studentadmissionprediction

March 27, 2023

1 Importing All Necessary Libraries

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')
```

2 Data Ingestion

[2]:
```
df=pd.read_csv(r'C:\Users\PS4Z\Downloads\Admission_Predict.csv')
```

[3]:
```
#seeing how the looks like
df.head()
```

[3]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

3 Understanding Data

[4]:
```
#seeing the shape of data
print('Data Shape:',df.shape)
```

```
Data Shape: (400, 9)
```

[5]:
```
#understanding about null values in data
df.isnull().sum()
```

[5]:
```
Serial No.           0
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
dtype: int64
```

[6]:
```
#Getting information about data; null counts and data types of data columns
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 9 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Serial No.         400 non-null    int64
 1   GRE Score          400 non-null    int64
 2   TOEFL Score        400 non-null    int64
 3   University Rating  400 non-null    int64
 4   SOP                400 non-null    float64
 5   LOR                400 non-null    float64
 6   CGPA               400 non-null    float64
 7   Research           400 non-null    int64
 8   Chance of Admit    400 non-null    float64
dtypes: float64(4), int64(5)
memory usage: 28.2 KB
```

[7]:
```
#list of column names
df.columns
```

[7]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR ', 'CGPA', 'Research', 'Chance of Admit '],
      dtype='object')
```

[8]:
```
#getting rid of all spaces in the column names
df.columns=df.columns.str.strip()
```

[9]:
```
df.columns
```

[9]:
```
Index(['Serial No.', 'GRE Score', 'TOEFL Score', 'University Rating', 'SOP',
       'LOR', 'CGPA', 'Research', 'Chance of Admit'],
      dtype='object')
```

[10]:
```
#getting data types of each column header
df.dtypes
```

[10]:
```
Serial No.             int64
GRE Score              int64
TOEFL Score            int64
University Rating      int64
SOP                  float64
LOR                  float64
CGPA                 float64
Research               int64
Chance of Admit      float64
dtype: object
```

[11]:
```
#Getting 5 point summary for all numercial features
df.describe()
```

[11]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
count	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000	400.000000
mean	200.500000	316.807500	107.410000	3.087500	3.400000	3.452500	8.598925	0.547500	0.724350
std	115.614301	11.473646	6.069514	1.143728	1.006869	0.898478	0.596317	0.498362	0.142609
min	1.000000	290.000000	92.000000	1.000000	1.000000	1.000000	6.800000	0.000000	0.340000
25%	100.750000	308.000000	103.000000	2.000000	2.500000	3.000000	8.170000	0.000000	0.640000
50%	200.500000	317.000000	107.000000	3.000000	3.500000	3.500000	8.610000	1.000000	0.730000
75%	300.250000	325.000000	112.000000	4.000000	4.000000	4.000000	9.062500	1.000000	0.830000
max	400.000000	340.000000	120.000000	5.000000	5.000000	5.000000	9.920000	1.000000	0.970000

[12]:
```
#duplicate entries in data
df.duplicated().sum()
```

[12]:
```
0
```

Observation:no duplicate entries

[13]:
```
#null entries in data
df.isna().sum()
```

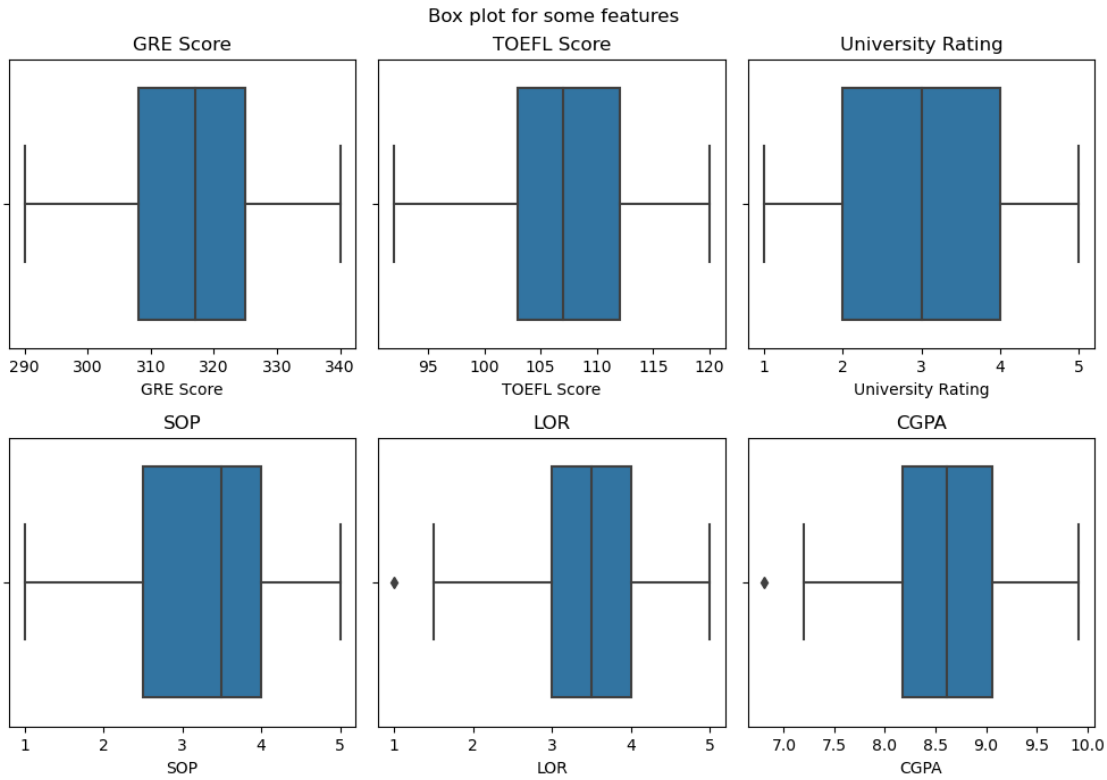
[13]:
```
Serial No.           0
GRE Score            0
TOEFL Score          0
University Rating    0
SOP                  0
LOR                  0
CGPA                 0
Research             0
Chance of Admit      0
dtype: int64
```

Observation:no null entries

[14]:
```
feat_df=df.drop(['Serial No.','Research','Chance of Admit'],axis=1)
feat=feat_df.columns
feat
```

[14]:
```
Index(['GRE Score', 'TOEFL Score', 'University Rating', 'SOP', 'LOR', 'CGPA'],
dtype='object')
```

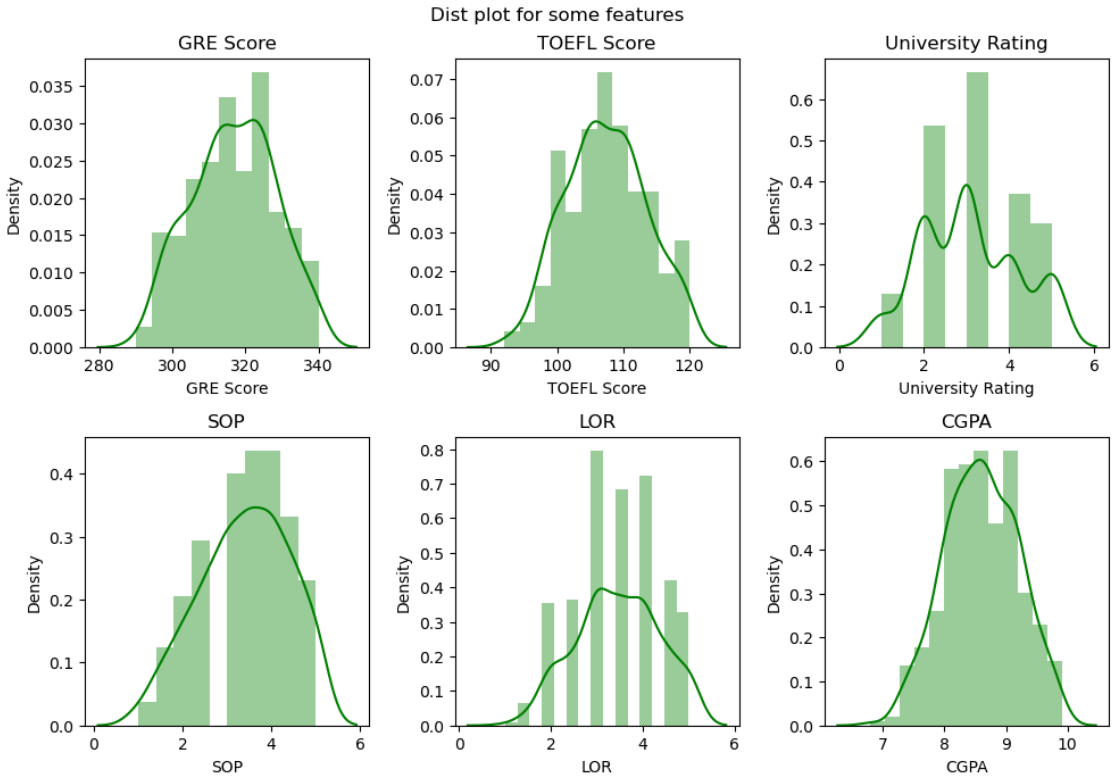
[15]:
```
#checking outliers
plt.figure(figsize=(10,10))
plt.suptitle('Box plot for some features')
for a in range(0,len(feat)):
    plt.subplot(3,3,a+1)
    sns.boxplot(x=df[feat[a]],hue=df['Chance of Admit'],data=df,orient='h')
    plt.title(label=feat[a])
    plt.tight_layout();
```



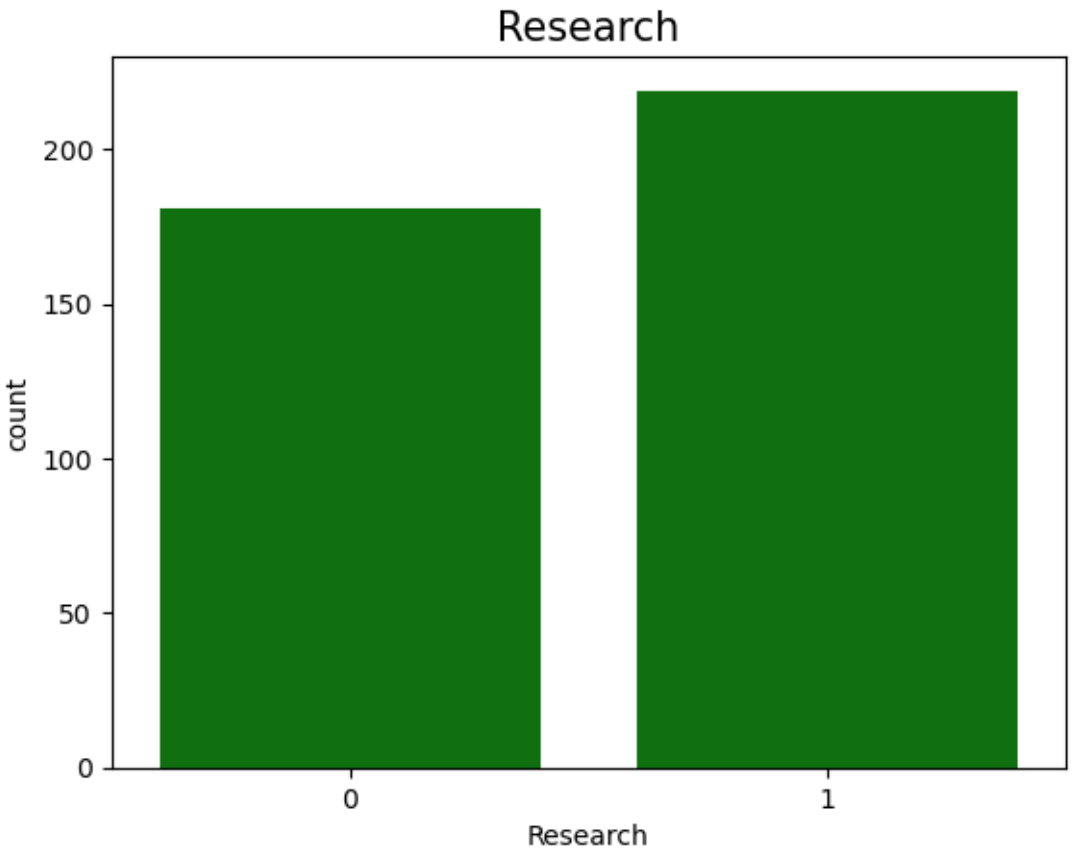
Observations:very few outliers are present in dataset, this will not affect our model so we do not handle it

4 Visualizing the Data

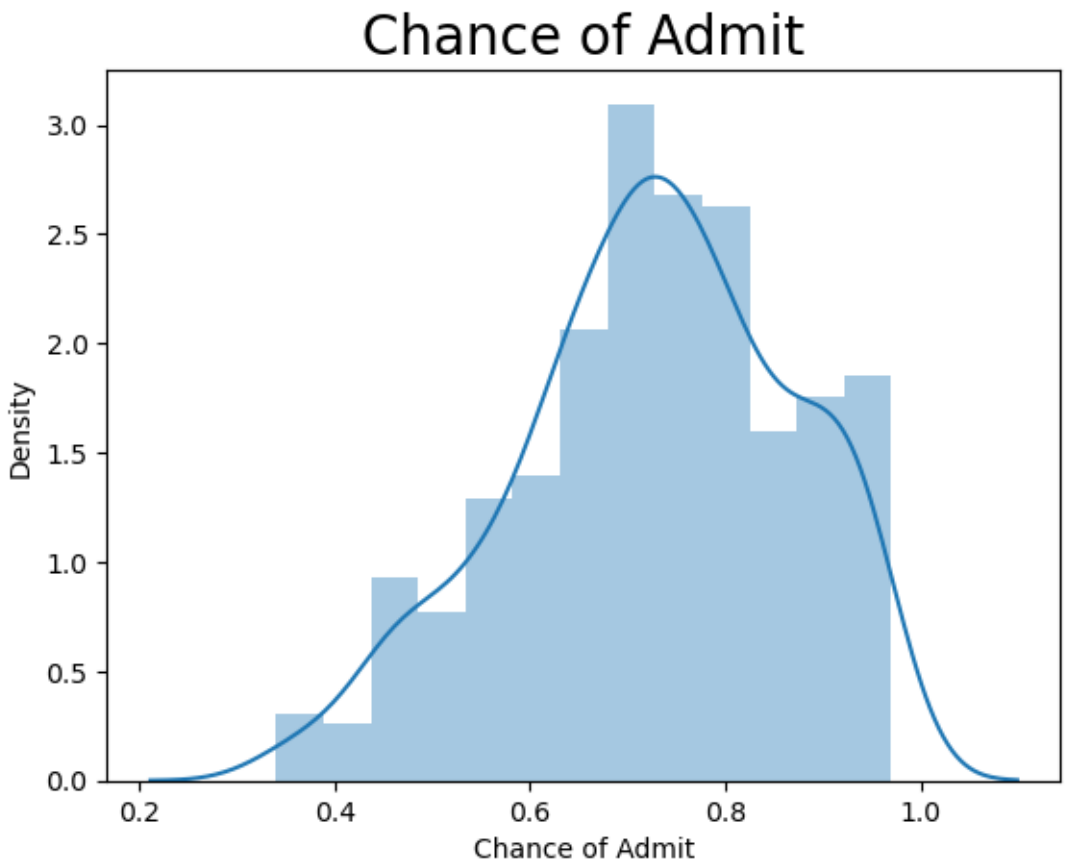
[16]:
```
#checking distribution of all features
plt.figure(figsize=(10,10))
plt.suptitle('Dist plot for some features')
for a in range(0,len(feat)):
    plt.subplot(3,3,a+1)
    sns.distplot(df[feat[a]],color='Green')
    plt.title(label=feat[a])
    plt.tight_layout();
```



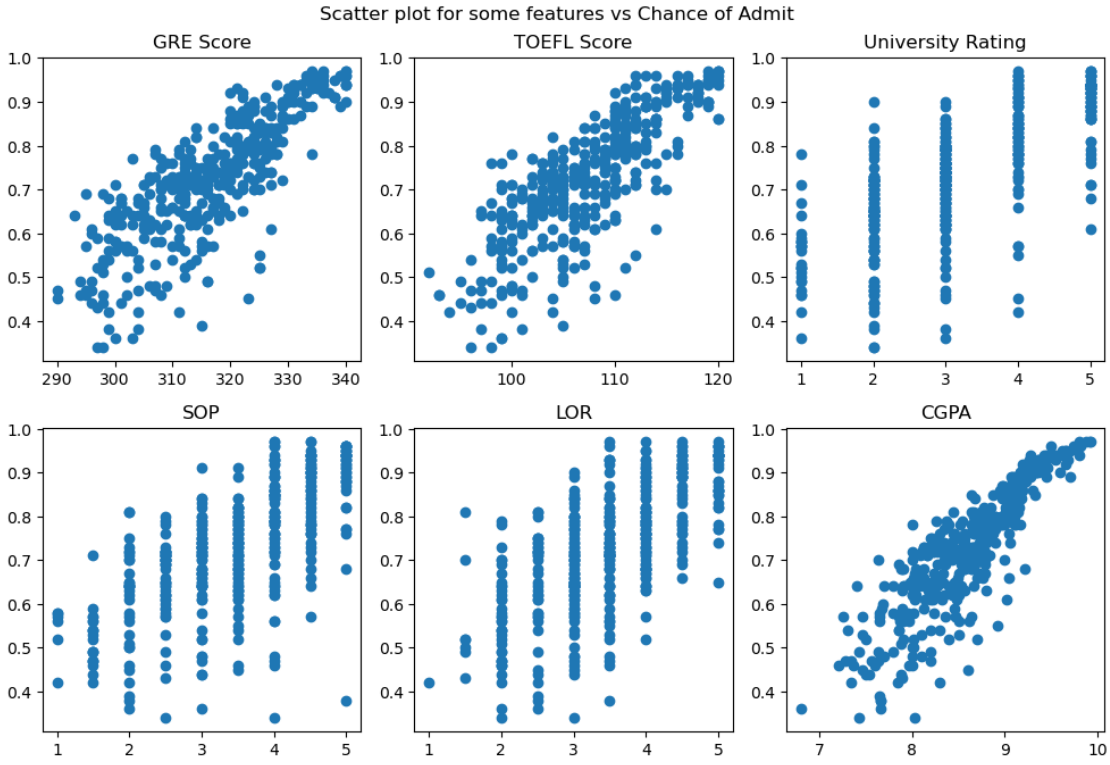
[17]:
```
#since research is more of a categorical feature
plt.title('Research',fontsize=15)
sns.countplot(df['Research'],color='green');
```



[18]:
```
#distribution of our target variable
sns.distplot(df['Chance of Admit']).set_title('Chance of Admit',size='20')
plt.show();
```



[19]:
```
#scatter plot wrt Target Variable
plt.figure(figsize=(10,10))
plt.suptitle('Scatter plot for some features vs Chance of Admit')
for a in range(0,len(feat)):
    plt.subplot(3,3,a+1)
    plt.scatter(df[feat[a]],df['Chance of Admit'])
    plt.title(label=feat[a])
    plt.tight_layout();
```



Observations:GRE Score, TOEFL Score and CGPA follows a linear trend wrt Chance of Admit

[20]:
```
#checking correlation between features
df.corr()
```

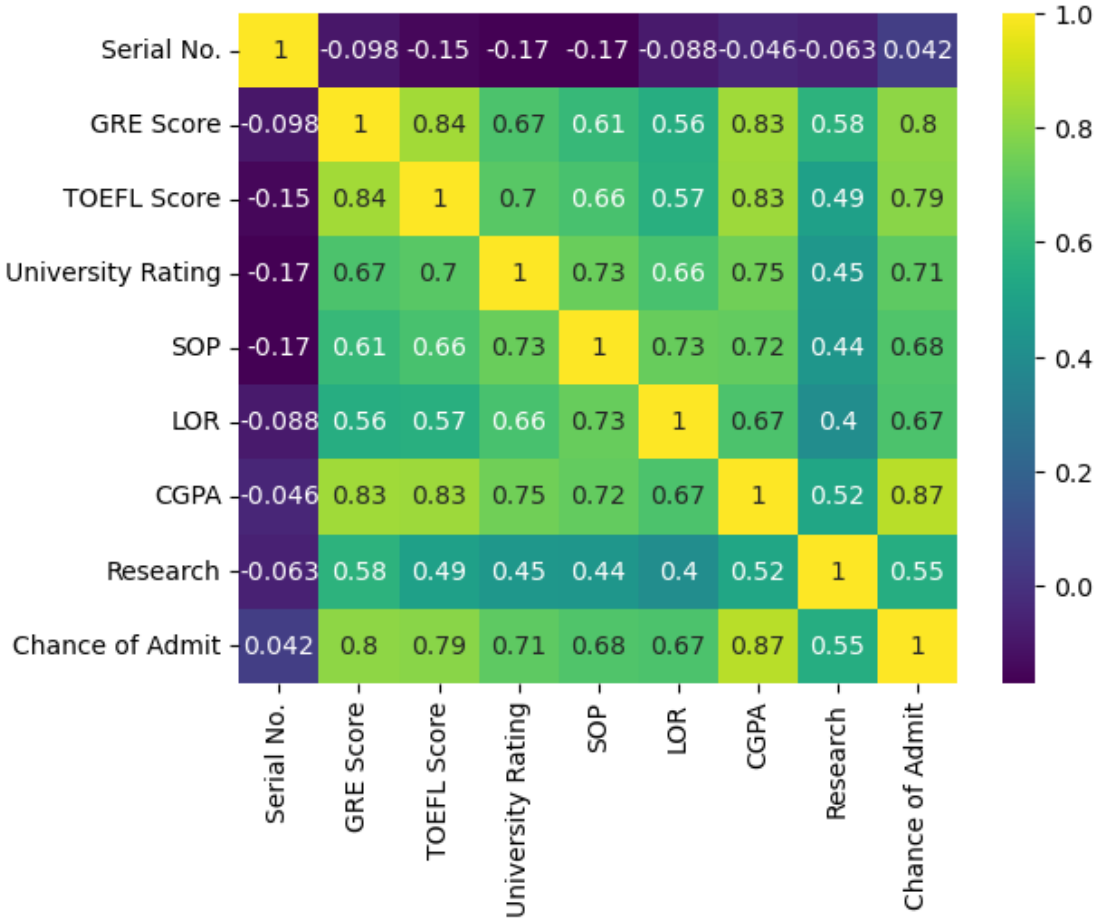
[20]:

	Serial No.	GRE Score	TOEFL Score	University Rating	\
Serial No.	1.000000	-0.097526	-0.147932	-0.169948	
GRE Score	-0.097526	1.000000	0.835977	0.668976	
TOEFL Score	-0.147932	0.835977	1.000000	0.695590	
University Rating	-0.169948	0.668976	0.695590	1.000000	
SOP	-0.166932	0.612831	0.657981	0.734523	
LOR	-0.088221	0.557555	0.567721	0.660123	
CGPA	-0.045608	0.833060	0.828417	0.746479	
Research	-0.063138	0.580391	0.489858	0.447783	
Chance of Admit	0.042336	0.802610	0.791594	0.711250	

	SOP	LOR	CGPA	Research	Chance of Admit
Serial No.	-0.166932	-0.088221	-0.045608	-0.063138	0.042336
GRE Score	0.612831	0.557555	0.833060	0.580391	0.802610
TOEFL Score	0.657981	0.567721	0.828417	0.489858	0.791594
University Rating	0.734523	0.660123	0.746479	0.447783	0.711250
SOP	1.000000	0.729593	0.718144	0.444029	0.675732
LOR	0.729593	1.000000	0.670211	0.396859	0.669889

CGPA	0.718144	0.670211	1.000000	0.521654	0.873289
Research	0.444029	0.396859	0.521654	1.000000	0.553202
Chance of Admit	0.675732	0.669889	0.873289	0.553202	1.000000

[21]:
```
sns.heatmap(data=df.corr(),annot=True,cmap='viridis');
```



5 Separating target variable(Dependent) from Indeendent variables

[22]:
```
#dependent features
x=df.iloc[:,:-1]

#independent features
y=df.iloc[:,-1]
```

[23]:
```
#checking our independent variable data
x.head()
```

[23]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research
0	1	337	118	4	4.5	4.5	9.65	1
1	2	324	107	4	4.0	4.5	8.87	1
2	3	316	104	3	3.0	3.5	8.00	1
3	4	322	110	3	3.5	2.5	8.67	1
4	5	314	103	2	2.0	3.0	8.21	0

[24]:
```
#checking oit dependent variable data
y.head()
```

[24]:
```
0    0.92
1    0.76
2    0.72
3    0.80
4    0.65
Name: Chance of Admit, dtype: float64
```

6 Train Test Split

[25]:
```
#random state train test split
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.
 ↪30,random_state=101)
```

[26]:
```
x_train.head()
```

[26]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research
237	238	329	114	5	4.5	5.0	9.19	1
268	269	327	113	4	4.5	5.0	9.14	0
186	187	317	107	3	3.5	3.0	8.68	1
106	107	329	111	4	4.5	4.5	9.18	1
41	42	316	105	2	2.5	2.5	8.20	1

```
186         1
106         1
41          1
```

[27]:
```
#getting shape of training data
x_train.shape,y_train.shape
```

[27]: ((280, 8), (280,))

[28]:
```
#getting shape of testing data
x_test.shape,y_test.shape
```

[28]: ((120, 8), (120,))

7 Standardize the variables

[29]:
```
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
scaler
```

[29]: StandardScaler()

[30]:
```
#fit and transform
x_train= scaler.fit_transform(x_train)
x_test=scaler.transform(x_test)
```

8 SVR Model

[31]:
```
#SVR Model
from sklearn.svm import SVR
regression=SVR(kernel='rbf')
regression.fit(x_train,y_train)
```

[31]: SVR()

[32]:
```
#prediction
y_pred=regression.predict(x_test)
```

9 Performance Metrics

[33]:
```
#performance metrics
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
```

[34]:
```
print('MSE:',mean_squared_error(y_test,y_pred))
print('MAE:',mean_absolute_error(y_test,y_pred))
```

```
MSE: 0.004277982013238933
MAE: 0.04855271860059429
```

10 R square and Adjusted R square

[35]:
```
from sklearn.metrics import r2_score
score=r2_score(y_test,y_pred)
print('R-square:',score)
```

```
R-square: 0.7676426930486213
```

[36]:
```
adjusted_r_2=1-(1-score)*(len(y_test)-1)/(len(y_test)-x_test.shape[1]-1)
print('adjusted_r_2:',adjusted_r_2)
```

```
adjusted_r_2: 0.7508962204755489
```

11 Hyperparameter Tuning

[37]:
```
from sklearn.model_selection import GridSearchCV
from sklearn import metrics
```

[38]:
```
#hyperparameter tuning the svm model
param_grid={'kernel':['rbf','linear','poly']}
grid=GridSearchCV(estimator=SVR(),
                  param_grid=param_grid,
                  cv=5,
                  n_jobs=-1)
grid.fit(x_train,y_train)
```

[38]:
```
GridSearchCV(cv=5, estimator=SVR(), n_jobs=-1,
             param_grid={'kernel': ['rbf', 'linear', 'poly']})
```

[39]:
```
#prediction
svr_pred=grid.predict(x_test)

#r2 score
svr_r2Score=metrics.r2_score(y_test,svr_pred)
print('SVR R2 score:',svr_r2Score)
```

```
SVR R2 score: 0.7721290956813317
```

[40]:
```
#Adjusted r2 score
Adjusted_r2=1-(1-svr_r2Score)*(len(y_test)-1)/(len(y_test)-x_test.shape[1]-1)
```

```
print('Adjusted_r2:',Adjusted_r2)
```

```
Adjusted_r2: 0.7557059674421485
```

[41]:
```
print('After Hyper-parameter Tuning')
print('MSE:',mean_squared_error(y_test,svr_pred))
print('MAE:',mean_absolute_error(y_test,svr_pred))
```

```
After Hyper-parameter Tuning
MSE: 0.00419538185738974
MAE: 0.04732226181713412
```

12 Before and After Hyperparameter

[42]:
```
print(f"Before Hyper-parameter Tuning\n R-Square:{score}\n Adjusted R_2:
  ↪{adjusted_r_2}\n")
print(f"After Hyper_parameter Tuning\n R-Square:{svr_r2Score} \n Adjusted R_2:
  ↪{Adjusted_r2}\n")
```

```
Before Hyper-parameter Tuning
 R-Square:0.7676426930486213
 Adjusted R_2:0.7508962204755489

After Hyper_parameter Tuning
 R-Square:0.7721290956813317
 Adjusted R_2:0.7557059674421485
```