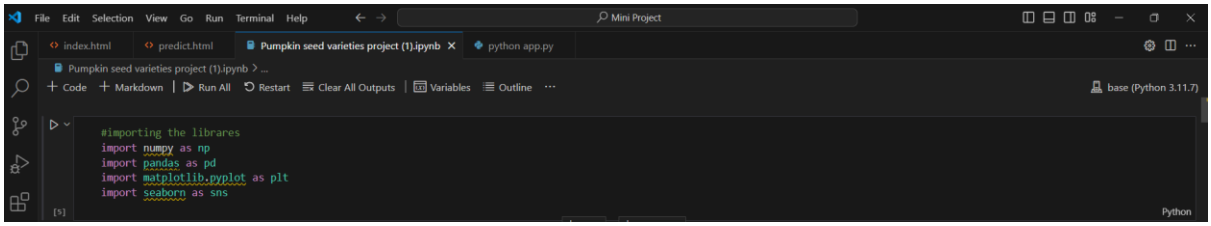



```
df=pd.read_csv("Pumpkin_Seeds_Dataset.xlsx - Pumpkin_Seeds_Dataset.csv",sep=",")
df
```

Pytho

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Convex_Area	Equiv_Diameter	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness	Class
0	56276	888.242	326.1485	220.2388	56831	267.6805	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207	Çerçevelik
1	76631	1068.146	417.1932	234.2289	77280	312.3614	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487	Çerçevelik
2	71623	1082.987	435.8328	211.0457	72663	301.9822	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929	Çerçevelik
3	66458	992.051	381.5638	222.5322	67118	290.8899	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624	Çerçevelik
4	66107	998.146	383.8883	220.4545	67117	290.1207	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557	Çerçevelik
...	...	...	...	...	...	...	...	...	...	...	...	...	...
2495	79637	1224.710	533.1513	190.4367	80381	318.4289	0.9340	0.9907	0.4888	0.6672	2.7996	0.5973	Ürgüp Sivrisi
2496	69647	1084.318	462.9416	191.8210	70216	297.7874	0.9101	0.9919	0.6002	0.7444	2.4134	0.6433	Ürgüp Sivrisi
2497	87994	1210.314	507.2200	222.1872	88702	334.7199	0.8990	0.9920	0.7643	0.7549	2.2828	0.6599	Ürgüp Sivrisi
2498	80011	1182.947	501.9065	204.7531	80902	319.1758	0.9130	0.9890	0.7374	0.7185	2.4513	0.6359	Ürgüp Sivrisi
2499	84934	1159.933	462.8951	234.5597	85781	328.8485	0.8621	0.9901	0.7360	0.7933	1.9735	0.7104	Ürgüp Sivrisi

2500 rows × 13 columns

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2500 entries, 0 to 2499
Data columns (total 13 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Area               2500 non-null   int64  
 1   Perimeter          2500 non-null   float64
 2   Major_Axis_Length  2500 non-null   float64
 3   Minor_Axis_Length  2500 non-null   float64
 4   Convex_Area        2500 non-null   int64  
 5   Equiv_Diameter     2500 non-null   float64
 6   Eccentricity       2500 non-null   float64
 7   Solidity           2500 non-null   float64
 8   Extent             2500 non-null   float64
 9   Roundness          2500 non-null   float64
 10  Aspect_Ration      2500 non-null   float64
 11  Compactness        2500 non-null   float64
 12  Class              2500 non-null   object 
dtypes: float64(10), int64(2), object(1)
memory usage: 254.0+ KB
```

```
df.shape
```

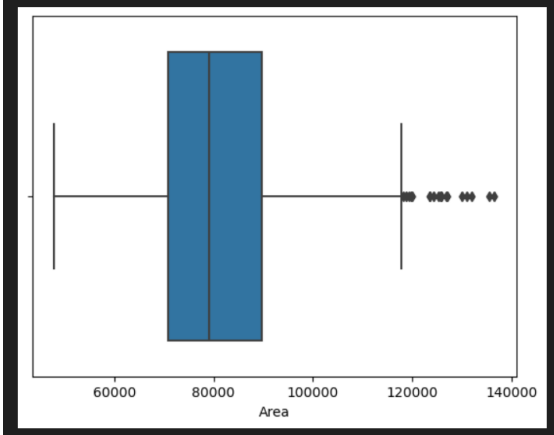
```
(2500, 13)
```

```
df.isnull().sum()
```

```
Area                0
Perimeter           0
Major_Axis_Length   0
Minor_Axis_Length   0
Convex_Area         0
Equiv_Diameter      0
Eccentricity        0
Solidity            0
Extent              0
Roundness           0
Aspect_Ration       0
Compactness         0
Class               0
dtype: int64
```

```
sns.boxplot(x = df['Area'])
```

```
<Axes: xlabel='Area'>
```

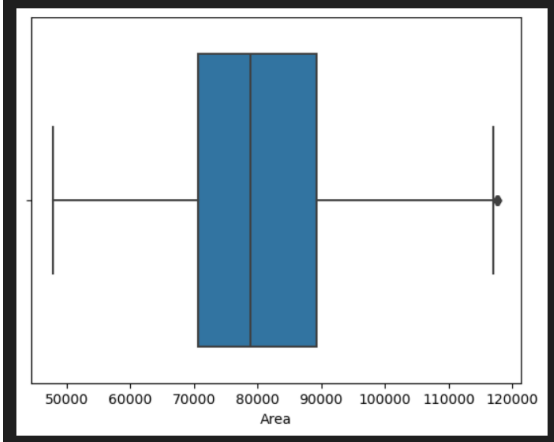



```
# removing the outlier
# calculate the first and third quartiles
Q1 = df["Area"].quantile(0.25)
Q3 = df["Area"].quantile(0.75)

#calculate the interquartile range(IQR)
IQR = Q3 - Q1

#Define the lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

#filter out outliers
df = df[(df["Area"] >= lower_bound) & (df["Area"] <= upper_bound)]
```

```python
# removing the outlier
# calculate the first and third quartiles
Q1 = df["Area"].quantile(0.25)
Q3 = df["Area"].quantile(0.75)

#calculate the interquartile range(IQR)
IQR = Q3 - Q1

#Define the lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

#filter out outliers
df = df[(df["Area"] >= lower_bound) & (df["Area"] <= upper_bound)]
```

```python
sns.boxplot(x = df['Area'])
```

```
<Axes: xlabel='Area'>
```




```python
from sklearn.preprocessing import MinMaxScaler
columns_to_scale= ['Area','Perimeter','Major_Axis_Length']
```

```python
# Apply MinMaxScaler only to selected columns
scaler = MinMaxScaler()
df[columns_to_scale] = scaler.fit_transform(df[columns_to_scale])
```

```
# Display the resulting DataFrame
print(df)
```

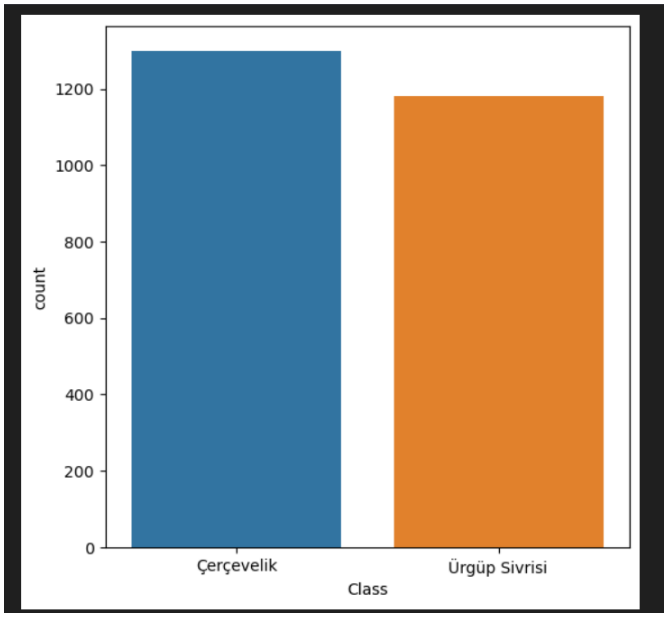
```
          Area  Perimeter  Major_Axis_Length  Minor_Axis_Length  Convex_Area  \
0     0.119284   0.033709           0.016192           220.2388        56831
1     0.410519   0.340661           0.294143           234.2289        77280
2     0.338866   0.365983           0.351048           211.0457        72663
3     0.264966   0.210828           0.185370           222.5322        67118
4     0.259944   0.221228           0.192467           220.4545        67117
...        ...        ...                ...                ...          ...
2495  0.453528   0.607791           0.648153           190.4367        80381
2496  0.310593   0.368254           0.433809           191.8210        70216
2497  0.573098   0.583228           0.568987           223.1872        88702
2498  0.458879   0.536535           0.552765           204.7531        80902
2499  0.529317   0.497268           0.433667           234.5597        85781

      Equiv_Diameter  Eccentricity  Solidity  Extent  Roundness  \
0           267.6805        0.7376    0.9902  0.7453     0.8963
1           312.3614        0.8275    0.9916  0.7151     0.8440
2           301.9822        0.8749    0.9857  0.7400     0.7674
3           290.8899        0.8123    0.9902  0.7396     0.8486
4           290.1207        0.8187    0.9850  0.6752     0.8338
...              ...           ...       ...     ...        ...
2495        318.4289        0.9340    0.9907  0.8888     0.6672
2496        297.7874        0.9101    0.9919  0.6002     0.7444
2497        334.7199        0.8990    0.9920  0.7643     0.7549
2498        319.1758        0.9130    0.9890  0.7374     0.7185
2499        328.8485        0.8621    0.9901  0.7360     0.7933
...
2498         2.4513       0.6359  Ürgüp Sivrisi
2499         1.9735       0.7104  Ürgüp Sivrisi

[2482 rows x 13 columns]
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
```

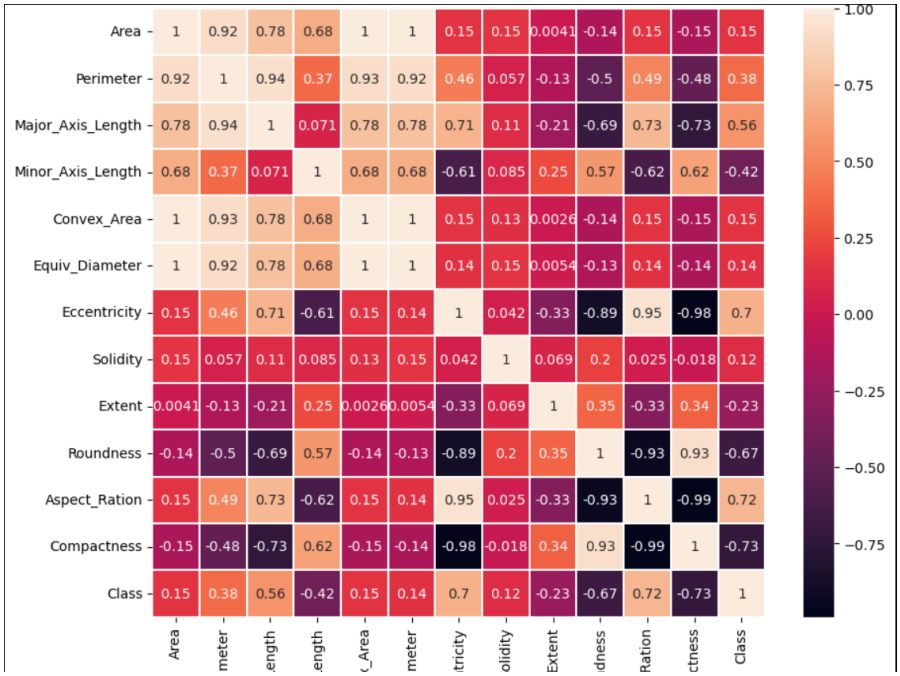
```
df.describe()
```

Pyth

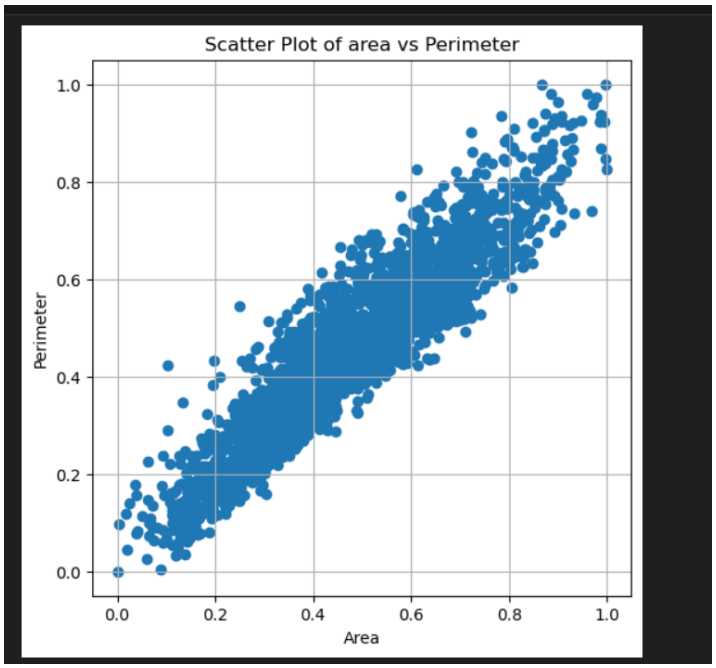
	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Convex_Area	Equiv_Diameter	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness
count	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000
mean	0.463459	0.442677	0.411127	225.505553	81179.048751	318.748695	0.860620	0.989479	0.693502	0.791838	2.039858	0.704435
std	0.188186	0.180938	0.167586	23.094748	13249.936542	26.081716	0.045183	0.003499	0.060676	0.055916	0.315819	0.053053
min	0.000000	0.000000	0.000000	152.171800	48366.000000	247.058400	0.492100	0.918600	0.468000	0.554600	1.148700	0.560800
25%	0.325145	0.307016	0.285968	211.110100	71449.500000	299.953675	0.831525	0.988300	0.659300	0.752325	1.800325	0.663900
50%	0.443448	0.433898	0.391094	224.478400	79802.500000	317.017300	0.863500	0.990300	0.713250	0.798200	1.982850	0.707900
75%	0.592092	0.567014	0.522056	240.022600	90430.250000	337.235300	0.896675	0.991500	0.740275	0.834575	2.258775	0.743700
max	1.000000	1.000000	1.000000	305.818000	118597.000000	387.333300	0.948100	0.994400	0.829600	0.939600	3.144400	0.904900

```
#counting the class values
plt.figure(figsize=(6,6))
sns.countplot(data=df,x='Class')
plt.show()
```






```
plt.figure(figsize=(6,6))
plt.scatter(df['Area'],df['Perimeter'])
plt.title(f'Scatter Plot of area vs Perimeter')
plt.xlabel("Area")
plt.ylabel("Perimeter")
plt.grid(True)
plt.show()
```



```
numeric_df = df.select_dtypes(include=[np.number])
sns.heatmap(numeric_df.corr(), annot=True, linewidths=0.2)
fig = plt.gcf()
fig.set_size_inches(10, 8)
plt.show()
```

```
#dropping columns
df=df.drop(['Convex_Area','Equiv_Diameter'],axis=1)
```

```
df.head()
```

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness	Class
0	0.119284	0.033709	0.016192	220.2388	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207	Çerçevelik
1	0.410519	0.340661	0.294143	234.2289	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487	Çerçevelik
2	0.338866	0.365983	0.351048	211.0457	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929	Çerçevelik
3	0.264966	0.210828	0.185370	222.5322	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624	Çerçevelik
4	0.259944	0.221228	0.192467	220.4545	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557	Çerçevelik

```
#splitting the data into X and Y
X=df.drop('Class',axis = 1)
x
```

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness
0	0.119284	0.033709	0.016192	220.2388	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207
1	0.410519	0.340661	0.294143	234.2289	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487
2	0.338866	0.365983	0.351048	211.0457	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929
3	0.264966	0.210828	0.185370	222.5322	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624
4	0.259944	0.221228	0.192467	220.4545	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557
...	...	...	...	...	...	...	...	...	...	...
2495	0.453528	0.607791	0.648153	190.4367	0.9340	0.9907	0.4888	0.6672	2.7996	0.5973
2496	0.310593	0.368254	0.433809	191.8210	0.9101	0.9919	0.6002	0.7444	2.4134	0.6433
2497	0.573098	0.583228	0.568987	222.1872	0.8990	0.9920	0.7643	0.7549	2.2828	0.6599
2498	0.458879	0.536535	0.552765	204.7531	0.9130	0.9890	0.7374	0.7185	2.4513	0.6359
2499	0.529317	0.497268	0.433667	234.5597	0.8621	0.9901	0.7360	0.7933	1.9735	0.7104

2482 rows × 10 columns

```
Y=df['Class']
Y
```

```
0          Çerçevelik
1          Çerçevelik
2          Çerçevelik
3          Çerçevelik
4          Çerçevelik
             ...
2495    Ürgüp Sivrisi
2496    Ürgüp Sivrisi
2497    Ürgüp Sivrisi
2498    Ürgüp Sivrisi
2499    Ürgüp Sivrisi
Name: Class, Length: 2482, dtype: object
```

```python
#splitting into training and testing dataset
from sklearn.model_selection import train_test_split
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.2,random_state=30)
```

```python
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
```

```
(1985, 10)
(497, 10)
(1985,)
(497,)
```

```python
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report
```

```python
logistic_regression=LogisticRegression()
logistic_regression.fit(X_train,Y_train)
Y_pred=logistic_regression.predict(X_test)
```

```python
acc_lr=accuracy_score(Y_test,Y_pred)
c_lr=classification_report(Y_test,Y_pred)
```

```python
print('Accuracy Score:',acc_lr)
print(c_lr)
```

```
Accuracy Score: 0.869215291750503
              precision    recall  f1-score   support

   Çerçevelik       0.85      0.91      0.88       257
Ürgüp Sivrisi       0.89      0.83      0.86       240

    accuracy                           0.87       497
   macro avg       0.87      0.87      0.87       497
weighted avg       0.87      0.87      0.87       497
```

```python
from sklearn.ensemble import RandomForestClassifier
```

```python
random_forest=RandomForestClassifier()
random_forest.fit(X_train,Y_train)
Y_pred=random_forest.predict(X_test)
```

```python
acc_rf=accuracy_score(Y_test,Y_pred)
c_rf=classification_report(Y_test,Y_pred)
```

```python
print('Accuracy Score:',acc_rf)
print(c_rf)
```

```
Accuracy Score: 0.8752515090543259
              precision    recall  f1-score   support

   Çerçevelik       0.86      0.91      0.88       257
Ürgüp Sivrisi       0.90      0.84      0.87       240

    accuracy                           0.88       497
   macro avg       0.88      0.87      0.87       497
weighted avg       0.88      0.88      0.87       497
```

```python
from sklearn.tree import DecisionTreeClassifier


decision_tree_model=DecisionTreeClassifier()
decision_tree_model.fit(X_train,Y_train)
Y_pred=decision_tree_model.predict(X_test)


acc_dt=accuracy_score(Y_test,Y_pred)
c_dt=classification_report(Y_test,Y_pred)


print('Accuracy Score:',acc_dt)
print(c_dt)
```

```
Accuracy Score: 0.8289738430583501
              precision    recall  f1-score   support

   Çerçevelik       0.81      0.87      0.84       257
Ürgüp Sivrisi       0.85      0.78      0.82       240

     accuracy                           0.83       497
    macro avg       0.83      0.83      0.83       497
 weighted avg       0.83      0.83      0.83       497
```

```python
from sklearn.naive_bayes import MultinomialNB


NB=MultinomialNB()
NB.fit(X_train,Y_train)
Y_pred=NB.predict(X_test)


acc_nb=accuracy_score(Y_test,Y_pred)
c_nb=classification_report(Y_test,Y_pred)


print('Accuracy Score:',acc_nb)
print(c_nb)
```

```
Accuracy Score: 0.8148893360160966
              precision    recall  f1-score   support

   Çerçevelik       0.75      0.95      0.84       257
Ürgüp Sivrisi       0.93      0.67      0.78       240

     accuracy                           0.81       497
    macro avg       0.84      0.81      0.81       497
 weighted avg       0.84      0.81      0.81       497
```

```python
from sklearn.svm import SVC


support_vector=SVC()
support_vector.fit(X_train,Y_train)
Y_pred=support_vector.predict(X_test)


acc_svc=accuracy_score(Y_test,Y_pred)
c_svc=classification_report(Y_test,Y_pred)


print('Accuracy Score:',acc_svc)
print(c_svc)
```

```
Accuracy Score: 0.6680080482897385
              precision    recall  f1-score   support

   Çerçevelik       0.64      0.80      0.71       257
Ürgüp Sivrisi       0.71      0.53      0.60       240

     accuracy                           0.67       497
    macro avg       0.68      0.66      0.66       497
 weighted avg       0.68      0.67      0.66       497
```

```
from sklearn.ensemble import GradientBoostingClassifier
```

```
GBC=GradientBoostingClassifier()
GBC.fit(X_train,Y_train)
Y_pred=GBC.predict(X_test)
```

```
acc_gbc=accuracy_score(Y_test,Y_pred)
c_gbc=classification_report(Y_test,Y_pred)
```

```
print('Accuracy Score:',acc_gbc)
print(c_gbc)
```

```
Accuracy Score: 0.8832997987927566
              precision    recall  f1-score   support

   Çerçevelik       0.86      0.92      0.89       257
Ürgüp Sivrisi       0.91      0.85      0.88       240

    accuracy                           0.88       497
   macro avg       0.89      0.88      0.88       497
weighted avg       0.88      0.88      0.88       497
```

```
prediction=random_forest.predict([[ 0.410519,0.340661,0.294143,234.2289,77280,312.3614,0.8275,0.9916,0.7151,0.8440]])
```

```
c:\Users\LENOVO\anaconda3\Lib\site-packages\sklearn\base.py:439: UserWarning: X does not have valid feature names, but RandomForestClassifier was fitted with feature names
  warnings.warn(
```

```
prediction[0]
```

```
'Ürgüp Sivrisi'
```

```
if prediction[0]==0:
  print("Your seed lies in cercevelik class")
elif prediction[0]==1:
  print("Your seed lies in Urgup Sivrisi class")
```

```
model = pd.DataFrame({'Model':['Linear Regression','Decision Tree Classifier','RandomForest Classifier',
                               'Multinomial Navie Bayes','Support Vector Classifier', 'Gradient Boost Classifier'],
                      'Score':[acc_lr,acc_dt,acc_rf,acc_nb,acc_svc,acc_gbc],})
```

```
model
```

	Model	Score
0	Linear Regression	0.869215
1	Decision Tree Classifier	0.828974
2	RandomForest Classifier	0.875252
3	Multinomial Navie Bayes	0.814889
4	Support Vector Classifier	0.668008
5	Gradient Boost Classifier	0.883300

```
import pickle
import warnings
pickle.dump(random_forest,open("model.pkl","wb"))
```