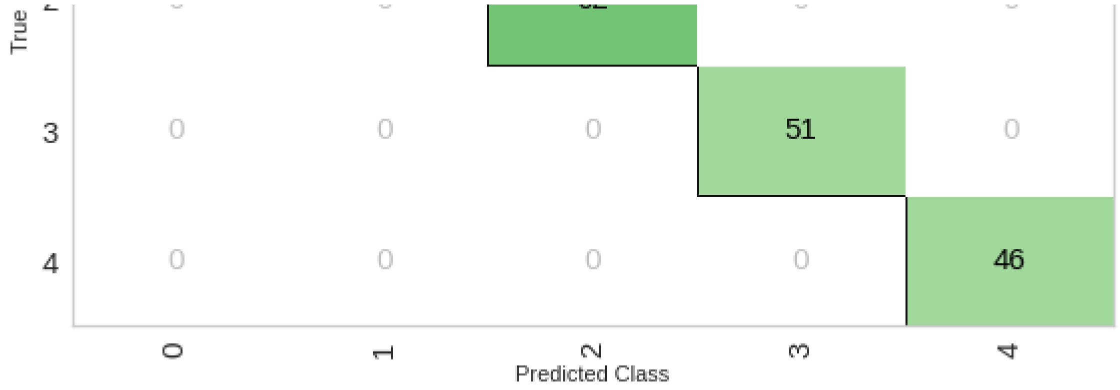
Build a single model - "RandomForest"

```
#from pycaret.datasets import get_data
from pycaret.classification import *

#diabetesDataSet = get_data("diabetes")
s = setup(data=juiceDataSet, target='STORE', silent=True)

rfModel = create_model('rf')
plot_model(rfModel, plot='confusion_matrix')
#Explore more parameters
```



RandomForestClassifier Confusion Matrix

0	117	0	0	0	0
1	0	46	0	0	0
2	0	0	62	0	0



```
INFO:logs:Visual Rendered Successfully
INFO:logs:plot_model() succesfully completed......................................
```

Save the trained model

```
sm = save_model(rfModel, 'rfModelFile')
```

Make prediction on the new dataset

Get new dataset

```
newDataSet = get_data("juice").iloc[:10]
```

	Id	Purchase	WeekofPurchase	StoreID	PriceCH	PriceMM	DiscCH	DiscMM	SpecialC
0	1	CH	237	1	1.75	1.99	0.00	0.0	
1	2	CH	239	1	1.75	1.99	0.00	0.3	
2	3	CH	245	1	1.86	2.09	0.17	0.0	
3	4	MM	227	1	1.69	1.69	0.00	0.0	
4	5	CH	228	7	1.69	1.69	0.00	0.0	

Make prediction on new dataset

```
newPredictions = predict_model(rfModel, data = newDataSet)
newPredictions
```

```
INFO:logs:Initializing predict_model()
```

```
INFO:logs:predict_model(estimator=RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, clas
                    criterion='gini', max_depth=None, max_features='auto',
                    max_leaf_nodes=None, max_samples=None,
                    min_impurity_decrease=0.0, min_impurity_split=None,
                    min_samples_leaf=1, min_samples_split=2,
                    min_weight_fraction_leaf=0.0, n_estimators=100,
                    n_jobs=-1, oob_score=False, random_state=3145, verbose=0,
                    warm_start=False), probability_threshold=None, encoded_labels=False,
INFO:logs:Checking exceptions
INFO:logs:Preloading libraries
INFO:logs:Preparing display monitor
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
0	Random Forest Classifier	1.0	1.0	1.0	1.0	1.0	1.0	1.0

	Id	Purchase	WeekofPurchase	StoreID	PriceCH	PriceMM	DiscCH	DiscMM	SpecialC
0	1	CH	237	1	1.75	1.99	0.00	0.0	
1	2	CH	239	1	1.75	1.99	0.00	0.3	
2	3	CH	245	1	1.86	2.09	0.17	0.0	
3	4	MM	227	1	1.69	1.69	0.00	0.0	
4	5	CH	228	7	1.69	1.69	0.00	0.0	
5	6	CH	230	7	1.69	1.99	0.00	0.0	
6	7	CH	232	7	1.69	1.99	0.00	0.4	
7	8	CH	234	7	1.75	1.99	0.00	0.4	
8	9	CH	235	7	1.75	1.99	0.00	0.4	
9	10	CH	238	7	1.75	1.99	0.00	0.4	

10 rows × 21 columns

Save prediction results to csv

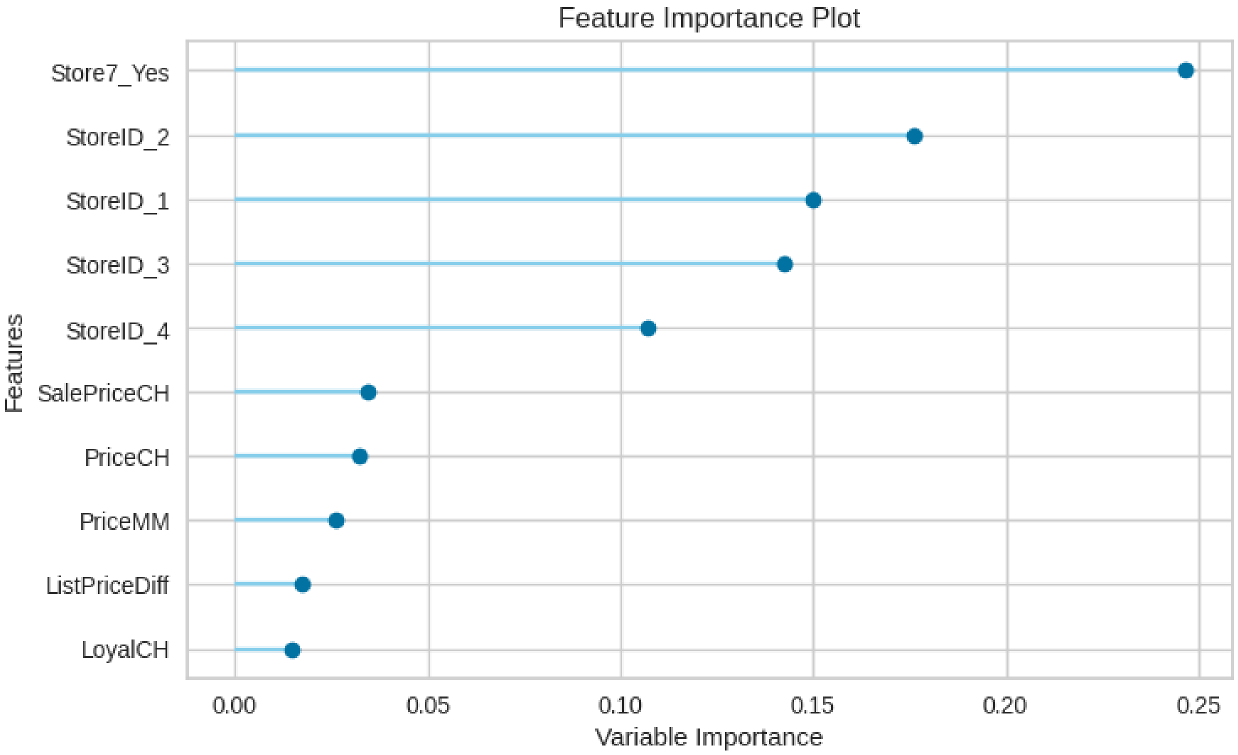
```
newPredictions.to_csv("NewPredictions.csv")
print('predictions saved successfully')
```

```
predictions saved successfully
```

Feature Importance

Feature Importance using Random Forest

```
rfModel = create_model('rf', verbose=True)
plot_model(rfModel, plot='feature')
```



```
INFO:logs:Visual Rendered Successfully
INFO:logs:plot_model() succesfully completed......................................
```

Run and compare the Model Performance

```
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
knn	K Neighbors Classifier	0.9479	0.9978	0.9307	0.9518	0.9468	0.9326	0.9339

Model Performance using data "Normalization"

```
s = setup(data=juiceDataSet, target='STORE', normalize = True, normalize_method =
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

knn	K Neighbors Classifier	0.9625	0.9963	0.9535	0.9651	0.9623	0.9514	0.9521

Model Performance using "Feature Selection"

```
s = setup(data=juiceDataSet, target='STORE', feature_selection = True, feature_selection_threshol
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	0.9813	0.0000	0.9800	0.9714	0.9748	0.9757	0.9794
knn	K Neighbors Classifier	0.9599	0.9968	0.9423	0.9632	0.9581	0.9476	0.9488

Model Performance using "Outlier Removal"

```
s = setup(data=juiceDataSet, target='STORE', remove_outliers = True, outliers_threshold =
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
knn	K Neighbors Classifier	0.9521	0.9976	0.9423	0.9563	0.9509	0.9386	0.9401

Model Performance using "Transformation"

```
s = setup(data=juiceDataSet, target='STORE', transformation = True, transformation_method =
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.000	1.0000	1.0000	1.0000	1.0000

ridge	Ridge Classifier	1.0000	0.0000	1.000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.000	1.0000	1.0000	1.0000	1.0000
knn	K Neighbors Classifier	0.9491	0.9942	0.940	0.9537	0.9489	0.9344	0.9356

Model Performance using "PCA"

```
s = setup(data=juiceDataSet, target='STORE', pca = True, pca_method = 'linear', silent=
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
dt	Decision Tree Classifier	0.4934	0.6765	0.4569	0.5037	0.4933	0.3437	0.3455
rf	Random Forest Classifier	0.4934	0.7223	0.4569	0.5037	0.4933	0.3437	0.3455
et	Extra Trees Classifier	0.4934	0.6936	0.4567	0.5045	0.4939	0.3443	0.3461
gbc	Gradient Boosting Classifier	0.4413	0.6845	0.3717	0.4192	0.4119	0.2512	0.2591
knn	K Neighbors Classifier	0.4038	0.6818	0.3230	0.3617	0.3691	0.2019	0.2082
lightgbm	Light Gradient Boosting Machine	0.3997	0.6601	0.3393	0.3811	0.3789	0.2048	0.2088
lr	Logistic Regression	0.3369	0.5247	0.2000	0.1135	0.1698	0.0000	0.0000

nb	Naive Bayes	0.3369	0.5292	0.2000	0.1135	0.1698	0.0000	0.0000
ridge	Ridge Classifier	0.3369	0.0000	0.2000	0.1135	0.1698	0.0000	0.0000
qda	Quadratic Discriminant Analysis	0.3369	0.5291	0.2000	0.1135	0.1698	0.0000	0.0000
lda	Linear Discriminant	0.3369	0.5254	0.2000	0.1135	0.1698	0.0000	0.0000

Model Performance using "Outlier Removal" + "Normalization"

```
s = setup(data=juiceDataSet, target='STORE', remove_outliers = True, outliers_threshold =
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
knn	K Neighbors Classifier	0.9690	0.9965	0.9623	0.9713	0.9688	0.9604	0.9610

Model Performance using "Outlier Removal" + "Normalization" +

Model Performance using "Outlier Removal" + "Normalization" + "Transformation"

```
s = setup(data=juiceDataSet, target='STORE', remove_outliers = True, outliers_threshold =
cm = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
lr	Logistic Regression	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
nb	Naive Bayes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
dt	Decision Tree Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
svm	SVM - Linear Kernel	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ridge	Ridge Classifier	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000
rf	Random Forest Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ada	Ada Boost Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
gbc	Gradient Boosting Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
et	Extra Trees Classifier	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
lightgbm	Light Gradient Boosting Machine	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
knn	K Neighbors Classifier	0.9521	0.9969	0.9415	0.9552	0.9506	0.9386	0.9398

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Department of Computer Science & Engineering

Evaluation Grid (To be filled by Faculty):

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Worksheet completion including writinglearning objectives/Outcomes. (To be submitted at the end of the day)		10
2.	Post Lab Quiz Result.		5
3.	Student Engagement in Simulation/Demonstration/Performance and Controls/Pre-Lab Questions.		5
	Signature of Faculty (with Date):	**Total Marks Obtained:**	**20**