Predict Graduate Admissions

- The Dataset source : Kaggle (https://www.kaggle.com/mohansacharya/graduate-admissions/home (https://www.kaggle.com/mohansacharya/graduate-admissions/home)).
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Aim : Prediction of Graduate Admissions Using SVR Model

About dataset :

This dataset contains several parameters which are considered important during the application for graduate Programs. The parameters included are :

- GRE Scores (out of 340)
- TOEFL Scores (out of 120)
- University Rating (out of 5)
- Statement of Purpose and Letter of Recommendation Strength (out of 5)
- Undergraduate GPA (out of 10)
- Research Experience (either 0 or 1)
- Chance of Admit (ranging from 0 to 1) is the Target Variable

In [60]:

```
## Load the Libraries

### Pandas and Numpy
import pandas as pd
import numpy as np
### Visualisation libraries
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
### For Q-Q Plot
import scipy.stats as stats
### To ignore warnings
import warnings
warnings.filterwarnings('ignore')
### Machine Learning libraries
import sklearn
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC
from sklearn.svm import SVR
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, accuracy_score, classification_report, r2
### To be able to see maximum columns on screen
pd.set_option('display.max_columns', 500)
### To save the model
import pickle
```

In [2]:

```
# Load the dataset
df=pd.read_csv("https://raw.githubusercontent.com/srinivasav22/Graduate-Admission-Predi
```

In [16]:

```
df.head()
```

Out[16]:

	GRE_S	TOEFL_S	rating	sop	lor	gpa	research	chance_Of_admission
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65

In [17]:

```
print('Shape of the data is:')
df.shape
```

```
Shape of the data is:
```

Out[17]:

```
(500, 8)
```

In [18]:

```
print('Information of the data is:')
df.info()
```

```
Information of the data is:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 8 columns):
 #   Column               Non-Null Count  Dtype  
---  ------               --------------  -----  
 0   GRE_S                500 non-null    int64  
 1   TOEFL_S              500 non-null    int64  
 2   rating               500 non-null    int64  
 3   sop                  500 non-null    float64
 4   lor                  500 non-null    float64
 5   gpa                  500 non-null    float64
 6   research             500 non-null    int64  
 7   chance_Of_admission  500 non-null    float64
dtypes: float64(4), int64(4)
memory usage: 31.4 KB
```

In [19]:

```
print('Missing values in columns:')
df.isnull().sum()
```

```
Missing values in columns:
```

Out[19]:

```
GRE_S                0
TOEFL_S              0
rating               0
sop                  0
lor                  0
gpa                  0
research             0
chance_Of_admission    0
dtype: int64
```

Column names are not proper like :

*Serial No. ,Chance of Admit etc. We need to remove the spaces *Serial No has Full stop so we need to remove this and chance as no (Serial No.=no) *Need to change the other variable into lowercase for easy to use

In [20]:

```
df=df.rename(columns={'Serial No.':'no','GRE Score':'GRE_S','TOEFL Score':'TOEFL_S','Ur
                      'CGPA':'gpa',
                      'Research':'research','Chance of Admit ':'chance_Of_admissic
```

In [21]:

```
1 df
```

Out[21]:

	GRE_S	TOEFL_S	rating	sop	lor	gpa	research	chance_Of_admission
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65
...	...	...	...	...	...	...	...	...
495	332	108	5	4.5	4.0	9.02	1	0.87
496	337	117	5	5.0	5.0	9.87	1	0.96
497	330	120	5	4.5	5.0	9.56	1	0.93
498	312	103	4	4.0	5.0	8.43	0	0.73
499	327	113	4	4.5	4.5	9.04	0	0.84

500 rows × 8 columns

Check the data type of the columns

In [22]:

```
1 df.dtypes
```

Out[22]:

```
GRE_S                int64
TOEFL_S              int64
rating               int64
sop                float64
lor                float64
gpa                float64
research             int64
chance_Of_admission    float64
dtype: object
```

Data Exploration

In [23]:

```
print("The basic statistics of the data")
df.describe().T
```

```
The basic statistics of the data
```

Out[23]:

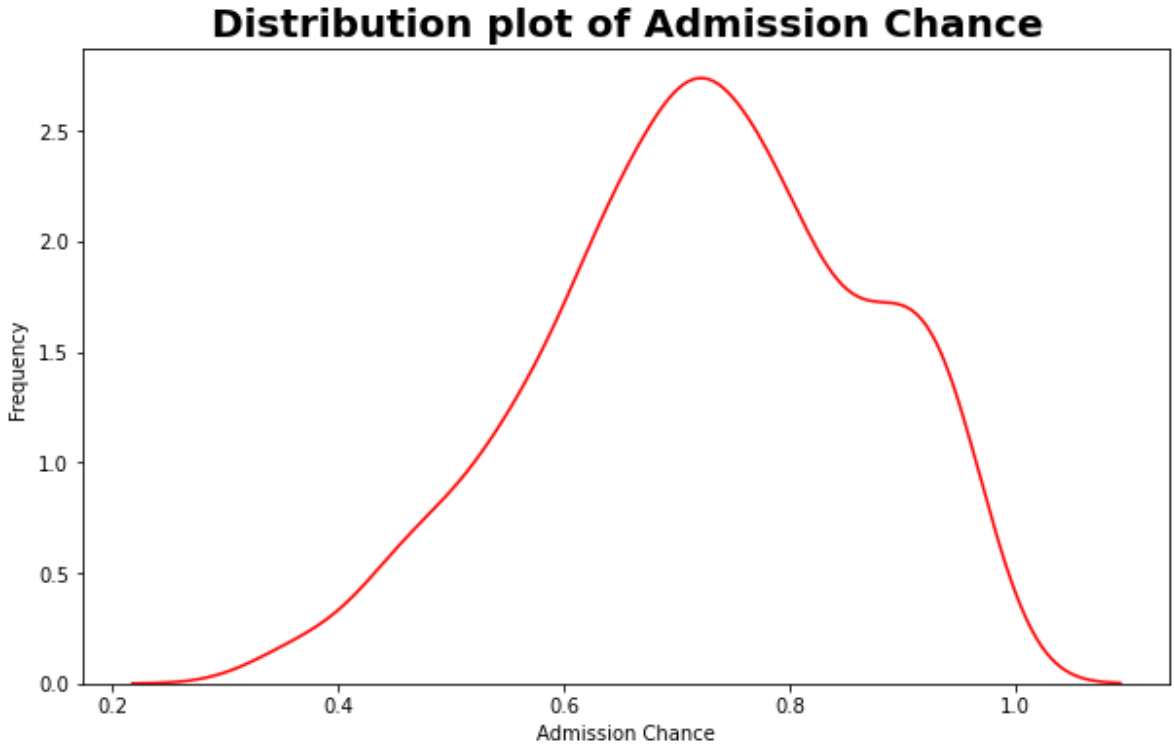
	count	mean	std	min	25%	50%	75%	max
GRE_S	500.0	316.47200	11.295148	290.00	308.0000	317.00	325.00	340.00
TOEFL_S	500.0	107.19200	6.081868	92.00	103.0000	107.00	112.00	120.00
rating	500.0	3.11400	1.143512	1.00	2.0000	3.00	4.00	5.00
sop	500.0	3.37400	0.991004	1.00	2.5000	3.50	4.00	5.00
lor	500.0	3.48400	0.925450	1.00	3.0000	3.50	4.00	5.00
gpa	500.0	8.57644	0.604813	6.80	8.1275	8.56	9.04	9.92
research	500.0	0.56000	0.496884	0.00	0.0000	1.00	1.00	1.00
chance_Of_admission	500.0	0.72174	0.141140	0.34	0.6300	0.72	0.82	0.97

Data Visualization

- This gives clearity about data

In [24]:

```
import seaborn as sns
plt.figure(figsize=(10,6))
sns.kdeplot(df['chance_Of_admission'],color="red")
plt.title('Distribution plot of Admission Chance',fontsize=20,fontweight="bold")
plt.xlabel('Admission Chance')
plt.ylabel('Frequency ')
plt.show()
```



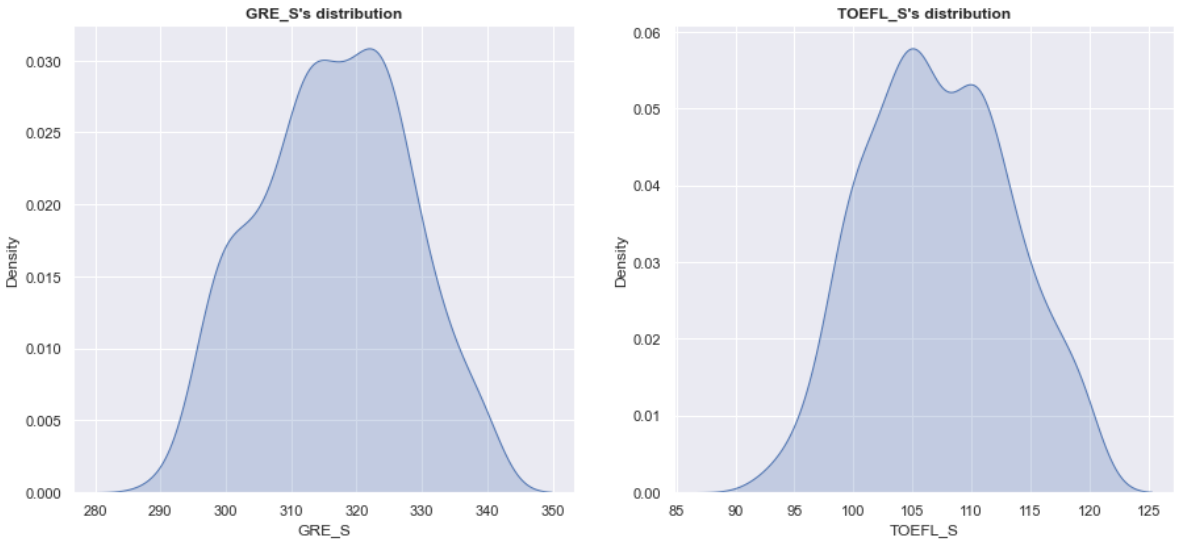
In [52]:

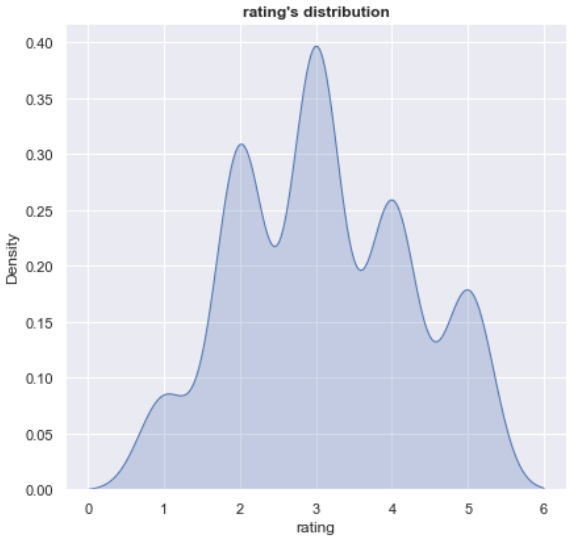
```
numerical_features=df.columns
print(numerical_features)

```

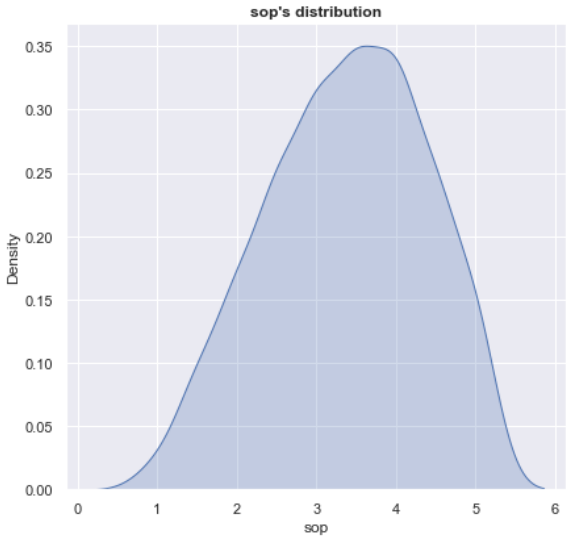
```
Index(['GRE_S', 'TOEFL_S', 'rating', 'sop', 'lor', 'gpa', 'research',
       'chance_Of_admission'],
      dtype='object')
```

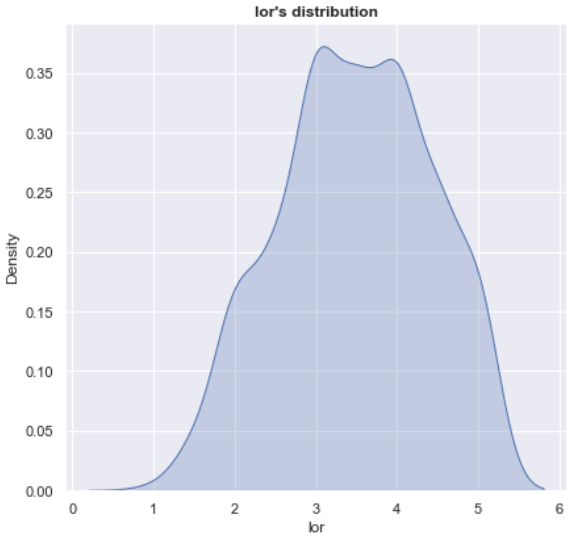
In [55]:

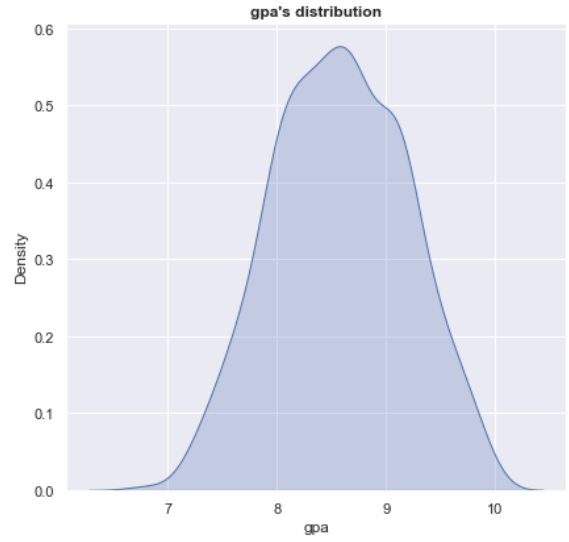
```
plt.figure(figsize=(15,30))
for i in enumerate(numerical_features):
    plt.subplot(4, 2, i[0]+1)
    sns.set(rc={'figure.figsize':(7,5)})
    sns.kdeplot(data=df, x=i[1], fill=True)
    plt.title("{}'s distribution".format(i[1]),fontweight="bold")

```

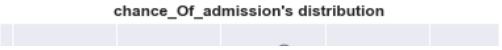


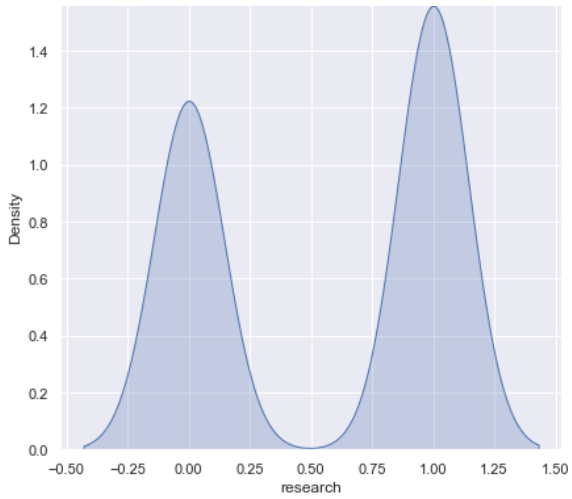


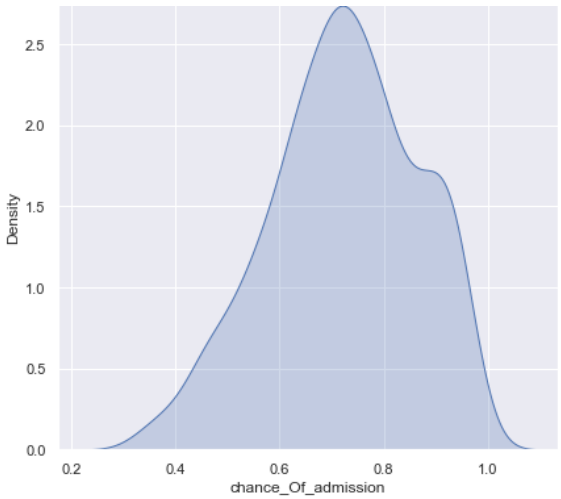












Data Preperation

- here in data set all variables are numerical
- consider chance_Of_admission dependent variable and others are independent variables
- The model will predict chance_Of_admission with the help of other variables (ie. predictors)
- drop the no column as it has no impact on dataset

In [26]:

```
1 X=df.drop(['no'],axis=1,inplace=True)
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
Input In [26], in <cell line: 1>()
----> 1 X=df.drop(['no'],axis=1,inplace=True)

File ~\anaconda3\lib\site-packages\pandas\util\_decorators.py:311, in deprecate_nonkeyword_arguments.<locals>.decorate.<locals>.wrapper(*args, **kwargs)
    305 if len(args) > num_allow_args:
    306     warnings.warn(
    307         msg.format(arguments=arguments),
    308         FutureWarning,
    309         stacklevel=stacklevel,
    310     )
--> 311 return func(*args, **kwargs)

File ~\anaconda3\lib\site-packages\pandas\core\frame.py:4954, in DataFrame.drop(self, labels, axis, index, columns, level, inplace, errors)
   4806 @deprecate_nonkeyword_arguments(version=None, allowed_args=["self", "labels"])
   4807 def drop(
   4808     self,
   (...)
   4815     errors: str = "raise",
   4816 ):
   4817     """
   4818     Drop specified labels from rows or columns.
   4819
   (...)
   4952             weight  1.0     0.8
   4953     """
-> 4954     return super().drop(
   4955         labels=labels,
   4956         axis=axis,
   4957         index=index,
   4958         columns=columns,
   4959         level=level,
   4960         inplace=inplace,
   4961         errors=errors,
   4962     )

File ~\anaconda3\lib\site-packages\pandas\core\generic.py:4267, in NDFrame.drop(self, labels, axis, index, columns, level, inplace, errors)
   4265 for axis, labels in axes.items():
   4266     if labels is not None:
-> 4267         obj = obj._drop_axis(labels, axis, level=level, errors=errors)
   4269 if inplace:
   4270     self._update_inplace(obj)

File ~\anaconda3\lib\site-packages\pandas\core\generic.py:4311, in NDFrame._drop_axis(self, labels, axis, level, errors, consolidate, only_slice)
   4309         new_axis = axis.drop(labels, level=level, errors=errors)
   4310     else:
```

```
-> 4311         new_axis = axis.drop(labels, errors=errors)
   4312     indexer = axis.get_indexer(new_axis)
   4314 # Case for non-unique axis
   4315 else:

File ~\anaconda3\lib\site-packages\pandas\core\indexes\base.py:6644, in In
dex.drop(self, labels, errors)
   6642 if mask.any():
   6643     if errors != "ignore":
-> 6644         raise KeyError(f"{list(labels[mask])} not found in axis")
   6645     indexer = indexer[~mask]
   6646 return self.delete(indexer)

KeyError: "['no'] not found in axis"
```

In [13]:

```
1 df.columns
```

Out[13]:

```
Index(['GRE_S', 'TOEFL_S', 'rating', 'sop', 'lor', 'gpa', 'research',
       'chance_Of_admission'],
      dtype='object')
```

In [27]:

```
1 X=df.drop("chance_Of_admission",axis=1)
2 y=df['chance_Of_admission']
3
```

In [28]:

```
1 X
```

Out[28]:

	GRE_S	TOEFL_S	rating	sop	lor	gpa	research
0	337	118	4	4.5	4.5	9.65	1
1	324	107	4	4.0	4.5	8.87	1
2	316	104	3	3.0	3.5	8.00	1
3	322	110	3	3.5	2.5	8.67	1
4	314	103	2	2.0	3.0	8.21	0
...	...	...	...	...	...	...	...
495	332	108	5	4.5	4.0	9.02	1
496	337	117	5	5.0	5.0	9.87	1
497	330	120	5	4.5	5.0	9.56	1
498	312	103	4	4.0	5.0	8.43	0
499	327	113	4	4.5	4.5	9.04	0

500 rows × 7 columns

In [30]:

```
y.head()
```

Out[30]:

```
0    0.92
1    0.76
2    0.72
3    0.80
4    0.65
Name: chance_Of_admission, dtype: float64
```

Data will be splitted using train_test_split module of scikitlearn library

- Ref :https://scikit-learn.org/stable/modules/generated/sklearn.model_selection.train_test_split.html (https://scikit-learn.org/stable/modules/generated/sklearn.model_selection.train_test_split.html)
- sklearn.model_selection.train_test_split(*arrays, test_size=None, train_size=None, random_state=None, shuffle=True, stratify=None)[source]
- Here test size taken as 20% of data (80-20 ratio of train-test).

In [83]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.25, random_state=10)
```

In [84]:

```
y_train.head()
```

Out[84]:

```
324    0.67
252    0.71
441    0.79
427    0.71
70     0.94
Name: chance_Of_admission, dtype: float64
```

In [85]:

```
X_test.head()

```

Out[85]:

	GRE_S	TOEFL_S	rating	sop	lor	gpa	research
151	332	116	5	5.0	5.0	9.28	1
424	325	114	5	4.0	5.0	9.46	1
154	326	108	3	3.0	3.5	8.89	0
190	324	111	5	4.5	4.0	9.16	1
131	303	105	5	5.0	4.5	8.65	0

In [86]:

```
y_test.head()
```

Out[86]:

```
151    0.94
424    0.91
154    0.80
190    0.90
131    0.77
Name: chance_Of_admission, dtype: float64
```

In [87]:

```
### both will have same shape
X_train.shape, y_train.shape
```

Out[87]:

```
((375, 7), (375,))
```

In [88]:

```
### both will have same shape
X_test.shape, y_test.shape

```

Out[88]:

```
((125, 7), (125,))
```

Transforming data

In [89]:

```
X_train=scaler.fit_transform(X_train)
X_train
X_test=scaler.transform(X_test)
X_test
```

```
       0.20192308,  0.        ],
       [ 0.54      ,  0.44444444,  0.5       ,  0.625     ,  0.5       ,
         0.56410256,  0.        ],
       [ 0.58      ,  0.62962963,  0.5       ,  0.5       ,  0.375     ,
         0.63782051,  0.        ],
       [ 0.92      ,  0.92592593,  1.        ,  0.875     ,  1.        ,
         0.875     ,  1.        ],
       [ 0.76      ,  0.74074074,  0.75      ,  0.75      ,  0.375     ,
         0.63141026,  1.        ],
       [ 0.14      ,  0.2962963 ,  0.5       ,  0.25      ,  0.75      ,
         0.27884615,  1.        ],
       [ 0.42      ,  0.2962963 ,  0.25      ,  0.375     ,  0.625     ,
         0.49358974,  1.        ],
       [ 0.64      ,  0.51851852,  0.5       ,  0.625     ,  0.625     ,
         0.53205128,  1.        ],
       [ 0.78      ,  0.96296296,  0.75      ,  0.875     ,  0.875     ,
         0.75641026,  1.        ],
       [ 0.68      ,  0.62962963,  0.75      ,  0.5       ,  0.625     ,
         0.69551282,  1.        ],
       [ 0.18      ,  0.33333333,  0.5       ,  0.75      ,  0.625     ,
```

Building SVR Model

In [90]:

```
svr=SVR()
svr

```

Out[90]:

```
SVR()
```

In [91]:

```
svr.fit(X_train,y_train)

```

Out[91]:

```
SVR()
```

In [92]:

```
svr_pred=svr.predict(X_test)
svr_pred

```

Out[92]:

```
array([0.8530122 , 0.85878143, 0.66607036, 0.85201859, 0.73296598,
       0.74516515, 0.650184  , 0.85113676, 0.61194738, 0.73690793,
       0.87287702, 0.80851996, 0.85861529, 0.67264923, 0.81073542,
       0.75034243, 0.6806016 , 0.69774459, 0.74521387, 0.6272066 ,
       0.73314907, 0.62810708, 0.61362472, 0.86126621, 0.46746224,
       0.85398424, 0.73538769, 0.53381885, 0.66666846, 0.68324957,
       0.8714581 , 0.80858066, 0.57285162, 0.64223422, 0.73241553,
       0.86233993, 0.82526655, 0.66318999, 0.66729112, 0.69183415,
       0.85989873, 0.6118147 , 0.68574295, 0.86433997, 0.87314784,
       0.49975215, 0.57019248, 0.65968592, 0.78727405, 0.73433589,
       0.79588108, 0.6964019 , 0.56604054, 0.61040253, 0.66226745,
       0.80022019, 0.83315883, 0.61114315, 0.70476323, 0.85566571,
       0.62349619, 0.8243358 , 0.7545564 , 0.50881424, 0.83502712,
       0.49569389, 0.73047824, 0.74484777, 0.51781424, 0.70395694,
       0.8886297 , 0.55082174, 0.58351099, 0.73627234, 0.70385515,
       0.64371777, 0.67797754, 0.71736436, 0.84589492, 0.73139704,
       0.63235909, 0.65500572, 0.62840802, 0.76919364, 0.80742055,
       0.81707701, 0.82838058, 0.596353  , 0.73355733, 0.85645826,
       0.82657299, 0.61192559, 0.483337  , 0.76896799, 0.76569028,
       0.66979711, 0.71191007, 0.87338848, 0.49080749, 0.70032865,
       0.77931955, 0.88609856, 0.69002474, 0.7459358 , 0.8783273 ,
       0.48335399, 0.7902876 , 0.46009648, 0.78980076, 0.81522003,
       0.45108094, 0.73375626, 0.6964646 , 0.627624  , 0.67901536,
       0.63964866, 0.69923064, 0.48101521, 0.78704419, 0.74641343,
       0.6513775 , 0.8718778 , 0.80124519, 0.82954968, 0.81027533])
```

In [93]:

```
svr_r2_score=r2_score(y_test, svr_pred)
print("The Support Vector Regressor model has {} % accuracy".format(round(svr_r2_score*
```

```
The Support Vector Regressor model has 74.322 % accuracy
```

In [94]:

```
adjusted_r2_score=1-((1-svr_r2_score)*(len(y_test)-1)/(len(y_test)-X_test.shape[1]-1))
print(" The Adjusted R square accuracy is {} % ".format(round(adjusted_r2_score*100,3))
```

```
 The Adjusted R square accuracy is 72.786 %
```

Observations :

- The Support Vector Regressor model has 74.322 % accuracy
- The Adjusted R square accuracy is 72.786 %

In [ ]:

```
1 END
```