Course Project Code

Keiuntae Smith

DSC630 Predictive Analysis

28 July 2022

In [1]:
```
!pip install termcolor
```

```
Requirement already satisfied: termcolor in /Users/keiuntaesmith/opt/anaconda3/lib/python3.9/site-packages (1.1.0)
```

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import seaborn as sb
from termcolor import colored as cl

from sklearn.model_selection import train_test_split

from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Ridge
from sklearn.linear_model import Lasso

from sklearn.metrics import explained_variance_score as evs
from sklearn.metrics import r2_score as r2
from sklearn.metrics import mean_squared_error

sb.set_style('whitegrid')
plt.rcParams['figure.figsize'] = (15, 8)
```

In [3]:
```
# IMPORTING DATA

df = pd.read_csv('House_Data.csv')

df.head()
```

Out[3]:

	Id	LotArea	MasVnrArea	BsmtUnfSF	TotalBsmtSF	1stFlrSF	2ndFlrSF	GrLivArea	GarageArea	WoodDeckSF	OpenPorchSF	SalePrice
0	1	8450	196.0	150	856	856	854	1710	548	0	61	208500
1	2	9600	0.0	284	1262	1262	0	1262	460	298	0	181500
2	3	11250	162.0	434	920	920	866	1786	608	0	42	223500
3	4	9550	0.0	540	756	961	756	1717	642	0	35	140000
4	5	14260	350.0	490	1145	1145	1053	2198	836	192	84	250000

In [4]:
```
df.shape
```

Out[4]:
```
(1460, 12)
```

In [5]:
```
# remove all the null values contained in dataset
df.dropna(inplace=True)

print(cl(df.isnull().sum(), attrs='bold'))
```

```
Id             0
LotArea        0
MasVnrArea     0
BsmtUnfSF      0
TotalBsmtSF    0
1stFlrSF       0
2ndFlrSF       0
GrLivArea      0
GarageArea     0
WoodDeckSF     0
OpenPorchSF    0
SalePrice      0
dtype: int64
```

In [6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1452 entries, 0 to 1459
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   Id           1452 non-null   int64  
 1   LotArea      1452 non-null   int64  
 2   MasVnrArea   1452 non-null   float64
 3   BsmtUnfSF    1452 non-null   int64  
 4   TotalBsmtSF  1452 non-null   int64  
 5   1stFlrSF     1452 non-null   int64  
 6   2ndFlrSF     1452 non-null   int64  
 7   GrLivArea    1452 non-null   int64  
 8   GarageArea   1452 non-null   int64  
 9   WoodDeckSF   1452 non-null   int64  
 10  OpenPorchSF  1452 non-null   int64  
 11  SalePrice    1452 non-null   int64  
dtypes: float64(1), int64(11)
memory usage: 147.5 KB
```

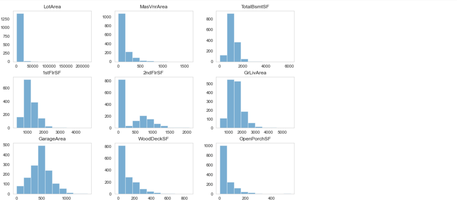
In [7]:
```
#set the ID as index
df.set_index('Id', inplace = True)
```

In [8]:
```
#convert float values to integer types using the 'astype' function
df['MasVnrArea'] = pd.to_numeric(df['MasVnrArea'], errors = 'coerce')
df['MasVnrArea'] = df['MasVnrArea'].astype('int64')
```

In [9]:
```
#recheck variable datatypes
df.info()
```

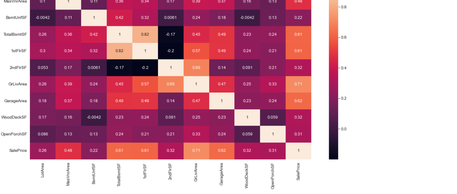
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1452 entries, 1 to 1460
Data columns (total 11 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   LotArea      1452 non-null   int64
 1   MasVnrArea   1452 non-null   int64
 2   BsmtUnfSF    1452 non-null   int64
 3   TotalBsmtSF  1452 non-null   int64
 4   1stFlrSF     1452 non-null   int64
 5   2ndFlrSF     1452 non-null   int64
 6   GrLivArea    1452 non-null   int64
 7   GarageArea   1452 non-null   int64
 8   WoodDeckSF   1452 non-null   int64
 9   OpenPorchSF  1452 non-null   int64
 10  SalePrice    1452 non-null   int64
dtypes: int64(11)
memory usage: 136.1 KB
```

In [10]:
```
#generate histograms for selected numerical features
df[['LotArea', 'MasVnrArea', 'TotalBsmtSF', '1stFlrSF', '2ndFlrSF', 'GrLivArea', 'GarageArea', 'WoodDeckSF', 'OpenPorchSF']].hist(figsize=(12, 8), alpha
plt.show()
```



In [11]:
```
#generate heatmap of dataset to check for correlation
cor = df.corr()
sns.heatmap(cor, annot = True)
```

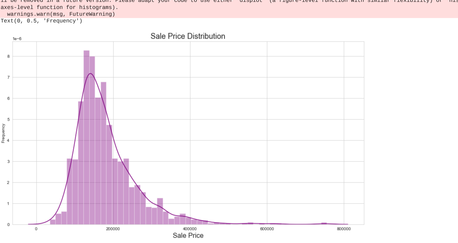
Out[11]:
```
<AxesSubplot:>
```



In [12]:
```
#create a distribution plot of Sale Price
sns.distplot(df.SalePrice, color='purple')
plt.title('Sale Price Distribution', fontsize=18)
plt.xlabel('Sale Price', fontsize=15)
plt.ylabel('Frequency')
```

```
/Users/keiuntaesmith/opt/anaconda3/lib/python3.9/site-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and wi
ll be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an
 axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[12]:
```
Text(0, 0.5, 'Frequency')
```



Split the Data into training and test set

In [13]:
```
# FEATURE SELECTION & DATA SPLIT

X = df[['LotArea', 'MasVnrArea', 'BsmtUnfSF', 'TotalBsmtSF', '1stFlrSF', '2ndFlrSF', 'GrLivArea', 'GarageArea', 'WoodDeckSF', 'OpenPorchSF']].values
y = df['SalePrice'].values

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)

print(cl('X_train samples : ', attrs = ['bold']), X_train[0:5])
print(cl('X_test samples : ', attrs = ['bold']), X_test[0:5])
print(cl('y_train samples : ', attrs = ['bold']), y_train[0:5])
print(cl('y_test samples : ', attrs = ['bold']), y_test[0:5])
```

```
X_train samples :  [[ 10200    219    678   1461   1509      0   1509    600    224      0]
 [  9947      0    577   1188   1217      0   1217    497    168    271]
 [  7200      0      0      0   1040      0   1040    625      0      0]
 [215245      0    80   2136   2036      0   2936    513      0      0]
 [  6120      0    952    952   1022    752   1774    468     90      0]]
X_test samples :  [[ 1053    408    174    483    483    504    807    264     72      0]
 [ 4500    116    319   1216   1216      0   1216    402      0    125]
 [10762    344    284    978   1005    976   1983    498      0      0]
 [39104      0     96   1305   1363      0   1363    439     81      0]
 [10905    299    768   1160   1156    866   2022    505    288    117]]
y_train samples :  [175000 173000 109500 375000 129900]
y_test samples :  [ 83000 164000 225000 241500 102000]
```

Modeling and Evaluations

Ordinal Least Square Algorithm (OLS)

In [14]:
```
# Create and fit Ordinal Least Square algorithm

ols_model = LinearRegression()
ols_model.fit(X_train, y_train)
```

Out[14]:
```
LinearRegression()
```

In [15]:
```
ols_model_pre = ols_model.predict(X_test)
```

In [16]:
```
#obtain the coefficient of determination (R2)
print(cl('Coefficient of determination Score of ols_model model: {}'.format(r2(y_test, ols_model_pre)*100),
         attrs = ['bold']))
```

```
Coefficient of determination Score of ols_model model: 77.2383636249033
```

In [17]:
```
# Obtain the Explained Variance Score
print(cl('Explained Variance Score of ols_model model: {}'.format(evs(y_test, ols_model_pre)*100),
         attrs = ['bold']))
```

```
Explained Variance Score of ols_model model: 77.33369645921897
```

Lasso Regression Model

In [18]:
```
# Create and fit Lasso Regression algorithm

lasso_model = Lasso()
lasso_model.fit(X_train, y_train)
```

```
/Users/keiuntaesmith/opt/anaconda3/lib/python3.9/site-packages/sklearn/linear_model/_coordinate_descent.py:647: ConvergenceWarning: Objective did not c
onverge. You might want to increase the number of iterations, check the scale of the features or consider increasing regularisation. Duality gap: 9.334
e+11, tolerance: 7.239e+08
  model = cd_fast.enet_coordinate_descent(
```

Out[18]:
```
Lasso()
```

In [19]:
```
lasso_model_pre = lasso_model.predict(X_test)
```

In [20]:
```
#obtain the coefficient of determination (R2)
print(cl('Coefficient of determination Score of lasso model: {}'.format(r2(y_test, lasso_model_pre)*100),
         attrs = ['bold']))
```

```
Coefficient of determination Score of lasso model: 77.23836423441476
```

In [21]:
```
# Obtain the Explained Variance Score
print(cl('Explained Variance Score of Lasso model is {}'.format(evs(y_test, lasso_model_pre)*100),
         attrs = ['bold']))
```

```
Explained Variance Score of Lasso model is 77.33370054270638
```

Ridge Regression Algorithm

In [22]:
```
# Create and fit Ridge Regression algorithm

ridge_model = Ridge()
ridge_model.fit(X_train, y_train)
```

Out[22]:
```
Ridge()
```

In [23]:
```
ridge_model_pre = ridge_model.predict(X_test)
```

In [24]:
```
#obtain the coefficient of determination (R2)
print(cl('Coefficient of determination Score of Ridge model: {}'.format(r2(y_test, ridge_model_pre)*100),
         attrs = ['bold']))
```

```
Coefficient of determination Score of Ridge model: 77.23836360889462
```

In [25]:
```
# Obtain the Explained Variance Score
print(cl('Explained Variance Score of Ridge model: {}'.format(evs(y_test, ridge_model_pre)*100),
         attrs = ['bold']))
```

```
Explained Variance Score of Ridge model: 77.33369645976185
```