```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import math
import statsmodels.api as sm
import datetime

%matplotlib inline
import seaborn as sns
import sklearn
import sklearn.metrics as metrics
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Lasso, Ridge
from sklearn.model_selection import KFold
from sklearn.model_selection import GridSearchCV
from sklearn.feature_selection import RFE
pd.options.display.max_colwidth=200
pd.options.display.max_rows=100
pd.options.display.max_columns=500
import warnings
warnings.filterwarnings('ignore')
```

1. Read The Data

```python
df=pd.read_csv(r'train.xlsx.csv')
df
```

```
         Id  MSSubClass MSZoning  LotFrontage  LotArea Street Alley
LotShape  \
0       127         120       RL          NaN     4928   Pave   NaN
IR1
1       889          20       RL         95.0    15865   Pave   NaN
IR1
2       793          60       RL         92.0     9920   Pave   NaN
IR1
3       110          20       RL        105.0    11751   Pave   NaN
IR1
4       422          20       RL          NaN    16635   Pave   NaN
IR1
...     ...         ...      ...          ...      ...    ...   ...
...
1163    289          20       RL          NaN     9819   Pave   NaN
IR1
1164    554          20       RL         67.0     8777   Pave   NaN
Reg
1165    196         160       RL         24.0     2280   Pave   NaN
Reg
1166     31          70  C (all)         50.0     8500   Pave  Pave
```

```
     Reg
1167  617         60        RL        NaN      7861    Pave   NaN
     IR1

     LandContour Utilities LotConfig LandSlope Neighborhood Condition1 \
0           Lvl    AllPub    Inside       Gtl      NPkVill       Norm

1           Lvl    AllPub    Inside       Mod        NAmes       Norm

2           Lvl    AllPub   CulDSac       Gtl      NoRidge       Norm

3           Lvl    AllPub    Inside       Gtl       NWAmes       Norm

4           Lvl    AllPub       FR2       Gtl       NWAmes       Norm

...         ...       ...       ...       ...          ...        ...

1163        Lvl    AllPub    Inside       Gtl       Sawyer       Norm

1164        Lvl    AllPub    Inside       Gtl      Edwards      Feedr

1165        Lvl    AllPub       FR2       Gtl      NPkVill       Norm

1166        Lvl    AllPub    Inside       Gtl       IDOTRR      Feedr

1167        Lvl    AllPub    Inside       Gtl      Gilbert       Norm


     Condition2 BldgType HouseStyle  OverallQual  OverallCond  YearBuilt \
0          Norm    TwnhsE     1Story            6            5       1976
1          Norm      1Fam     1Story            8            6       1970
2          Norm      1Fam     2Story            7            5       1996
3          Norm      1Fam     1Story            6            6       1977
4          Norm      1Fam     1Story            6            7       1977
...         ...       ...        ...          ...          ...        ...
1163       Norm      1Fam     1Story            5            5       1967
1164       Norm      1Fam     1Story            4            5       1949
1165       Norm     Twnhs     2Story            6            6       1976
```

```
1166          Norm    1Fam    2Story              4              4
1920
1167          Norm    1Fam    2Story              6              5
2002

      YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd
MasVnrType  \
0             1976     Gable  CompShg     Plywood     Plywood
None
1             1970      Flat   Tar&Grv    Wd Sdng     Wd Sdng
None
2             1997     Gable  CompShg     MetalSd     MetalSd
None
3             1977       Hip  CompShg     Plywood     Plywood
BrkFace
4             2000     Gable  CompShg     CemntBd     CmentBd
Stone
...            ...       ...      ...         ...         ...      .
..
1163          1967     Gable  CompShg     MetalSd     MetalSd
BrkFace
1164          2003     Gable  CompShg     VinylSd     VinylSd
None
1165          1976     Gable  CompShg     Plywood     Brk Cmn
None
1166          1950   Gambrel  CompShg     BrkFace     BrkFace
None
1167          2003     Gable  CompShg     VinylSd     VinylSd
None

      MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond  \
0            0.0        TA        TA     CBlock       Gd       TA
1            0.0        Gd        Gd      PConc       TA       Gd
2            0.0        Gd        TA      PConc       Gd       TA
3          480.0        TA        TA     CBlock       Gd       TA
4          126.0        Gd        TA     CBlock       Gd       TA
...          ...       ...       ...        ...      ...      ...
1163        31.0        TA        Gd     CBlock       TA       TA
1164         0.0        TA        TA     CBlock      NaN      NaN
1165         0.0        TA        TA     CBlock       Gd       TA
1166         0.0        TA        Fa     BrkTil       TA       TA
1167         0.0        Gd        TA      PConc       Gd       TA

      BsmtExposure BsmtFinType1  BsmtFinSF1 BsmtFinType2  BsmtFinSF2  \
0               No          ALQ         120          Unf           0
1               Gd          ALQ         351          Rec         823
2               Av          GLQ         862          Unf           0
3               No          BLQ         705          Unf           0
4               No          ALQ        1246          Unf           0
...            ...          ...         ...          ...         ...
```

```
1163          No         BLQ          450          Unf          0
1164         NaN         NaN            0          NaN          0
1165          No         ALQ          566          Unf          0
1166          No         Unf            0          Unf          0
1167          No         GLQ          457          Unf          0

      BsmtUnfSF  TotalBsmtSF Heating HeatingQC CentralAir  \
Electrical
0           958         1078    GasA        TA          Y       SBrkr

1          1043         2217    GasA        Ex          Y       SBrkr

2           255         1117    GasA        Ex          Y       SBrkr

3          1139         1844    GasA        Ex          Y       SBrkr

4           356         1602    GasA        Gd          Y       SBrkr

...         ...          ...     ...       ...        ...         ...

1163        432          882    GasA        TA          Y       SBrkr

1164          0            0    GasA        Ex          Y       SBrkr

1165        289          855    GasA        TA          Y       SBrkr

1166        649          649    GasA        TA          N       SBrkr

1167        326          783    GasA        Ex          Y       SBrkr


      1stFlrSF  2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  \
BsmtHalfBath
0          958         0             0        958             0
0
1         2217         0             0       2217             1
0
2         1127       886             0       2013             1
0
3         1844         0             0       1844             0
0
4         1602         0             0       1602             0
1
...        ...       ...           ...        ...           ...
...
1163       900         0             0        900             0
0
1164      1126         0             0       1126             0
0
```

```
1165          855          601             0        1456              0
0
1166          649          668             0        1317              0
0
1167          807          702             0        1509              1
0

      FullBath  HalfBath  BedroomAbvGr  KitchenAbvGr KitchenQual  \
0            2         0             2             1          TA
1            2         0             4             1          Gd
2            2         1             3             1          TA
3            2         0             3             1          TA
4            2         0             3             1          Gd
...        ...       ...           ...           ...         ...
1163         1         0             3             1          TA
1164         2         0             2             1          Gd
1165         2         1             3             1          TA
1166         1         0             3             1          TA
1167         2         1             3             1          Gd

      TotRmsAbvGrd Functional  Fireplaces FireplaceQu GarageType
GarageYrBlt  \
0                5        Typ           1          TA     Attchd
1977.0
1                8        Typ           1          TA     Attchd
1970.0
2                8        Typ           1          TA     Attchd
1997.0
3                7        Typ           1          TA     Attchd
1977.0
4                8        Typ           1          TA     Attchd
1977.0
...            ...        ...         ...         ...        ...
...
1163             5        Typ           0         NaN     Detchd
1970.0
1164             5        Typ           0         NaN     Detchd
2002.0
1165             7        Typ           1          TA     Attchd
1976.0
1166             6        Typ           0         NaN     Detchd
1920.0
1167             7        Typ           1          Gd     Attchd
2002.0

      GarageFinish  GarageCars  GarageArea GarageQual GarageCond
PavedDrive  \
0              RFn           2         440         TA         TA
Y
1              Unf           2         621         TA         TA
```

```
     Y
2             Unf          2       455     TA       TA
     Y
3             RFn          2       546     TA       TA
     Y
4             Fin          2       529     TA       TA
     Y
...           ...        ...       ...     ...      ...
     ...
1163          Unf          1       280     TA       TA
     Y
1164          Fin          2       520     TA       TA
     N
1165          Unf          2       440     TA       TA
     Y
1166          Unf          1       250     TA       Fa
     N
1167          Fin          2       393     TA       TA
     Y

      WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  \
ScreenPorch
0              0          205              0          0          0

1             81          207              0          0        224

2            180          130              0          0          0

3              0          122              0          0          0

4            240            0              0          0          0

...          ...          ...            ...        ...        ...

1163           0            0              0          0          0

1164           0           96              0          0          0

1165          87            0              0          0          0

1166           0           54            172          0          0

1167         100           75              0          0          0


      PoolArea PoolQC  Fence MiscFeature  MiscVal  MoSold  YrSold  \
SaleType
0            0    NaN    NaN         NaN        0       2    2007
WD
```

1	0	NaN	NaN	NaN	0	10	2007	WD
2	0	NaN	NaN	NaN	0	6	2007	WD
3	0	NaN	MnPrv	NaN	0	1	2010	COD
4	0	NaN	NaN	NaN	0	6	2009	WD
...	...	...	...	...	...	...	...	...
1163	0	NaN	MnPrv	NaN	0	2	2010	WD
1164	0	NaN	MnPrv	NaN	0	5	2009	WD
1165	0	NaN	NaN	NaN	0	7	2009	WD
1166	0	NaN	MnPrv	NaN	0	7	2008	WD
1167	0	NaN	NaN	NaN	0	6	2006	WD

	SaleCondition	SalePrice
0	Normal	128000
1	Normal	268000
2	Normal	269790
3	Normal	190000
4	Normal	215000
...	...	...
1163	Normal	122000
1164	Normal	108000
1165	Normal	148500
1166	Normal	40000
1167	Normal	183200

[1168 rows x 81 columns]

2.see the info and data to understand the data

```
df.shape
```

```
(1168, 81)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1168 entries, 0 to 1167
Data columns (total 81 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Id            1168 non-null   int64
 1   MSSubClass    1168 non-null   int64
```

```
2    MSZoning       1168 non-null   object
3    LotFrontage    954 non-null    float64
4    LotArea        1168 non-null   int64
5    Street         1168 non-null   object
6    Alley          77 non-null     object
7    LotShape       1168 non-null   object
8    LandContour    1168 non-null   object
9    Utilities      1168 non-null   object
10   LotConfig      1168 non-null   object
11   LandSlope      1168 non-null   object
12   Neighborhood   1168 non-null   object
13   Condition1     1168 non-null   object
14   Condition2     1168 non-null   object
15   BldgType       1168 non-null   object
16   HouseStyle     1168 non-null   object
17   OverallQual    1168 non-null   int64
18   OverallCond    1168 non-null   int64
19   YearBuilt      1168 non-null   int64
20   YearRemodAdd   1168 non-null   int64
21   RoofStyle      1168 non-null   object
22   RoofMatl       1168 non-null   object
23   Exterior1st    1168 non-null   object
24   Exterior2nd    1168 non-null   object
25   MasVnrType     1161 non-null   object
26   MasVnrArea     1161 non-null   float64
27   ExterQual      1168 non-null   object
28   ExterCond      1168 non-null   object
29   Foundation     1168 non-null   object
30   BsmtQual       1138 non-null   object
31   BsmtCond       1138 non-null   object
32   BsmtExposure   1137 non-null   object
33   BsmtFinType1   1138 non-null   object
34   BsmtFinSF1     1168 non-null   int64
35   BsmtFinType2   1137 non-null   object
36   BsmtFinSF2     1168 non-null   int64
37   BsmtUnfSF      1168 non-null   int64
38   TotalBsmtSF    1168 non-null   int64
39   Heating        1168 non-null   object
40   HeatingQC      1168 non-null   object
41   CentralAir     1168 non-null   object
42   Electrical     1168 non-null   object
43   1stFlrSF       1168 non-null   int64
44   2ndFlrSF       1168 non-null   int64
45   LowQualFinSF   1168 non-null   int64
46   GrLivArea      1168 non-null   int64
47   BsmtFullBath   1168 non-null   int64
48   BsmtHalfBath   1168 non-null   int64
49   FullBath       1168 non-null   int64
50   HalfBath       1168 non-null   int64
51   BedroomAbvGr   1168 non-null   int64
```

```
 52  KitchenAbvGr    1168 non-null   int64
 53  KitchenQual     1168 non-null   object
 54  TotRmsAbvGrd    1168 non-null   int64
 55  Functional      1168 non-null   object
 56  Fireplaces      1168 non-null   int64
 57  FireplaceQu     617 non-null    object
 58  GarageType      1104 non-null   object
 59  GarageYrBlt     1104 non-null   float64
 60  GarageFinish    1104 non-null   object
 61  GarageCars      1168 non-null   int64
 62  GarageArea      1168 non-null   int64
 63  GarageQual      1104 non-null   object
 64  GarageCond      1104 non-null   object
 65  PavedDrive      1168 non-null   object
 66  WoodDeckSF      1168 non-null   int64
 67  OpenPorchSF     1168 non-null   int64
 68  EnclosedPorch   1168 non-null   int64
 69  3SsnPorch       1168 non-null   int64
 70  ScreenPorch     1168 non-null   int64
 71  PoolArea        1168 non-null   int64
 72  PoolQC          7 non-null      object
 73  Fence           237 non-null    object
 74  MiscFeature     44 non-null     object
 75  MiscVal         1168 non-null   int64
 76  MoSold          1168 non-null   int64
 77  YrSold          1168 non-null   int64
 78  SaleType        1168 non-null   object
 79  SaleCondition   1168 non-null   object
 80  SalePrice       1168 non-null   int64
dtypes: float64(3), int64(35), object(43)
memory usage: 739.2+ KB
```

```
df.describe().T
```

	count	mean	std	min	25%
Id	1168.0	724.136130	416.159877	1.0	360.50
MSSubClass	1168.0	56.767979	41.940650	20.0	20.00
LotFrontage	954.0	70.988470	24.828750	21.0	60.00
LotArea	1168.0	10484.749144	8957.442311	1300.0	7621.50
OverallQual	1168.0	6.104452	1.390153	1.0	5.00
OverallCond	1168.0	5.595890	1.124343	1.0	5.00
YearBuilt	1168.0	1970.930651	30.145255	1875.0	1954.00

YearRemodAdd	1168.0	1984.758562	20.785185	1950.0	1966.00
MasVnrArea	1161.0	102.310078	182.595606	0.0	0.00
BsmtFinSF1	1168.0	444.726027	462.664785	0.0	0.00
BsmtFinSF2	1168.0	46.647260	163.520016	0.0	0.00
BsmtUnfSF	1168.0	569.721747	449.375525	0.0	216.00
TotalBsmtSF	1168.0	1061.095034	442.272249	0.0	799.00
1stFlrSF	1168.0	1169.860445	391.161983	334.0	892.00
2ndFlrSF	1168.0	348.826199	439.696370	0.0	0.00
LowQualFinSF	1168.0	6.380137	50.892844	0.0	0.00
GrLivArea	1168.0	1525.066781	528.042957	334.0	1143.25
BsmtFullBath	1168.0	0.425514	0.521615	0.0	0.00
BsmtHalfBath	1168.0	0.055651	0.236699	0.0	0.00
FullBath	1168.0	1.562500	0.551882	0.0	1.00
HalfBath	1168.0	0.388699	0.504929	0.0	0.00
BedroomAbvGr	1168.0	2.884418	0.817229	0.0	2.00
KitchenAbvGr	1168.0	1.045377	0.216292	0.0	1.00
TotRmsAbvGrd	1168.0	6.542808	1.598484	2.0	5.00
Fireplaces	1168.0	0.617295	0.650575	0.0	0.00
GarageYrBlt	1104.0	1978.193841	24.890704	1900.0	1961.00
GarageCars	1168.0	1.776541	0.745554	0.0	1.00
GarageArea	1168.0	476.860445	214.466769	0.0	338.00
WoodDeckSF	1168.0	96.206336	126.158988	0.0	0.00
OpenPorchSF	1168.0	46.559932	66.381023	0.0	0.00
EnclosedPorch	1168.0	23.015411	63.191089	0.0	0.00

	count	mean	std	min	25%
3SsnPorch	1168.0	3.639555	29.088867	0.0	0.00
ScreenPorch	1168.0	15.051370	55.080816	0.0	0.00
PoolArea	1168.0	3.448630	44.896939	0.0	0.00
MiscVal	1168.0	47.315068	543.264432	0.0	0.00
MoSold	1168.0	6.344178	2.686352	1.0	5.00
YrSold	1168.0	2007.804795	1.329738	2006.0	2007.00
SalePrice	1168.0	181477.005993	79105.586863	34900.0	130375.00

	50%	75%	max
Id	714.5	1079.5	1460.0
MSSubClass	50.0	70.0	190.0
LotFrontage	70.0	80.0	313.0
LotArea	9522.5	11515.5	164660.0
OverallQual	6.0	7.0	10.0
OverallCond	5.0	6.0	9.0
YearBuilt	1972.0	2000.0	2010.0
YearRemodAdd	1993.0	2004.0	2010.0
MasVnrArea	0.0	160.0	1600.0
BsmtFinSF1	385.5	714.5	5644.0
BsmtFinSF2	0.0	0.0	1474.0
BsmtUnfSF	474.0	816.0	2336.0
TotalBsmtSF	1005.5	1291.5	6110.0
1stFlrSF	1096.5	1392.0	4692.0
2ndFlrSF	0.0	729.0	2065.0
LowQualFinSF	0.0	0.0	572.0
GrLivArea	1468.5	1795.0	5642.0
BsmtFullBath	0.0	1.0	3.0
BsmtHalfBath	0.0	0.0	2.0
FullBath	2.0	2.0	3.0
HalfBath	0.0	1.0	2.0
BedroomAbvGr	3.0	3.0	8.0
KitchenAbvGr	1.0	1.0	3.0
TotRmsAbvGrd	6.0	7.0	14.0
Fireplaces	1.0	1.0	3.0
GarageYrBlt	1980.0	2002.0	2010.0
GarageCars	2.0	2.0	4.0
GarageArea	480.0	576.0	1418.0
WoodDeckSF	0.0	171.0	857.0
OpenPorchSF	24.0	70.0	547.0
EnclosedPorch	0.0	0.0	552.0
3SsnPorch	0.0	0.0	508.0

```
ScreenPorch          0.0         0.0       480.0
PoolArea             0.0         0.0       738.0
MiscVal              0.0         0.0     15500.0
MoSold               6.0         8.0        12.0
YrSold            2008.0      2009.0      2010.0
SalePrice       163995.0    215000.0    755000.0
```

#checking for null values
NA_col=df.isnull().sum()
NA_col

```
Id                 0
MSSubClass         0
MSZoning           0
LotFrontage      214
LotArea            0
Street             0
Alley           1091
LotShape           0
LandContour        0
Utilities          0
LotConfig          0
LandSlope          0
Neighborhood       0
Condition1         0
Condition2         0
BldgType           0
HouseStyle         0
OverallQual        0
OverallCond        0
YearBuilt          0
YearRemodAdd       0
RoofStyle          0
RoofMatl           0
Exterior1st        0
Exterior2nd        0
MasVnrType         7
MasVnrArea         7
ExterQual          0
ExterCond          0
Foundation         0
BsmtQual          30
BsmtCond          30
BsmtExposure      31
BsmtFinType1      30
BsmtFinSF1         0
BsmtFinType2      31
BsmtFinSF2         0
BsmtUnfSF          0
```

```
TotalBsmtSF        0
Heating            0
HeatingQC          0
CentralAir         0
Electrical         0
1stFlrSF           0
2ndFlrSF           0
LowQualFinSF       0
GrLivArea          0
BsmtFullBath       0
BsmtHalfBath       0
FullBath           0
HalfBath           0
BedroomAbvGr       0
KitchenAbvGr       0
KitchenQual        0
TotRmsAbvGrd       0
Functional         0
Fireplaces         0
FireplaceQu      551
GarageType        64
GarageYrBlt       64
GarageFinish      64
GarageCars         0
GarageArea         0
GarageQual        64
GarageCond        64
PavedDrive         0
WoodDeckSF         0
OpenPorchSF        0
EnclosedPorch      0
3SsnPorch          0
ScreenPorch        0
PoolArea           0
PoolQC          1161
Fence            931
MiscFeature     1124
MiscVal            0
MoSold             0
YrSold             0
SaleType           0
SaleCondition      0
SalePrice          0
dtype: int64
```

```
#find out the column which have null values
NA_col=NA_col[NA_col>0]
NA_col
```

```
LotFrontage      214
Alley           1091
```

```
MasVnrType          7
MasVnrArea          7
BsmtQual           30
BsmtCond           30
BsmtExposure       31
BsmtFinType1       30
BsmtFinType2       31
FireplaceQu       551
GarageType         64
GarageYrBlt        64
GarageFinish       64
GarageQual         64
GarageCond         64
PoolQC           1161
Fence             931
MiscFeature      1124
dtype: int64
```

```python
#% of column missing
print(round(100*NA_col[NA_col>0]/len(df),2))
```

```
LotFrontage      18.32
Alley            93.41
MasVnrType        0.60
MasVnrArea        0.60
BsmtQual          2.57
BsmtCond          2.57
BsmtExposure      2.65
BsmtFinType1      2.57
BsmtFinType2      2.65
FireplaceQu      47.17
GarageType        5.48
GarageYrBlt       5.48
GarageFinish      5.48
GarageQual        5.48
GarageCond        5.48
PoolQC           99.40
Fence            79.71
MiscFeature      96.23
dtype: float64
```

observation Based on the above data, we can drop the following columns - LotFrontage - Alley - FireplaceQu - PoolQC - Fence - MiscFeature - Id (dropping this not because of count, irrelevant) - MoSold (dropping this not because of count, irrelevant) - Street (dropping this not because of count, irrelevant) - Utilities (dropping this not because of count, irrelevant)

3. Data Treatment

```python
#dropping column with high missing values and irrevelent column
df.drop(['LotFrontage','Alley','FireplaceQu','PoolQC','Fence','MiscFeature','Id','MoSold','Street','Utilities'],axis=1,inplace=True)
```

```python
df.shape
```

```
(1168, 193)
```

```python
#checking all null values
NA_col=df.isnull().sum()
#column have null values
NA_col=NA_col[NA_col>0]
#% of colmun missing
print(round(100*NA_col[NA_col>0]/len(df),2))
```

```
MasVnrType      0.60
MasVnrArea      0.60
BsmtQual        2.57
BsmtCond        2.57
BsmtExposure    2.65
BsmtFinType1    2.57
BsmtFinType2    2.65
GarageType      5.48
GarageYrBlt     5.48
GarageFinish    5.48
GarageQual      5.48
GarageCond      5.48
dtype: float64
```

```python
#converting years to age
df['YearBuilt_Age']=df['YearBuilt'].max()-df['YearBuilt']
df['YearRemodAdd_Age']=df['YearRemodAdd'].max()-df['YearRemodAdd']
df['YrSold_Age']=df['YrSold'].max()-df['YrSold']
df['GarageYrBlt_Age']=df['GarageYrBlt'].max()-df['GarageYrBlt']
# droping columns
df.drop(['YearBuilt','YearRemodAdd','YrSold','GarageYrBlt'],axis=1,inplace=True)
```

```python
df[['YearBuilt_Age','YearRemodAdd_Age','YrSold_Age','GarageYrBlt_Age']].head(10)
```

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age	GarageYrBlt_Age
0	34	34	3	33.0
1	40	40	3	40.0
2	14	13	3	13.0
3	33	33	0	33.0

```
4            33               10           1            33.0
5             4                4           4             4.0
6            53               14           0            53.0
7            53               10           4            53.0
8            45               45           3            45.0
9            63               60           2            63.0
```

4. filling misssing values

```python
def treat_missing_values(x):

    #check for null values
    NA_col=df.isnull().sum()

    #checking for the column which have null value
    NA_col=NA_col[NA_col>0]

    for col in NA_col.index:
        if x[col].dtype.name== 'object':
            x[col].fillna(df[col].mode()[0],inplace=True)
        elif x[col].dtype.name=='float64' or
x[col].dtype.name=='int32' or x[col].dtype.name=='int64':
            x[col].fillna((x[col].median()))
        else:
            print('unable to detect the dtype for col--',col)
        return x


df=treat_missing_values(df)

df
```

```
       MSSubClass  LotArea  LotShape  LandSlope  OverallQual
OverallCond  \
0          120     4928         0          0              6
5
1           20    15865         0          1              8
6
2           60     9920         0          0              7
5
3           20    11751         0          0              6
6
4           20    16635         0          0              6
7
...        ...      ...       ...        ...            ...        .
..
1163        20     9819         0          0              5
5
1164        20     8777         1          0              4
5
```

1165	160	2280	1	0	6
6					
1166	70	8500	1	0	4
4					
1167	60	7861	0	0	6
5					

	MasVnrArea	ExterQual	ExterCond	BsmtQual	BsmtCond	BsmtExposure \
0	0.0	0	0	0	0	0
1	0.0	1	1	1	1	1
2	0.0	1	0	0	0	2
3	480.0	0	0	0	0	0
4	126.0	1	0	0	0	0
...	...	...	...	...	...	...
1163	31.0	0	1	1	0	0
1164	0.0	0	0	3	3	4
1165	0.0	0	0	0	0	0
1166	0.0	0	2	1	0	0
1167	0.0	1	0	0	0	0

	BsmtFinType1	BsmtFinSF1	BsmtFinType2	BsmtFinSF2	BsmtUnfSF \
0	0	120	0	0	958
1	0	351	1	823	1043
2	1	862	0	0	255
3	2	705	0	0	1139
4	0	1246	0	0	356
...	...	...	...	...	...
1163	2	450	0	0	432
1164	6	0	4	0	0
1165	0	566	0	0	289
1166	3	0	0	0	649
1167	1	457	0	0	326

	TotalBsmtSF	HeatingQC	CentralAir	1stFlrSF	2ndFlrSF	LowQualFinSF \
0	1078	0	0	958	0	0
1	2217	1	0	2217	0	

0						0
2	1117	1	0	1127	886	0
3	1844	1	0	1844	0	0
4	1602	2	0	1602	0	0
...	...	...	...	...	...	...
1163	882	0	0	900	0	0
1164	0	1	0	1126	0	0
1165	855	0	0	855	601	0
1166	649	0	1	649	668	0
1167	783	1	0	807	702	0

	GrLivArea	BsmtFullBath	BsmtHalfBath	FullBath	HalfBath	BedroomAbvGr \
0	958	0	0	2	0	2
1	2217	1	0	2	0	4
2	2013	1	0	2	1	3
3	1844	0	0	2	0	3
4	1602	0	1	2	0	3
...	...	...	...	...	...	...
1163	900	0	0	1	0	3
1164	1126	0	0	2	0	2
1165	1456	0	0	2	1	3
1166	1317	0	0	1	0	3
1167	1509	1	0	2	1	3

	KitchenAbvGr	KitchenQual	TotRmsAbvGrd	Fireplaces	GarageFinish \
0	1	0	5	1	0
1	1	1	8	1	

```
1
2                      1          0          8          1
1
3                      1          0          7          1
0
4                      1          1          8          1
2
...                  ...        ...        ...        ...        ..
.
1163                   1          0          5          0
1
1164                   1          1          5          0
2
1165                   1          0          7          1
1
1166                   1          0          6          0
1
1167                   1          1          7          1
2

      GarageCars  GarageArea  GarageQual  GarageCond  WoodDeckSF
OpenPorchSF  \
0              2         440           0           0           0
205
1              2         621           0           0          81
207
2              2         455           0           0         180
130
3              2         546           0           0           0
122
4              2         529           0           0         240
0
...          ...         ...         ...         ...         ...
...
1163           1         280           0           0           0
0
1164           2         520           0           0           0
96
1165           2         440           0           0          87
0
1166           1         250           0           1           0
54
1167           2         393           0           0         100
75

      EnclosedPorch  3SsnPorch  ScreenPorch  PoolArea  MiscVal
SalePrice  \
0                 0          0            0         0        0
2.546299
1                 0          0          224         0        0
```

```
2.602597
2                 0          0          0          0          0
2.603090
3                 0          0          0          0          0
2.576786
4                 0          0          0          0          0
2.586139
...              ...        ...        ...        ...        ...
...
1163              0          0          0          0          0
2.542529
1164              0          0          0          0          0
2.532895
1165              0          0          0          0          0
2.557874
1166            172          0          0          0          0
2.450717
1167              0          0          0          0          0
2.574011
```

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age	GarageYrBlt_Age \
0	34	34	3	33.0
1	40	40	3	40.0
2	14	13	3	13.0
3	33	33	0	33.0
4	33	10	1	33.0
...	...	...	...	...
1163	43	43	0	40.0
1164	61	7	1	8.0
1165	34	34	1	34.0
1166	90	60	2	90.0
1167	8	7	4	8.0

	MSZoning_FV	MSZoning_RH	MSZoning_RL	MSZoning_RM	LandContour_HLS \
0	0	0	1	0	0
1	0	0	1	0	0
2	0	0	1	0	0
3	0	0	1	0	0
4	0	0	1	0	0
...	...	...	...	...	...
1163	0	0	1	0	0
1164	0	0	1	0	

```
                                                           0
1165              0              0              1              0
0
1166              0              0              0              0
0
1167              0              0              1              0
0

         LandContour_Low  LandContour_Lvl  LotConfig_CulDSac  \
LotConfig_FR2  \
0                      0                1                  0
0
1                      0                1                  0
0
2                      0                1                  1
0
3                      0                1                  0
0
4                      0                1                  0
1
...                  ...              ...                ...              .
..
1163                   0                1                  0
0
1164                   0                1                  0
0
1165                   0                1                  0
1
1166                   0                1                  0
0
1167                   0                1                  0
0

      LotConfig_FR3  LotConfig_Inside  Neighborhood_Blueste  \
0                 0                 1                     0
1                 0                 1                     0
2                 0                 0                     0
3                 0                 1                     0
4                 0                 0                     0
...             ...               ...                   ...
1163              0                 1                     0
1164              0                 1                     0
1165              0                 0                     0
1166              0                 1                     0
1167              0                 1                     0

      Neighborhood_BrDale  Neighborhood_BrkSide  Neighborhood_ClearCr
\
0                       0                     0                     0
```

1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_CollgCr	Neighborhood_Crawfor	Neighborhood_Edwards
\			
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	1
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_Gilbert	Neighborhood_IDOTRR	Neighborhood_MeadowV
\			

0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	1	0
1167	1	0	0

	Neighborhood_Mitchel	Neighborhood_NAmes	Neighborhood_NPkVill \
0	0	0	1
1	0	1	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	1
1166	0	0	0
1167	0	0	0

	Neighborhood_NWAmes	Neighborhood_NoRidge	Neighborhood_NridgHt
0	0	0	0
1	0	0	0
2	0	1	0
3	1	0	0
4	1	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_OldTown	Neighborhood_SWISU	Neighborhood_Sawyer
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	1
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_SawyerW	Neighborhood_Somerst	Neighborhood_StoneBr
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0

4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_Timber	Neighborhood_Veenker	Condition1_Feedr \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	1
1165	0	0	0
1166	0	0	1
1167	0	0	0

	Condition1_Norm	Condition1_PosA	Condition1_PosN	Condition1_RRAe \
0	1	0	0	0
1	1	0	0	0
2	1	0	0	0
3	1	0	0	0
4	1	0	0	0
...	...	...	...	...
1163	1	0	0	0
1164	0	0	0	0
1165	1	0	0	0
1166	0	0	0	

```
0
1167                  1                  0                  0   
0

       Condition1_RRAn  Condition1_RRNe  Condition1_RRNn  \
Condition2_Feedr   
0                    0                0                0   
0
1                    0                0                0   
0
2                    0                0                0   
0
3                    0                0                0   
0
4                    0                0                0   
0
...                ...              ...              ...   
...
1163                 0                0                0   
0
1164                 0                0                0   
0
1165                 0                0                0   
0
1166                 0                0                0   
0
1167                 0                0                0   
0

       Condition2_Norm  Condition2_PosA  Condition2_PosN  \
Condition2_RRAe   
0                    1                0                0   
0
1                    1                0                0   
0
2                    1                0                0   
0
3                    1                0                0   
0
4                    1                0                0   
0
...                ...              ...              ...   .
..
1163                 1                0                0   
0
1164                 1                0                0   
0
1165                 1                0                0   
0
1166                 1                0                0   
```

```
0
1167                    1                0                0
0

        Condition2_RRAn  Condition2_RRNn  BldgType_2fmCon
BldgType_Duplex  \
0                     0                0                0
0
1                     0                0                0
0
2                     0                0                0
0
3                     0                0                0
0
4                     0                0                0
0
...                 ...              ...              ...                       .
..
1163                  0                0                0
0
1164                  0                0                0
0
1165                  0                0                0
0
1166                  0                0                0
0
1167                  0                0                0
0

        BldgType_Twnhs  BldgType_TwnhsE  HouseStyle_1.5Unf
HouseStyle_1Story  \
0                    0                1                  0
1
1                    0                0                  0
1
2                    0                0                  0
0
3                    0                0                  0
1
4                    0                0                  0
1
...                ...              ...                ...
...
1163                 0                0                  0
1
1164                 0                0                  0
1
1165                 1                0                  0
0
1166                 0                0                  0
```

```
0
1167                    0                  0                    0
0

        HouseStyle_2.5Fin  HouseStyle_2.5Unf  HouseStyle_2Story  \
0                      0                  0                    0
1                      0                  0                    0
2                      0                  0                    1
3                      0                  0                    0
4                      0                  0                    0
...                  ...                ...                  ...
1163                   0                  0                    0
1164                   0                  0                    0
1165                   0                  0                    1
1166                   0                  0                    1
1167                   0                  0                    1

        HouseStyle_SFoyer  HouseStyle_SLvl  RoofStyle_Gable
RoofStyle_Gambrel  \
0                      0                0                    1
0
1                      0                0                    0
0
2                      0                0                    1
0
3                      0                0                    0
0
4                      0                0                    1
0
...                  ...              ...                  ...
...
1163                   0                0                    1
0
1164                   0                0                    1
0
1165                   0                0                    1
0
1166                   0                0                    0
1
1167                   0                0                    1
0

        RoofStyle_Hip  RoofStyle_Mansard  RoofStyle_Shed
RoofMatl_CompShg  \
0                  0                  0                0
1
1                  0                  0                0
0
2                  0                  0                0
1
```

```
3                     1                    0                      0
1
4                     0                    0                      0
1
...                 ...                  ...                    ...          .
..
1163                  0                    0                      0
1
1164                  0                    0                      0
1
1165                  0                    0                      0
1
1166                  0                    0                      0
1
1167                  0                    0                      0
1

      RoofMatl_Membran  RoofMatl_Metal  RoofMatl_Roll  \
RoofMatl_Tar&Grv
0                     0               0              0
0
1                     0               0              0
1
2                     0               0              0
0
3                     0               0              0
0
4                     0               0              0
0
...                 ...             ...            ...            ..
.
1163                  0               0              0
0
1164                  0               0              0
0
1165                  0               0              0
0
1166                  0               0              0
0
1167                  0               0              0
0

      RoofMatl_WdShake  RoofMatl_WdShngl  Exterior1st_AsphShn  \
0                    0                 0                    0
1                    0                 0                    0
2                    0                 0                    0
3                    0                 0                    0
4                    0                 0                    0
...                ...               ...                  ...
1163                 0                 0                    0
```

1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Exterior1st_BrkComm	Exterior1st_BrkFace	Exterior1st_CemntBd \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	1
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	1	0
1167	0	0	0

	Exterior1st_HdBoard	Exterior1st_ImStucc	Exterior1st_MetalSd \
0	0	0	0
1	0	0	0
2	0	0	1
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	1
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Exterior1st_Plywood	Exterior1st_Stone	Exterior1st_Stucco \
0	1	0	0
1	0	0	0
2	0	0	0
3	1	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	1	0	0
1166	0	0	0
1167	0	0	0

	Exterior1st_VinylSd	Exterior1st_Wd Sdng	Exterior1st_WdShing \
0	0	0	0
1	0	1	0
2	0	0	0
3	0	0	0
4	0	0	0

```
...               ...                    ...                     ...
1163              0                      0                       0
1164              1                      0                       0
1165              0                      0                       0
1166              0                      0                       0
1167              1                      0                       0

       Exterior2nd_AsphShn  Exterior2nd_Brk Cmn  Exterior2nd_BrkFace  \
0                       0                    0                    0
1                       0                    0                    0
2                       0                    0                    0
3                       0                    0                    0
4                       0                    0                    0
...                   ...                  ...                  ...
1163                    0                    0                    0
1164                    0                    0                    0
1165                    0                    1                    0
1166                    0                    0                    1
1167                    0                    0                    0

       Exterior2nd_CmentBd  Exterior2nd_HdBoard  Exterior2nd_ImStucc  \
0                       0                    0                    0
1                       0                    0                    0
2                       0                    0                    0
3                       0                    0                    0
4                       1                    0                    0
...                   ...                  ...                  ...
1163                    0                    0                    0
1164                    0                    0                    0
1165                    0                    0                    0
1166                    0                    0                    0
1167                    0                    0                    0

       Exterior2nd_MetalSd  Exterior2nd_Other  Exterior2nd_Plywood  \
0                       0                  0                    1
1                       0                  0                    0
2                       1                  0                    0
3                       0                  0                    1
4                       0                  0                    0
...                   ...                ...                  ...
1163                    1                  0                    0
1164                    0                  0                    0
1165                    0                  0                    0
1166                    0                  0                    0
1167                    0                  0                    0

       Exterior2nd_Stone  Exterior2nd_Stucco  Exterior2nd_VinylSd  \
0                     0                   0                    0
1                     0                   0                    0
2                     0                   0                    0
```

3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	1
1165	0	0	0
1166	0	0	0
1167	0	0	1

	Exterior2nd_Wd Sdng	Exterior2nd_Wd Shng	MasVnrType_BrkFace \
0	0	0	0
1	1	0	0
2	0	0	0
3	0	0	1
4	0	0	0
...	...	...	...
1163	0	0	1
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	MasVnrType_None	MasVnrType_Stone	Foundation_CBlock	Foundation_PConc \
0	1	0	1	0
1	1	0	0	1
2	1	0	0	1
3	0	0	1	0
4	0	1	1	0
...	...	...	...	...
1163	0	0	1	0
1164	1	0	1	0
1165	1	0	1	0
1166	1	0	0	0
1167	1	0	0	1

	Foundation_Slab	Foundation_Stone	Foundation_Wood	Heating_GasA \
0	0	0	0	1

1	0	0	0	1
2	0	0	0	1
3	0	0	0	1
4	0	0	0	1
...	...	...	...	...
1163	0	0	0	1
1164	0	0	0	1
1165	0	0	0	1
1166	0	0	0	1
1167	0	0	0	1

	Heating_GasW	Heating_Grav	Heating_OthW	Heating_Wall \
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
...	...	...	...	...
1163	0	0	0	0
1164	0	0	0	0
1165	0	0	0	0
1166	0	0	0	0
1167	0	0	0	0

	Electrical_FuseF	Electrical_FuseP	Electrical_Mix	Electrical_SBrkr \
0	0	0	0	1
1	0	0	0	1
2	0	0	0	1
3	0	0	0	1
4	0	0	0	1
...	...	...	...	...

```
        Functional_Maj2  Functional_Min1  Functional_Min2  \
1163                  0                0                0
1
1164                  0                0                0
1
1165                  0                0                0
1
1166                  0                0                0
1
1167                  0                0                0
1

        Functional_Maj2  Functional_Min1  Functional_Min2  \
Functional_Mod
0                     0                0                0
0
1                     0                0                0
0
2                     0                0                0
0
3                     0                0                0
0
4                     0                0                0
0
...                 ...              ...              ...              ..
.
1163                  0                0                0
0
1164                  0                0                0
0
1165                  0                0                0
0
1166                  0                0                0
0
1167                  0                0                0
0

        Functional_Sev  Functional_Typ  GarageType_Attchd  \
GarageType_Basment
0                    0               1                1
0
1                    0               1                1
0
2                    0               1                1
0
3                    0               1                1
0
4                    0               1                1
0
...                ...             ...              ...
...
```

```
               0             1             0  \
1163           0             1             0
0
1164           0             1             0
0
1165           0             1             1
0
1166           0             1             0
0
1167           0             1             1
0

      GarageType_BuiltIn  GarageType_CarPort  GarageType_Detchd  \
PavedDrive_P
0                      0                   0                  0
0
1                      0                   0                  0
0
2                      0                   0                  0
0
3                      0                   0                  0
0
4                      0                   0                  0
0
...                  ...                 ...                ...
...
1163                   0                   0                  1
0
1164                   0                   0                  1
0
1165                   0                   0                  0
0
1166                   0                   0                  1
0
1167                   0                   0                  0
0

      PavedDrive_Y  SaleType_CWD  SaleType_Con  SaleType_ConLD  \
0                1             0             0               0
1                1             0             0               0
2                1             0             0               0
3                1             0             0               0
4                1             0             0               0
...            ...           ...           ...             ...
1163             1             0             0               0
1164             0             0             0               0
1165             1             0             0               0
1166             0             0             0               0
1167             1             0             0               0

      SaleType_ConLI  SaleType_ConLw  SaleType_New  SaleType_Oth
```

```
       SaleType_WD  \
0                0                0                0                0
1
1                0                0                0                0
1
2                0                0                0                0
1
3                0                0                0                0
0
4                0                0                0                0
1
...            ...              ...              ...              ...
...
1163             0                0                0                0
1
1164             0                0                0                0
1
1165             0                0                0                0
1
1166             0                0                0                0
1
1167             0                0                0                0
1

      SaleCondition_AdjLand  SaleCondition_Alloca
SaleCondition_Family  \
0                         0                     0
0
1                         0                     0
0
2                         0                     0
0
3                         0                     0
0
4                         0                     0
0
...                     ...                   ...                    ..
.
1163                      0                     0
0
1164                      0                     0
0
1165                      0                     0
0
1166                      0                     0
0
1167                      0                     0
0

      SaleCondition_Normal  SaleCondition_Partial
```

```
0                      1                    0
1                      1                    0
2                      1                    0
3                      1                    0
4                      1                    0
...                    ...                  ...
1163                   1                    0
1164                   1                    0
1165                   1                    0
1166                   1                    0
1167                   1                    0

[1168 rows x 193 columns]
```

#checking all null values
round(df.isnull().sum()/len(df.index),2)[round(df.isnull().sum()/len(df.index),2).values>0.00]

```
MasVnrArea        0.01
BsmtQual          0.03
BsmtCond          0.03
BsmtExposure      0.03
BsmtFinType1      0.03
BsmtFinType2      0.03
GarageType        0.05
GarageFinish      0.05
GarageQual        0.05
GarageCond        0.05
GarageYrBlt_Age   0.05
dtype: float64
```

df.corr()

```
                        MSSubClass    LotArea   LotShape   LandSlope
OverallQual   \
MSSubClass                1.000000  -0.124151   0.077077   -0.014930
0.070462
LotArea                  -0.124151   1.000000   0.002460    0.395410
0.107188
LotShape                  0.077077   0.002460   1.000000   -0.037708    -
0.103230
LandSlope                -0.014930   0.395410  -0.037708    1.000000    -
0.084261
OverallQual               0.070462   0.107188  -0.103230   -0.084261
1.000000

...                            ...        ...        ...         ...
...
SaleCondition_AdjLand     0.018503  -0.016252   0.004998   -0.013256    -
0.046593
SaleCondition_Alloca      0.034183   0.011548   0.024342    0.036760    -
0.050430
```

```
SaleCondition_Family      0.007158 -0.016254  0.055524   0.045139    -
0.039416
SaleCondition_Normal      0.025423 -0.004047 -0.020325  -0.020564    -
0.139064
SaleCondition_Partial    -0.057171  0.033865 -0.021837  -0.040955
0.333335
```

	OverallCond	MasVnrArea	ExterQual	ExterCond \
MSSubClass	-0.056978	0.027868	0.031367	0.004413
LotArea	0.017513	0.121448	0.040480	-0.017011
LotShape	0.018512	-0.074128	-0.082677	0.029337
LandSlope	0.019606	-0.047084	-0.010480	0.002974
OverallQual	-0.083167	0.409163	0.575291	-0.137306
...	...	...	...	...
SaleCondition_AdjLand	-0.044122	-0.012825	-0.042192	0.045276
SaleCondition_Alloca	-0.038912	-0.010493	-0.004169	0.040774
SaleCondition_Family	-0.023043	-0.010718	-0.067399	-0.012012
SaleCondition_Normal	0.180035	-0.075116	-0.189811	0.060152
SaleCondition_Partial	-0.163984	0.163362	0.357706	-0.109840

	BsmtQual	BsmtCond	BsmtExposure	BsmtFinType1 \
MSSubClass	-0.083475	0.011126	0.064003	-0.041187
LotArea	0.000080	-0.029257	0.060699	-0.036841
LotShape	0.092444	0.064169	-0.041608	0.099003
LandSlope	0.008518	0.014780	0.055847	-0.009143
OverallQual	-0.206696	-0.228989	0.042259	-0.233234
...	...	...	...	...
SaleCondition_AdjLand	0.031106	0.074220	0.025986	0.013055

SaleCondition_Alloca	0.054064	0.115583	0.119802	0.066641
SaleCondition_Family	-0.008156	-0.039262	-0.045354	0.059344
SaleCondition_Normal	-0.054269	-0.016195	-0.053052	-0.014450
SaleCondition_Partial	0.029241	-0.039467	0.084340	-0.041746

	BsmtFinSF1	BsmtFinType2	BsmtFinSF2	BsmtUnfSF
MSSubClass	-0.052236	-0.049942	-0.062403	-0.134170
LotArea	0.221851	0.029940	0.056656	0.006600
LotShape	-0.060986	0.000167	-0.008636	-0.024337
LandSlope	0.090363	0.056534	0.062504	-0.109262
OverallQual	0.219643	-0.140668	-0.040893	0.308676
...	...	...	...	...
SaleCondition_AdjLand	-0.016539	0.021334	-0.016730	-0.038398
SaleCondition_Alloca	0.023340	0.037080	-0.029077	-0.065640
SaleCondition_Family	0.001577	0.015838	-0.005343	0.020007
SaleCondition_Normal	-0.017824	0.057417	0.062484	-0.162729
SaleCondition_Partial	0.045366	-0.111108	-0.091096	0.259501

	TotalBsmtSF	HeatingQC	CentralAir	1stFlrSF	2ndFlrSF
MSSubClass	-0.214042	-0.017862	0.113883	-0.227927	0.300366
LotArea	0.259733	-0.010255	-0.051182	0.312843	0.059803
LotShape	-0.091719	-0.008150	0.070236	-0.093710	-0.011729
LandSlope	0.006621	0.020265	0.011974	0.041459	-0.015997
OverallQual	0.528285	0.081583	-0.269386	0.458758	0.316624
...	...	...	...	...	...

SaleCondition_AdjLand	-0.062501	-0.013685	0.101729	-0.042484	-0.016382
SaleCondition_Alloca	-0.053029	-0.111563	0.006756	0.073455	-0.022910
SaleCondition_Family	0.020003	-0.051663	0.022216	0.024469	-0.035390
SaleCondition_Normal	-0.160887	0.046548	-0.000941	-0.163214	0.024947
SaleCondition_Partial	0.277445	0.051523	-0.085387	0.226597	0.002487

	LowQualFinSF	GrLivArea	BsmtFullBath	BsmtHalfBath \
MSSubClass	0.053737	0.086448	0.004556	0.008207
LotArea	-0.001915	0.281360	0.142387	0.059282
LotShape	0.043682	-0.074974	-0.056842	0.015048
LandSlope	0.019291	0.019250	0.104588	0.074245
OverallQual	-0.039295	0.599700	0.101732	-0.030702
...	...	...	...	...
SaleCondition_AdjLand	-0.007352	-0.045821	-0.019733	0.110095
SaleCondition_Alloca	-0.012778	0.034105	0.079692	-0.023965
SaleCondition_Family	-0.015691	-0.012855	-0.035449	0.058703
SaleCondition_Normal	-0.019194	-0.101982	0.028785	-0.033052
SaleCondition_Partial	-0.040033	0.166070	-0.011085	-0.037604

	FullBath	HalfBath	BedroomAbvGr	KitchenAbvGr \
MSSubClass	0.140807	0.168423	-0.013283	0.283506
LotArea	0.123197	0.007271	0.117351	-0.013075
LotShape	-0.086930	-0.070412	-0.030906	0.048928
LandSlope	-0.077542	-0.000910	-0.071350	-0.033515
OverallQual	0.548824	0.296134	0.099639	-0.178220
...	...	...	...	...

SaleCondition_AdjLand	-0.006642	-0.016109	0.044176	-0.012304
SaleCondition_Alloca	0.019239	0.005646	0.024810	0.253515
SaleCondition_Family	-0.014174	-0.055037	0.068753	0.070187
SaleCondition_Normal	-0.120687	0.002934	0.008601	-0.039104
SaleCondition_Partial	0.237076	0.064535	-0.063378	-0.066994

	KitchenQual	TotRmsAbvGrd	Fireplaces	GarageFinish \
MSSubClass	0.011261	0.051179	-0.035792	0.076505
LotArea	0.038422	0.184546	0.285983	0.029763
LotShape	-0.072009	-0.064411	-0.105403	0.021683
LandSlope	0.037313	-0.061724	0.100623	0.040885
OverallQual	0.446277	0.432579	0.390067	-0.062853
...	...	...	...	...
SaleCondition_AdjLand	0.009942	-0.010743	-0.055646	0.098035
SaleCondition_Alloca	-0.041118	0.066350	-0.005321	0.012910
SaleCondition_Family	-0.031368	0.035798	-0.011878	-0.008319
SaleCondition_Normal	-0.150557	-0.114459	0.035698	-0.086384
SaleCondition_Partial	0.277743	0.146827	0.074228	0.043871

	GarageCars	GarageArea	GarageQual	GarageCond \
MSSubClass	-0.027639	-0.092408	0.107870	0.095353
LotArea	0.158313	0.195162	-0.053968	-0.085978
LotShape	-0.108713	-0.086019	0.094594	0.062342
LandSlope	-0.033339	-0.027278	0.014825	0.015550
OverallQual	0.596322	0.566782	-0.209694	-0.288502

```
...                            ...        ...        ...        ...

SaleCondition_AdjLand    -0.120080  -0.113991   0.126112   0.153539

SaleCondition_Alloca      0.030550  -0.007934   0.052296   0.025033

SaleCondition_Family     -0.018446  -0.022290  -0.026864  -0.027750

SaleCondition_Normal     -0.122276  -0.130160  -0.040601  -0.051905

SaleCondition_Partial     0.294007   0.306687  -0.073381  -0.082279


                         WoodDeckSF  OpenPorchSF  EnclosedPorch
3SsnPorch  \
MSSubClass                -0.022609     0.017468      -0.004252  -
0.043210
LotArea                    0.216720     0.093080      -0.007446
0.025794
LotShape                  -0.085152    -0.019612       0.031851  -
0.000962
LandSlope                  0.089264    -0.047393       0.001663
0.014520
OverallQual                0.227137     0.341030      -0.098374
0.045919
...                            ...          ...            ...         .
..
SaleCondition_AdjLand     -0.044722    -0.007783      -0.021360  -
0.007338
SaleCondition_Alloca      -0.003668    -0.032082      -0.010241  -
0.012753
SaleCondition_Family      -0.022417    -0.040756       0.003711  -
0.015660
SaleCondition_Normal       0.037883    -0.102665       0.043642  -
0.017410
SaleCondition_Partial      0.020501     0.178907      -0.116308
0.025913

                         ScreenPorch  PoolArea   MiscVal   SalePrice  \
MSSubClass                -0.013291  0.009583 -0.023503  -0.044183
LotArea                    0.025256  0.097107  0.051679   0.249115
LotShape                  -0.021340  0.012004 -0.047531  -0.160647
LandSlope                  0.030839 -0.017377 -0.001636   0.003457
OverallQual                0.059387  0.072247 -0.025786   0.816351
...                            ...       ...       ...        ...
SaleCondition_AdjLand     -0.016026 -0.004505 -0.005108  -0.074474
SaleCondition_Alloca      -0.027853  0.131793 -0.008033  -0.030103
SaleCondition_Family      -0.014887 -0.009614 -0.010901  -0.047552
SaleCondition_Normal       0.019128 -0.073585  0.038018  -0.098339
```

SaleCondition_Partial	-0.010390	0.007083	-0.027812	0.327614

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age \
MSSubClass	-0.023988	-0.056618	0.038595
LotArea	-0.005506	-0.027228	0.035399
LotShape	0.142563	0.067062	-0.011235
LandSlope	0.085931	0.048599	0.005352
OverallQual	-0.575800	-0.555945	0.048759
...	...	...	...
SaleCondition_AdjLand	0.050447	0.044463	0.046520
SaleCondition_Alloca	0.010191	0.022518	-0.027739
SaleCondition_Family	0.049536	0.059098	0.065293
SaleCondition_Normal	0.179538	0.135972	-0.167936
SaleCondition_Partial	-0.374144	-0.342134	0.148798

	GarageYrBlt_Age	MSZoning_FV	MSZoning_RH	MSZoning_RL \
MSSubClass	-0.077630	0.169130	0.066187	-0.308607
LotArea	0.034981	-0.093624	-0.040865	0.209905
LotShape	0.109670	0.079639	0.050794	-0.207461
LandSlope	0.084241	-0.048811	-0.000711	0.040376
OverallQual	-0.541719	0.166004	-0.072468	0.119047
...	...	...	...	...
SaleCondition_AdjLand	0.046224	-0.012654	-0.006909	0.029812
SaleCondition_Alloca	0.020576	-0.021993	-0.012007	-0.011226
SaleCondition_Family	0.057637	-0.027006	-0.014744	-0.039588
SaleCondition_Normal	0.193459	-0.127502	-0.036455	0.049482
SaleCondition_Partial	-0.371799	0.203367	-0.037618	0.008718

	MSZoning_RM	LandContour_HLS	LandContour_Low \
MSSubClass	0.237026	0.007760	-0.023630
LotArea	-0.173430	0.090886	0.317317
LotShape	0.169873	-0.089527	-0.001128
LandSlope	-0.038863	0.231616	0.515997

OverallQual	-0.177852	0.078141	-0.058943
...	...	...	...
SaleCondition_AdjLand	-0.023608	-0.011322	-0.009518
SaleCondition_Alloca	0.007971	0.025924	-0.016543
SaleCondition_Family	0.069961	0.050498	-0.020313
SaleCondition_Normal	0.051050	-0.058279	0.023791
SaleCondition_Partial	-0.111491	0.081218	-0.033143

	LandContour_Lvl	LotConfig_CulDSac	LotConfig_FR2 \
MSSubClass	-0.009970	-0.045649	-0.005342
LotArea	-0.250877	0.232208	-0.004037
LotShape	0.035409	-0.144371	0.026447
LandSlope	-0.524109	0.109587	-0.038558
OverallQual	0.039774	0.072633	-0.009099
...	...	...	...
SaleCondition_AdjLand	0.020020	0.047472	0.078451
SaleCondition_Alloca	-0.131767	0.046495	-0.017373
SaleCondition_Family	-0.002724	-0.031348	-0.021333
SaleCondition_Normal	0.047772	0.038564	0.017098
SaleCondition_Partial	-0.006950	-0.017301	-0.000916

	LotConfig_FR3	LotConfig_Inside	Neighborhood_Blueste \
MSSubClass	-0.011626	0.078144	0.101984
LotArea	0.004446	-0.169231	-0.040982
LotShape	-0.015562	0.128212	0.022623

LandSlope	-0.009365	-0.013892	-0.009365
OverallQual	0.041594	-0.039764	-0.003113
...	...	...	...
SaleCondition_AdjLand	-0.002428	-0.028867	-0.002428
SaleCondition_Alloca	-0.004220	0.025540	-0.004220
SaleCondition_Family	-0.005181	0.000371	-0.005181
SaleCondition_Normal	0.020119	-0.010885	0.020119
SaleCondition_Partial	-0.013220	0.033892	-0.013220

	Neighborhood_BrDale	Neighborhood_BrkSide \
MSSubClass	0.240102	-0.033636
LotArea	-0.094238	-0.073305
LotShape	0.053262	0.014129
LandSlope	-0.022049	-0.018032
OverallQual	-0.026467	-0.168087
...	...	...
SaleCondition_AdjLand	-0.005716	-0.012397
SaleCondition_Alloca	-0.009934	-0.021546
SaleCondition_Family	0.059762	0.007879
SaleCondition_Normal	-0.020294	0.059685
SaleCondition_Partial	-0.031124	-0.067503

	Neighborhood_ClearCr	Neighborhood_CollgCr \
MSSubClass	-0.010427	-0.109011
LotArea	0.329017	-0.030654
LotShape	0.001220	-0.000233
LandSlope	0.371049	-0.025782
OverallQual	-0.006544	0.142450
...	...	...
SaleCondition_AdjLand	-0.008491	-0.019652
SaleCondition_Alloca	-0.014757	-0.034155
SaleCondition_Family	-0.018121	-0.041941
SaleCondition_Normal	0.008940	0.025510
SaleCondition_Partial	-0.025400	0.049909

	Neighborhood_Crawfor	Neighborhood_Edwards \
MSSubClass	0.008536	-0.010472
LotArea	0.025475	0.002609
LotShape	-0.071114	0.071201
LandSlope	0.111387	0.019602
OverallQual	0.020167	-0.205445
...	...	...

SaleCondition_AdjLand	-0.011735	0.211948
SaleCondition_Alloca	0.067833	0.037912
SaleCondition_Family	0.047182	-0.034603
SaleCondition_Normal	0.006696	-0.009778
SaleCondition_Partial	-0.048540	-0.042271

	Neighborhood_Gilbert	Neighborhood_IDOTRR \
MSSubClass	0.005999	-0.029439
LotArea	0.032984	-0.040875
LotShape	-0.083531	0.068731
LandSlope	-0.041197	0.039521
OverallQual	0.079367	-0.144630
...	...	...
SaleCondition_AdjLand	-0.014114	-0.009518
SaleCondition_Alloca	-0.024531	0.037129
SaleCondition_Family	0.000418	-0.020313
SaleCondition_Normal	-0.017046	-0.017519
SaleCondition_Partial	0.078988	-0.051826

	Neighborhood_MeadowV	Neighborhood_Mitchel \
MSSubClass	0.235677	-0.000621
LotArea	-0.084430	0.032596
LotShape	0.048136	-0.018107
LandSlope	-0.019926	0.050517
OverallQual	-0.112318	-0.071656
...	...	...
SaleCondition_AdjLand	-0.005166	-0.010150
SaleCondition_Alloca	-0.008978	0.032862
SaleCondition_Family	-0.011025	0.061025
SaleCondition_Normal	0.017895	0.006368
SaleCondition_Partial	-0.028128	-0.037690

	Neighborhood_NAmes	Neighborhood_NPkVill \
MSSubClass	-0.176628	0.164876
LotArea	-0.011149	-0.065807
LotShape	0.012686	0.007080
LandSlope	-0.038960	-0.018779
OverallQual	-0.225962	-0.006242
...	...	...
SaleCondition_AdjLand	-0.025186	-0.004868
SaleCondition_Alloca	-0.043773	-0.008461
SaleCondition_Family	0.022905	-0.010390
SaleCondition_Normal	0.076569	0.013930
SaleCondition_Partial	-0.137137	-0.026508

	Neighborhood_NWAmes	Neighborhood_NoRidge \
MSSubClass	-0.077801	-0.015198
LotArea	0.027875	0.072481
LotShape	-0.047018	-0.098450
LandSlope	-0.052157	-0.022060

OverallQual	0.041743	0.236146
...	...	...
SaleCondition_AdjLand	-0.013521	-0.010303
SaleCondition_Alloca	-0.023500	-0.017907
SaleCondition_Family	0.034617	-0.021989
SaleCondition_Normal	0.032472	0.034272
SaleCondition_Partial	-0.073624	-0.056102

	Neighborhood_NridgHt	Neighborhood_OldTown \
MSSubClass	0.047471	0.086247
LotArea	0.006106	-0.062828
LotShape	-0.027886	0.111687
LandSlope	-0.053081	-0.006029
OverallQual	0.361762	-0.143869
...	...	...
SaleCondition_AdjLand	-0.013761	-0.016527
SaleCondition_Alloca	-0.023917	0.003785
SaleCondition_Family	-0.029368	0.071181
SaleCondition_Normal	-0.140539	0.028522
SaleCondition_Partial	0.270463	-0.089990

	Neighborhood_SWISU	Neighborhood_Sawyer \
MSSubClass	0.062688	-0.089838
LotArea	-0.037139	-0.001203
LotShape	0.073912	-0.044527
LandSlope	-0.007907	-0.038963
OverallQual	-0.084362	-0.187750
...	...	...
SaleCondition_AdjLand	-0.007932	-0.013641
SaleCondition_Alloca	-0.013786	0.014752
SaleCondition_Family	-0.016928	0.002372
SaleCondition_Normal	0.016548	0.073571
SaleCondition_Partial	-0.043190	-0.074279

	Neighborhood_SawyerW	Neighborhood_Somerst \
MSSubClass	0.003981	0.097663
LotArea	-0.013455	-0.075883
LotShape	0.016285	0.068392
LandSlope	-0.018809	-0.056222
OverallQual	0.032181	0.220760
...	...	...
SaleCondition_AdjLand	-0.012526	-0.014575
SaleCondition_Alloca	0.144426	-0.025332
SaleCondition_Family	-0.026733	-0.031106
SaleCondition_Normal	0.007858	-0.167614
SaleCondition_Partial	-0.053742	0.274052

	Neighborhood_StoneBr	Neighborhood_Timber \
MSSubClass	0.090634	-0.055054
LotArea	-0.031017	0.168236

LotShape	-0.091998	-0.121194
LandSlope	-0.005244	0.052258
OverallQual	0.190030	0.115064
...	...	...
SaleCondition_AdjLand	-0.007538	-0.008491
SaleCondition_Alloca	-0.013102	-0.014757
SaleCondition_Family	-0.016088	-0.018121
SaleCondition_Normal	-0.058074	-0.037126
SaleCondition_Partial	0.122499	0.078767

	Neighborhood_Veenker	Condition1_Feedr \
MSSubClass	0.016136	-0.031481
LotArea	0.062262	-0.001759
LotShape	-0.060193	0.032912
LandSlope	-0.019926	-0.016884
OverallQual	0.056793	-0.140428
...	...	...
SaleCondition_AdjLand	-0.005166	0.048563
SaleCondition_Alloca	-0.008978	0.084404
SaleCondition_Family	-0.011025	-0.030862
SaleCondition_Normal	0.042807	-0.001949
SaleCondition_Partial	-0.028128	-0.027901

	Condition1_Norm	Condition1_PosA	Condition1_PosN \
MSSubClass	0.038495	-0.040168	-0.032409
LotArea	-0.028002	0.055572	0.032915
LotShape	-0.042306	-0.004916	0.013656
LandSlope	0.038863	0.025926	-0.027481
OverallQual	0.083615	0.029074	0.062891
...	...	...	...
SaleCondition_AdjLand	-0.018684	-0.004212	-0.007124
SaleCondition_Alloca	-0.032473	-0.007321	-0.012382
SaleCondition_Family	0.010269	-0.008990	-0.015205
SaleCondition_Normal	-0.000759	0.034907	0.022659
SaleCondition_Partial	0.026201	-0.022937	0.010564

	Condition1_RRAe	Condition1_RRAn	Condition1_RRNe \

MSSubClass	-0.030575	-0.013437	0.003193
LotArea	0.012973	0.022649	-0.005147
LotShape	-0.006029	-0.013086	-0.053747
LandSlope	-0.019926	-0.029847	-0.009365
OverallQual	-0.041855	0.037572	0.011789
...	...	...	...
SaleCondition_AdjLand	-0.005166	-0.007737	-0.002428
SaleCondition_Alloca	-0.008978	-0.013448	-0.004220
SaleCondition_Family	-0.011025	-0.016513	-0.005181
SaleCondition_Normal	-0.031929	-0.019839	0.020119
SaleCondition_Partial	0.005672	0.048997	-0.013220

	Condition1_RRNn	Condition2_Feedr	Condition2_Norm \
MSSubClass	-0.019951	0.002683	-0.054470
LotArea	-0.008474	-0.013418	-0.027369
LotShape	-0.076074	-0.071168	0.084908
LandSlope	-0.013256	-0.016249	-0.002799
OverallQual	0.058874	-0.031258	-0.003044
...	...	...	...
SaleCondition_AdjLand	-0.003436	-0.004212	0.006457
SaleCondition_Alloca	-0.005973	-0.007321	0.011222
SaleCondition_Family	-0.007334	-0.008990	0.013780
SaleCondition_Normal	-0.008811	0.004435	0.026564
SaleCondition_Partial	0.031879	-0.022937	-0.019160

	Condition2_PosA	Condition2_PosN	Condition2_RRAe \

MSSubClass	0.012731	-0.016565	0.023204
LotArea	0.009858	0.078467	0.027480
LotShape	0.015990	-0.015562	-0.037988
LandSlope	-0.006619	-0.009365	-0.006619
OverallQual	0.082065	0.116107	-0.023267
...	...	...	...
SaleCondition_AdjLand	-0.001716	-0.002428	-0.001716
SaleCondition_Alloca	-0.002982	-0.004220	-0.002982
SaleCondition_Family	-0.003662	-0.005181	-0.003662
SaleCondition_Normal	0.014220	-0.085257	0.014220
SaleCondition_Partial	-0.009344	0.129750	-0.009344

	Condition2_RRAn	Condition2_RRNn	BldgType_2fmCon \
MSSubClass	0.023204	-0.025674	0.465772
LotArea	0.003319	-0.007355	0.109876
LotShape	-0.037988	-0.037988	0.052511
LandSlope	-0.006619	-0.006619	0.065533
OverallQual	-0.023267	-0.023267	-0.114067
...	...	...	...
SaleCondition_AdjLand	-0.001716	-0.001716	-0.009018
SaleCondition_Alloca	-0.002982	-0.002982	-0.015673
SaleCondition_Family	-0.003662	-0.003662	-0.019245
SaleCondition_Normal	0.014220	0.014220	0.045735
SaleCondition_Partial	-0.009344	-0.009344	-0.049102

	BldgType_Duplex	BldgType_Twnhs	BldgType_TwnhsE \

MSSubClass	0.151195	0.382419	0.524646
LotArea	-0.019127	-0.143780	-0.184247
LotShape	0.026984	0.077016	0.027593
LandSlope	-0.043130	-0.036082	-0.031420
OverallQual	-0.158296	0.019683	0.149252
...	...	...	...
SaleCondition_AdjLand	0.148081	-0.009354	-0.016938
SaleCondition_Alloca	0.303504	-0.016257	-0.029439
SaleCondition_Family	0.089436	0.024705	-0.010086
SaleCondition_Normal	-0.073055	0.007515	-0.023009
SaleCondition_Partial	-0.060882	-0.050933	0.074011

	HouseStyle_1.5Unf	HouseStyle_1Story \
MSSubClass	-0.002271	-0.457156
LotArea	-0.039009	0.001154
LotShape	0.055655	-0.030874
LandSlope	0.006860	0.023430
OverallQual	-0.038210	-0.131089
...	...	...
SaleCondition_AdjLand	-0.005973	-0.028710
SaleCondition_Alloca	-0.010381	0.001047
SaleCondition_Family	-0.012747	0.029089
SaleCondition_Normal	0.049494	-0.072524
SaleCondition_Partial	-0.032522	0.080127

	HouseStyle_2.5Fin	HouseStyle_2.5Unf \
MSSubClass	0.062875	0.091397
LotArea	0.012995	-0.013504
LotShape	0.042415	0.016490
LandSlope	0.060568	-0.021013
OverallQual	0.010129	0.026453
...	...	...
SaleCondition_AdjLand	-0.004552	-0.005448
SaleCondition_Alloca	-0.007911	-0.009468
SaleCondition_Family	-0.009714	-0.011626
SaleCondition_Normal	-0.018727	0.045142
SaleCondition_Partial	-0.024785	-0.029662

	HouseStyle_2Story	HouseStyle_SFoyer

	HouseStyle_SLvl	
MSSubClass	0.333740	0.181210
	0.134255	
LotArea	-0.015165	-0.047703
	0.006824	
LotShape	-0.017287	-0.014706	-
	0.064887	
LandSlope	-0.027276	-0.037952	-
	0.000276	
OverallQual	0.303053	-0.088106	-
	0.009121	
...	...	...
...		
SaleCondition_AdjLand	-0.039208	0.079940	-
	0.012003	
SaleCondition_Alloca	-0.031398	0.138938
	0.022342	
SaleCondition_Family	-0.038555	0.021581	-
	0.025617	
SaleCondition_Normal	0.013783	-0.025227
	0.044044	
SaleCondition_Partial	0.042339	-0.035467	-
	0.065359	

	RoofStyle_Gable	RoofStyle_Gambrel
RoofStyle_Hip \		
MSSubClass	0.114885	0.020807	-
	0.120545	
LotArea	-0.086837	-0.014481
	0.050052	
LotShape	0.023199	0.030081	-
	0.021408	
LandSlope	-0.042117	0.014554	-
	0.049294	
OverallQual	-0.141456	-0.041855
	0.157013	
...	...	...	.
..		
SaleCondition_AdjLand	-0.040328	0.162434	-
	0.028634	
SaleCondition_Alloca	-0.028870	-0.008978
	0.014820	
SaleCondition_Family	0.032041	-0.011025	-
	0.025863	
SaleCondition_Normal	0.008969	0.017895	-
	0.005755	
SaleCondition_Partial	-0.040223	-0.028128
	0.053923	

RoofStyle_Mansard RoofStyle_Shed

```
                       RoofMatl_CompShg  \
MSSubClass                    0.023823          0.008132
0.029861
LotArea                       0.003580          0.049761          -
0.238058
LotShape                      0.011635         -0.015562
0.021037
LandSlope                    -0.014827          0.136482          -
0.264785
OverallQual                   0.004509         -0.003113          -
0.093348
...                                ...               ...
...
SaleCondition_AdjLand        -0.003844         -0.002428          -
0.094813
SaleCondition_Alloca         -0.006680         -0.004220          -
0.045091
SaleCondition_Family         -0.008203         -0.005181
0.018121
SaleCondition_Normal          0.031852          0.020119
0.037126
SaleCondition_Partial        -0.020929         -0.013220
0.004566


                       RoofMatl_Membran  RoofMatl_Metal  RoofMatl_Roll
\
MSSubClass                    -0.025674        0.016222       0.023204

LotArea                        0.093567        0.035859       0.002812

LotShape                      -0.037988       -0.037988       0.015990

LandSlope                      0.199551        0.199551      -0.006619

OverallQual                    0.018866       -0.002200      -0.023267

...                                 ...             ...             ...

SaleCondition_AdjLand         -0.001716       -0.001716      -0.001716

SaleCondition_Alloca          -0.002982       -0.002982      -0.002982

SaleCondition_Family          -0.003662       -0.003662      -0.003662

SaleCondition_Normal           0.014220        0.014220       0.014220

SaleCondition_Partial         -0.009344       -0.009344      -0.009344
```

	RoofMatl_Tar&Grv	RoofMatl_WdShake
RoofMatl_WdShngl \		
MSSubClass	-0.021652	-0.023447
-0.018743		
LotArea	0.117286	0.041080
0.162154		
LotShape	-0.034917	-0.022026
-0.004916		
LandSlope	0.208061	0.089962
0.025926		
OverallQual	-0.006985	0.058874
0.115261		
...	...	...
...		
SaleCondition_AdjLand	0.153620	-0.003436
-0.004212		
SaleCondition_Alloca	0.082687	-0.005973
-0.007321		
SaleCondition_Family	-0.011626	-0.007334
-0.008990		
SaleCondition_Normal	-0.073078	-0.008811
0.034907		
SaleCondition_Partial	0.002417	-0.018712
-0.022937		

	Exterior1st_AsphShn	Exterior1st_BrkComm \
MSSubClass	0.023204	-0.025674
LotArea	-0.002157	-0.002987
LotShape	0.015990	0.015990
LandSlope	-0.006619	-0.006619
OverallQual	-0.023267	-0.023267
...	...	...
SaleCondition_AdjLand	-0.001716	-0.001716
SaleCondition_Alloca	-0.002982	-0.002982
SaleCondition_Family	-0.003662	-0.003662
SaleCondition_Normal	0.014220	-0.060260
SaleCondition_Partial	-0.009344	-0.009344

	Exterior1st_BrkFace	Exterior1st_CemntBd \
MSSubClass	-0.050766	0.132255
LotArea	0.007885	-0.025107
LotShape	0.009827	0.020705
LandSlope	0.022400	0.004908
OverallQual	-0.024381	0.137708
...	...	...
SaleCondition_AdjLand	-0.011181	-0.011322
SaleCondition_Alloca	0.026701	-0.019677
SaleCondition_Family	-0.023863	-0.024163
SaleCondition_Normal	0.068982	-0.093379
SaleCondition_Partial	-0.060882	0.160588

	Exterior1st_HdBoard	Exterior1st_ImStucc \
MSSubClass	-0.020493	-0.025674
LotArea	-0.019245	0.006461
LotShape	-0.074392	0.015990
LandSlope	-0.004135	-0.006619
OverallQual	-0.096975	0.039932
...	...	...
SaleCondition_AdjLand	-0.024939	-0.001716
SaleCondition_Alloca	-0.019776	-0.002982
SaleCondition_Family	0.004658	-0.003662
SaleCondition_Normal	0.122004	0.014220
SaleCondition_Partial	-0.135796	-0.009344

	Exterior1st_MetalSd	Exterior1st_Plywood \
MSSubClass	0.088377	0.057756
LotArea	-0.097303	0.156990
LotShape	0.077880	-0.066777
LandSlope	0.013172	0.133964
OverallQual	-0.179307	-0.056250
...	...	...
SaleCondition_AdjLand	0.015920	-0.017242
SaleCondition_Alloca	-0.043202	0.158215
SaleCondition_Family	0.004967	0.065902
SaleCondition_Normal	0.054456	-0.010010
SaleCondition_Partial	-0.094231	-0.093885

	Exterior1st_Stone	Exterior1st_Stucco \
MSSubClass	-0.036323	-0.009599
LotArea	0.019991	0.020376
LotShape	-0.053747	0.040845
LandSlope	-0.009365	0.013026
OverallQual	0.026692	0.012247
...	...	...
SaleCondition_AdjLand	-0.002428	-0.008122
SaleCondition_Alloca	-0.004220	0.048339
SaleCondition_Family	-0.005181	0.033793
SaleCondition_Normal	-0.085257	0.003210
SaleCondition_Partial	-0.013220	-0.022485

	Exterior1st_VinylSd	Exterior1st_Wd Sdng \
MSSubClass	-0.065364	-0.053492
LotArea	-0.044541	0.067812
LotShape	-0.028987	0.037886
LandSlope	-0.130108	0.066277
OverallQual	0.358761	-0.152581
...	...	...
SaleCondition_AdjLand	-0.041985	0.016633
SaleCondition_Alloca	-0.055035	0.005063
SaleCondition_Family	-0.045556	0.025738

```
SaleCondition_Normal              -0.158270          0.074767
SaleCondition_Partial              0.302078         -0.125248

                          Exterior1st_WdShing  Exterior2nd_AsphShn  \
MSSubClass                          -0.036097             0.024086
LotArea                              0.005722             0.001078
LotShape                             0.007843             0.027720
LandSlope                           -0.029078            -0.011475
OverallQual                         -0.048631            -0.028161
...                                       ...                  ...
SaleCondition_AdjLand                0.108313            -0.002975
SaleCondition_Alloca                -0.013102            -0.005170
SaleCondition_Family                -0.016088            -0.006349
SaleCondition_Normal                -0.006413             0.024651
SaleCondition_Partial                0.005681            -0.016198

                          Exterior2nd_Brk Cmn  Exterior2nd_BrkFace  \
MSSubClass                           0.117665            -0.015012
LotArea                             -0.049324            -0.010367
LotShape                             0.035817            -0.000917
LandSlope                           -0.014827             0.016635
OverallQual                         -0.014366            -0.000423
...                                       ...                  ...
SaleCondition_AdjLand               -0.003844            -0.007737
SaleCondition_Alloca                -0.006680            -0.013448
SaleCondition_Family                -0.008203            -0.016513
SaleCondition_Normal                -0.001514             0.064118
SaleCondition_Partial               -0.020929            -0.042131

                          Exterior2nd_CmentBd  Exterior2nd_HdBoard  \
MSSubClass                           0.132255             0.002863
LotArea                             -0.025601             0.020752
LotShape                             0.012225            -0.052112
LandSlope                           -0.011285             0.009267
OverallQual                          0.150945            -0.078198
...                                       ...                  ...
SaleCondition_AdjLand               -0.011322            -0.024194
SaleCondition_Alloca                -0.019677            -0.017975
SaleCondition_Family                -0.024163            -0.012217
SaleCondition_Normal                -0.093379             0.114012
SaleCondition_Partial                0.160588            -0.131740

                          Exterior2nd_ImStucc  Exterior2nd_MetalSd  \
MSSubClass                           0.021259             0.085615
LotArea                             -0.010024            -0.098747
LotShape                            -0.012062             0.072215
LandSlope                           -0.018779             0.016053
OverallQual                          0.053521            -0.171843
...                                       ...                  ...
SaleCondition_AdjLand               -0.004868             0.016814
```

```
SaleCondition_Alloca          -0.008461           -0.042484
SaleCondition_Family           0.073882            0.006533
SaleCondition_Normal          -0.038894            0.049244
SaleCondition_Partial         -0.026508           -0.091496

                        Exterior2nd_Other  Exterior2nd_Plywood  \
MSSubClass                      -0.025674            -0.047682
LotArea                          0.002672             0.169574
LotShape                        -0.037988            -0.105006
LandSlope                       -0.006619             0.114281
OverallQual                      0.039932            -0.115157
...                                   ...                  ...
SaleCondition_AdjLand           -0.001716             0.077608
SaleCondition_Alloca            -0.002982             0.134884
SaleCondition_Family            -0.003662             0.050313
SaleCondition_Normal            -0.060260            -0.003404
SaleCondition_Partial            0.091708            -0.107005

                        Exterior2nd_Stone  Exterior2nd_Stucco  \
MSSubClass                      -0.016455            -0.003037
LotArea                          0.032085             0.024045
LotShape                        -0.022026             0.043331
LandSlope                       -0.013256             0.011352
OverallQual                     -0.025500            -0.023958
...                                   ...                  ...
SaleCondition_AdjLand           -0.003436            -0.008308
SaleCondition_Alloca             0.139361             0.046669
SaleCondition_Family            -0.007334             0.032294
SaleCondition_Normal            -0.046099            -0.009544
SaleCondition_Partial           -0.018712            -0.023968

                        Exterior2nd_VinylSd  Exterior2nd_Wd Sdng  \
MSSubClass                      -0.073942            -0.054631
LotArea                         -0.039324             0.021276
LotShape                        -0.024679             0.049309
LandSlope                       -0.127150             0.072757
OverallQual                      0.354188            -0.150781
...                                   ...                  ...
SaleCondition_AdjLand           -0.010130            -0.023776
SaleCondition_Alloca            -0.053682             0.007430
SaleCondition_Family            -0.043768             0.029079
SaleCondition_Normal            -0.157871             0.096958
SaleCondition_Partial            0.302751            -0.120979

                        Exterior2nd_Wd Shng  MasVnrType_BrkFace  \
MSSubClass                       0.027341             0.041509
LotArea                         -0.023239            -0.018154
LotShape                         0.021443            -0.065726
LandSlope                       -0.018581            -0.090080
OverallQual                     -0.008579             0.230621
```

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...                                     ...                        ...
SaleCondition_AdjLand               -0.009680              -0.006771
SaleCondition_Alloca               -0.016823              -0.048716
SaleCondition_Family               -0.020658               0.023358
SaleCondition_Normal                0.012450               0.040702
SaleCondition_Partial              -0.015931              -0.011144

                          MasVnrType_None  MasVnrType_Stone
Foundation_CBlock  \
MSSubClass                   -0.020355         -0.008711          -
0.095914
LotArea                      -0.043550          0.057471
0.068197
LotShape                      0.104017         -0.073852          -
0.019532
LandSlope                     0.073041          0.007691
0.059902
OverallQual                  -0.375631          0.306163          -
0.442811
...                               ...               ...
...
SaleCondition_AdjLand         0.017738         -0.017741          -
0.022639
SaleCondition_Alloca          0.030829         -0.000210          -
0.005153
SaleCondition_Family         -0.011840         -0.012793
0.028663
SaleCondition_Normal          0.067731         -0.175133
0.164572
SaleCondition_Partial        -0.150964          0.297834          -
0.272059

                          Foundation_PConc  Foundation_Slab
Foundation_Stone  \
MSSubClass                    0.076252          0.003515
0.036336
LotArea                      -0.040612         -0.018777          -
0.007229
LotShape                     -0.054182          0.050150
0.011635
LandSlope                    -0.072542         -0.007907
0.031354
OverallQual                   0.580294         -0.177101          -
0.014366
...                               ...               ...
...
SaleCondition_AdjLand         0.007180         -0.007932          -
0.003844
SaleCondition_Alloca         -0.038844          0.177906          -
0.006680
```

SaleCondition_Family	-0.040696	-0.016928	-0.008203
SaleCondition_Normal	-0.193373	0.016548	-0.001514
SaleCondition_Partial	0.348769	-0.043190	-0.020929

	Foundation_Wood	Heating_GasA	Heating_GasW \
MSSubClass	-0.004726	-0.057968	0.080743
LotArea	0.005392	0.016385	0.006147
LotShape	-0.037988	-0.037152	0.031151
LandSlope	0.096466	0.012610	-0.024906
OverallQual	0.039932	0.117549	-0.025265
...	...	...	...
SaleCondition_AdjLand	-0.001716	0.008670	-0.006457
SaleCondition_Alloca	-0.002982	0.015068	-0.011222
SaleCondition_Family	-0.003662	-0.029522	0.050089
SaleCondition_Normal	0.014220	-0.041740	0.033488
SaleCondition_Partial	-0.009344	0.047207	-0.035158

	Heating_Grav	Heating_OthW	Heating_Wall \
MSSubClass	-0.029354	0.012731	0.032486
LotArea	-0.026080	-0.002893	-0.015134
LotShape	0.011635	0.015990	0.032022
LandSlope	0.031354	-0.006619	-0.013256
OverallQual	-0.089865	-0.002200	-0.109874
...	...	...	...
SaleCondition_AdjLand	-0.003844	-0.001716	-0.003436
SaleCondition_Alloca	-0.006680	-0.002982	-0.005973
SaleCondition_Family	-0.008203	-0.003662	-0.007334
SaleCondition_Normal	-0.001514	0.014220	0.028477
SaleCondition_Partial	-0.020929	-0.009344	-0.018712

	Electrical_FuseF	Electrical_FuseP	Electrical_Mix \
MSSubClass	-0.006475	0.082226	-0.018691
LotArea	-0.033692	-0.013385	-0.004962
LotShape	0.038268	0.022623	0.015990
LandSlope	-0.007907	-0.009365	-0.006619
OverallQual	-0.116821	-0.032918	-0.023267
...	...	...	...
SaleCondition_AdjLand	0.102360	0.352036	-0.001716
SaleCondition_Alloca	-0.013786	-0.004220	-

0.002982

SaleCondition_Family	-0.016928	-0.005181	-0.003662
SaleCondition_Normal	0.032942	-0.032569	-0.060260
SaleCondition_Partial	-0.043190	-0.013220	-0.009344

	Electrical_SBrkr	Functional_Maj2	Functional_Min1
MSSubClass	0.038913	-0.033934	-0.033753
LotArea	0.052780	-0.007860	0.051565
LotShape	-0.051425	0.004998	-0.017390
LandSlope	-0.018566	-0.013256	0.049887
OverallQual	0.262766	-0.046593	-0.083490
...	...	...	...
SaleCondition_AdjLand	-0.087980	-0.003436	-0.008670
SaleCondition_Alloca	0.000210	-0.005973	-0.015068
SaleCondition_Family	0.012793	-0.007334	0.029522
SaleCondition_Normal	-0.013441	-0.008811	0.026688
SaleCondition_Partial	0.096601	-0.018712	-0.047207

	Functional_Min2	Functional_Mod	Functional_Sev
MSSubClass	-0.019757	-0.014423	0.002257
LotArea	0.010491	0.018920	0.026042
LotShape	-0.001128	-0.006970	-0.037988
LandSlope	0.096698	0.036760	-0.006619
OverallQual	-0.129051	-0.062650	-0.002200
...	...	...	...
SaleCondition_AdjLand	-0.009518	-0.005973	-0.001716

SaleCondition_Alloca	-0.016543	-0.010381	-0.002982
SaleCondition_Family	-0.020313	-0.012747	-0.003662
SaleCondition_Normal	0.051332	0.027891	-0.060260
SaleCondition_Partial	-0.051826	-0.032522	-0.009344

	Functional_Typ	GarageType_Attchd	GarageType_Basment \
MSSubClass	0.031933	-0.144657	0.032805
LotArea	-0.041265	0.138305	-0.002819
LotShape	0.014825	-0.135872	-0.003535
LandSlope	-0.125216	-0.026809	0.077105
OverallQual	0.181464	0.353267	-0.030062
...	...	...	...
SaleCondition_AdjLand	0.016214	-0.070556	-0.006909
SaleCondition_Alloca	-0.004866	-0.036262	0.134082
SaleCondition_Family	0.007551	-0.009177	-0.014744
SaleCondition_Normal	-0.058050	-0.009178	-0.055196
SaleCondition_Partial	0.088284	0.132921	-0.012191

	GarageType_BuiltIn	GarageType_CarPort \
MSSubClass	0.070660	0.038592
LotArea	0.026037	0.014746
LotShape	-0.008405	0.007080
LandSlope	-0.044393	0.054333
OverallQual	0.217239	-0.110829
...	...	...
SaleCondition_AdjLand	-0.014801	-0.004868
SaleCondition_Alloca	-0.025725	0.094482
SaleCondition_Family	-0.031589	-0.010390
SaleCondition_Normal	-0.060895	-0.038894
SaleCondition_Partial	0.131084	-0.026508

	GarageType_Detchd	PavedDrive_P	PavedDrive_Y \

MSSubClass	0.052736	-0.020676	-0.057245
LotArea	-0.131229	0.021599	0.014476
LotShape	0.124693	0.043331	-0.084297
LandSlope	0.005694	-0.010349	-0.008428
OverallQual	-0.334644	-0.063869	0.212407
...	...	...	...
SaleCondition_AdjLand	-0.002490	0.097172	-0.141681
SaleCondition_Alloca	-0.004329	-0.014440	-0.000105
SaleCondition_Family	0.033877	-0.017732	0.037651
SaleCondition_Normal	0.098024	0.053170	-0.043572
SaleCondition_Partial	-0.173552	-0.045240	0.096062

	SaleType_CWD	SaleType_Con	SaleType_ConLD \
MSSubClass	0.011982	0.032830	0.104210
LotArea	-0.000868	-0.003431	-0.001942
LotShape	0.027720	-0.015562	0.026222
LandSlope	-0.011475	-0.009365	-0.018779
OverallQual	0.008359	0.041594	-0.043595
...	...	...	...
SaleCondition_AdjLand	-0.002975	-0.002428	-0.004868
SaleCondition_Alloca	-0.005170	-0.004220	-0.008461
SaleCondition_Family	0.130971	-0.005181	-0.010390
SaleCondition_Normal	-0.018387	0.020119	-0.012482
SaleCondition_Partial	-0.016198	-0.013220	0.009327

	SaleType_ConLI	SaleType_ConLw	SaleType_New \
MSSubClass	-0.001201	0.011511	-0.052425
LotArea	0.001576	-0.018013	0.028806
LotShape	-0.012546	0.059046	-0.019782
LandSlope	-0.014827	-0.013256	-0.060944
OverallQual	0.004509	-0.036047	0.334451
...	...	...	...
SaleCondition_AdjLand	-0.003844	-0.003436	-0.018520
SaleCondition_Alloca	-0.006680	-0.005973	-0.032189
SaleCondition_Family	-0.008203	-0.007334	-0.039526
SaleCondition_Normal	-0.001514	0.028477	-0.650360
SaleCondition_Partial	-0.020929	-0.018712	0.989764

	SaleType_Oth	SaleType_WD	SaleCondition_AdjLand
MSSubClass	-0.016262	0.042889	0.018503
LotArea	-0.006949	-0.011638	-0.016252
LotShape	-0.003472	0.004203	0.004998
LandSlope	-0.011475	0.075865	-0.013256
OverallQual	-0.064680	-0.219540	-0.046593
...	...	...	...
SaleCondition_AdjLand	-0.002975	0.024111	1.000000
SaleCondition_Alloca	-0.005170	0.041906	-0.005973
SaleCondition_Family	-0.006349	0.031700	-0.007334
SaleCondition_Normal	-0.104463	0.617576	-0.120675
SaleCondition_Partial	-0.016198	-0.767664	-0.018712

	SaleCondition_Alloca	SaleCondition_Family
MSSubClass	0.034183	0.007158
LotArea	0.011548	-0.016254
LotShape	0.024342	0.055524
LandSlope	0.036760	0.045139
OverallQual	-0.050430	-0.039416
...	...	...
SaleCondition_AdjLand	-0.005973	-0.007334
SaleCondition_Alloca	1.000000	-0.012747
SaleCondition_Family	-0.012747	1.000000
SaleCondition_Normal	-0.209737	-0.257544
SaleCondition_Partial	-0.032522	-0.039934

	SaleCondition_Normal	SaleCondition_Partial
MSSubClass	0.025423	-0.057171
LotArea	-0.004047	0.033865
LotShape	-0.020325	-0.021837
LandSlope	-0.020564	-0.040955
OverallQual	-0.139064	0.333335
...	...	...
SaleCondition_AdjLand	-0.120675	-0.018712
SaleCondition_Alloca	-0.209737	-0.032522
SaleCondition_Family	-0.257544	-0.039934
SaleCondition_Normal	1.000000	-0.657086
SaleCondition_Partial	-0.657086	1.000000

```
[193 rows x 193 columns]

df.shape

(1168, 193)

df.corr()['SalePrice'].sort_values()

YearBuilt_Age        -0.576723
YearRemodAdd_Age     -0.571524
GarageYrBlt_Age      -0.529527
GarageType_Detchd    -0.381623
MasVnrType_None      -0.371454
                      ...
GarageArea            0.645829
GarageCars            0.671233
GrLivArea             0.693082
OverallQual           0.816351
SalePrice             1.000000
Name: SalePrice, Length: 193, dtype: float64

f,ax=plt.subplots(figsize=(25,40))
sns.heatmap(df.corr(),xticklabels=df.corr().columns.values,yticklabels
=df.corr().columns.values,annot=True,linewidths=0.5,linecolor='black',
fmt='0.2f')
bottom,top=ax.get_ylim()
ax.set_ylim(bottom +0.5,top -0.5)
plt.show()
```
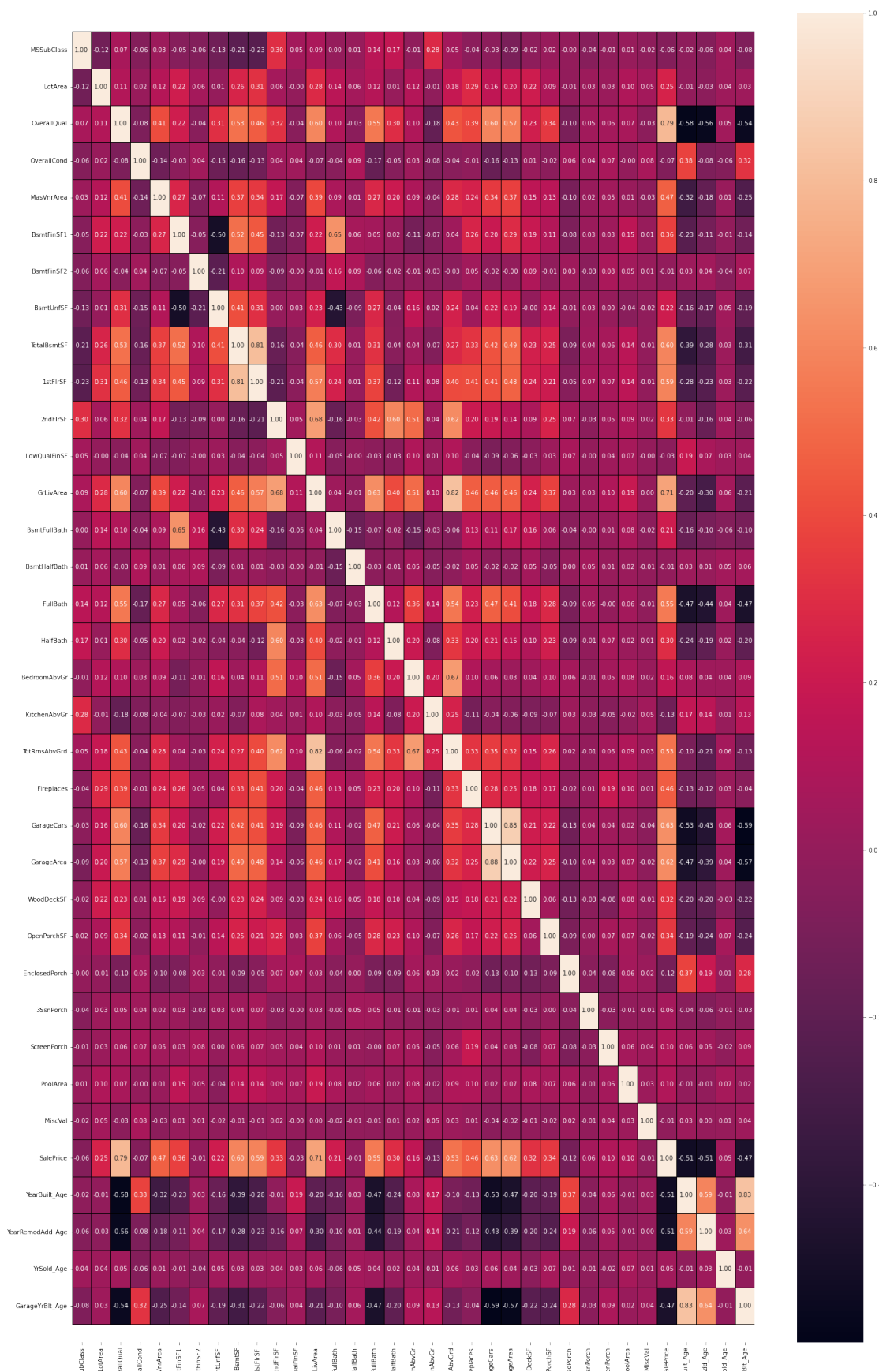
```
corr_val=df[list(df.dtypes[df.dtypes!='object'].index)].corr()
corr_val
```

	MSSubClass	LotArea	OverallQual	OverallCond	MasVnrArea \
MSSubClass	1.000000	-0.124151	0.070462	-0.056978	0.027868
LotArea	-0.124151	1.000000	0.107188	0.017513	0.121448
OverallQual	0.070462	0.107188	1.000000	-0.083167	0.409163
OverallCond	-0.056978	0.017513	-0.083167	1.000000	-0.137882
MasVnrArea	0.027868	0.121448	0.409163	-0.137882	1.000000
BsmtFinSF1	-0.052236	0.221851	0.219643	-0.028810	0.267066
BsmtFinSF2	-0.062403	0.056656	-0.040893	0.044336	-0.065723
BsmtUnfSF	-0.134170	0.006600	0.308676	-0.146384	0.109850
TotalBsmtSF	-0.214042	0.259733	0.528285	-0.162481	0.366833
1stFlrSF	-0.227927	0.312843	0.458758	-0.134420	0.339938
2ndFlrSF	0.300366	0.059803	0.316624	0.036668	0.173358
LowQualFinSF	0.053737	-0.001915	-0.039295	0.041877	-0.070518
GrLivArea	0.086448	0.281360	0.599700	-0.065006	0.387891
BsmtFullBath	0.004556	0.142387	0.101732	-0.039680	0.086720
BsmtHalfBath	0.008207	0.059282	-0.030702	0.091016	0.014198
FullBath	0.140807	0.123197	0.548824	-0.171931	0.268545
HalfBath	0.168423	0.007271	0.296134	-0.052125	0.200926
BedroomAbvGr	-0.013283	0.117351	0.099639	0.028393	0.091717
KitchenAbvGr	0.283506	-0.013075	-0.178220	-0.076047	-0.038281
TotRmsAbvGrd	0.051179	0.184546	0.432579	-0.039952	0.279391
Fireplaces	-0.035792	0.285983	0.390067	-0.013632	0.243812
GarageCars	-0.027639	0.158313	0.596322	-0.161996	0.342553
GarageArea	-0.092408	0.195162	0.566782	-0.126021	

```
                                                  0.365849
WoodDeckSF          -0.022609  0.216720   0.227137   0.012290
0.151978
OpenPorchSF          0.017468  0.093080   0.341030  -0.024899
0.131850
EnclosedPorch       -0.004252 -0.007446  -0.098374   0.056074  -
0.102321
3SsnPorch           -0.043210  0.025794   0.045919   0.040476
0.018721
ScreenPorch         -0.013291  0.025256   0.059387   0.069463
0.046509
PoolArea             0.009583  0.097107   0.072247  -0.003603
0.013590
MiscVal             -0.023503  0.051679  -0.025786   0.075178  -
0.027583
SalePrice           -0.060775  0.249499   0.789185  -0.065642
0.466386
YearBuilt_Age       -0.023988 -0.005506  -0.575800   0.377731  -
0.323006
YearRemodAdd_Age    -0.056618 -0.027228  -0.555945  -0.080669  -
0.181869
YrSold_Age           0.038595  0.035399   0.048759  -0.055517
0.013493
GarageYrBlt_Age     -0.077630  0.034981  -0.541719   0.318278  -
0.254547


                    BsmtFinSF1  BsmtFinSF2  BsmtUnfSF  TotalBsmtSF
1stFlrSF  \
MSSubClass          -0.052236   -0.062403  -0.134170   -0.214042 -
0.227927
LotArea              0.221851    0.056656   0.006600    0.259733
0.312843
OverallQual          0.219643   -0.040893   0.308676    0.528285
0.458758
OverallCond         -0.028810    0.044336  -0.146384   -0.162481 -
0.134420
MasVnrArea           0.267066   -0.065723   0.109850    0.366833
0.339938
BsmtFinSF1           1.000000   -0.052145  -0.499861    0.518940
0.445876
BsmtFinSF2          -0.052145    1.000000  -0.213580    0.098167
0.093442
BsmtUnfSF           -0.499861   -0.213580   1.000000    0.414186
0.307437
TotalBsmtSF          0.518940    0.098167   0.414186    1.000000
0.813357
1stFlrSF             0.445876    0.093442   0.307437    0.813357
1.000000
2ndFlrSF            -0.127656   -0.092049   0.002736   -0.164795 -
0.205683
```

	2ndFlrSF	LowQualFinSF	GrLivArea	BsmtFullBath	
LowQualFinSF	-0.070932	-0.000577	0.030088	-0.043845	-0.035870
GrLivArea	0.217160	-0.007484	0.232920	0.461067	0.566049
BsmtFullBath	0.645126	0.163518	-0.431740	0.296654	0.238026
BsmtHalfBath	0.063895	0.093692	-0.090372	0.009657	0.011042
FullBath	0.054511	-0.060773	0.272193	0.311120	0.374354
HalfBath	0.015767	-0.023734	-0.044025	-0.037014	-0.122019
BedroomAbvGr	-0.114888	-0.005788	0.156056	0.036237	0.106293
KitchenAbvGr	-0.065450	-0.034411	0.015532	-0.065410	0.084392
TotRmsAbvGrd	0.043499	-0.033702	0.237043	0.273895	0.399177
Fireplaces	0.257482	0.047945	0.040509	0.328241	0.406537
GarageCars	0.197529	-0.020806	0.221097	0.423592	0.414905
GarageArea	0.286290	-0.002051	0.191177	0.492980	0.475958
WoodDeckSF	0.192939	0.094690	-0.001966	0.234848	0.235467
OpenPorchSF	0.108802	-0.014103	0.138456	0.249284	0.211107
EnclosedPorch	-0.082351	0.032081	-0.013251	-0.087751	-0.047798
3SsnPorch	0.025485	-0.031263	0.025779	0.041295	0.068344
ScreenPorch	0.033490	0.076561	0.001076	0.064434	0.070193
PoolArea	0.154769	0.045990	-0.039029	0.139252	0.144006
MiscVal	0.008314	0.007915	-0.017266	-0.005920	-0.010792
SalePrice	0.362874	-0.010151	0.215724	0.595042	0.587642
YearBuilt_Age	-0.227933	0.027682	-0.155559	-0.386265	-0.279450
YearRemodAdd_Age	-0.114430	0.044694	-0.174732	-0.280720	-0.233384
YrSold_Age	-0.005614	-0.038438	0.049734	0.030448	0.028604
GarageYrBlt_Age	-0.135558	0.071691	-0.192237	-0.313928	-0.219750

```
              2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  \
```

	2ndFlrSF	LowQualFinSF	GrLivArea	BsmtFullBath
MSSubClass	0.300366	0.053737	0.086448	0.004556
LotArea	0.059803	-0.001915	0.281360	0.142387
OverallQual	0.316624	-0.039295	0.599700	0.101732
OverallCond	0.036668	0.041877	-0.065006	-0.039680
MasVnrArea	0.173358	-0.070518	0.387891	0.086720
BsmtFinSF1	-0.127656	-0.070932	0.217160	0.645126
BsmtFinSF2	-0.092049	-0.000577	-0.007484	0.163518
BsmtUnfSF	0.002736	0.030088	0.232920	-0.431740
TotalBsmtSF	-0.164795	-0.043845	0.461067	0.296654
1stFlrSF	-0.205683	-0.035870	0.566049	0.238026
2ndFlrSF	1.000000	0.046447	0.684802	-0.162017
LowQualFinSF	0.046447	1.000000	0.108485	-0.054033
GrLivArea	0.684802	0.108485	1.000000	0.036206
BsmtFullBath	-0.162017	-0.054033	0.036206	1.000000
BsmtHalfBath	-0.025422	-0.001615	-0.013145	-0.150317
FullBath	0.422460	-0.029220	0.626275	-0.070138
HalfBath	0.597111	-0.033099	0.403630	-0.020117
BedroomAbvGr	0.505511	0.099601	0.509273	-0.149870
KitchenAbvGr	0.040935	0.013767	0.097929	-0.034575
TotRmsAbvGrd	0.619871	0.103584	0.821845	-0.055266
Fireplaces	0.201345	-0.041799	0.464782	0.134348
GarageCars	0.188522	-0.089494	0.455707	0.105895
GarageArea	0.135475	-0.063572	0.459261	0.166060
WoodDeckSF	0.085662	-0.033553	0.242525	0.161772
OpenPorchSF	0.251556	0.025591	0.368318	0.060848
EnclosedPorch	0.065049	0.073690	0.025861	-0.038337
3SsnPorch	-0.026226	-0.004030	0.028401	-0.000783
ScreenPorch	0.047862	0.037403	0.095457	0.013853
PoolArea	0.090189	0.065630	0.188102	0.075230
MiscVal	0.015327	-0.003564	0.004425	-0.024692
SalePrice	0.330386	-0.032381	0.707300	0.212924
YearBuilt_Age	-0.011834	0.189044	-0.198644	-0.164983
YearRemodAdd_Age	-0.155102	0.072526	-0.295048	-0.104643
YrSold_Age	0.038241	0.034952	0.056401	-0.060557
GarageYrBlt_Age	-0.058220	0.037605	-0.210831	-0.102533

	BsmtHalfBath	FullBath	HalfBath	BedroomAbvGr \
MSSubClass	0.008207	0.140807	0.168423	-0.013283
LotArea	0.059282	0.123197	0.007271	0.117351
OverallQual	-0.030702	0.548824	0.296134	0.099639
OverallCond	0.091016	-0.171931	-0.052125	0.028393
MasVnrArea	0.014198	0.268545	0.200926	0.091717
BsmtFinSF1	0.063895	0.054511	0.015767	-0.114888
BsmtFinSF2	0.093692	-0.060773	-0.023734	-0.005788
BsmtUnfSF	-0.090372	0.272193	-0.044025	0.156056
TotalBsmtSF	0.009657	0.311120	-0.037014	0.036237
1stFlrSF	0.011042	0.374354	-0.122019	0.106293
2ndFlrSF	-0.025422	0.422460	0.597111	0.505511
LowQualFinSF	-0.001615	-0.029220	-0.033099	0.099601
GrLivArea	-0.013145	0.626275	0.403630	0.509273

BsmtFullBath	-0.150317	-0.070138	-0.020117	-0.149870
BsmtHalfBath	1.000000	-0.029929	-0.009073	0.051000
FullBath	-0.029929	1.000000	0.115699	0.357069
HalfBath	-0.009073	0.115699	1.000000	0.198263
BedroomAbvGr	0.051000	0.357069	0.198263	1.000000
KitchenAbvGr	-0.049367	0.137740	-0.075331	0.204218
TotRmsAbvGrd	-0.021023	0.544319	0.333965	0.672542
Fireplaces	0.054955	0.230161	0.200203	0.100466
GarageCars	-0.021730	0.468193	0.210440	0.058834
GarageArea	-0.020305	0.405734	0.159370	0.028543
WoodDeckSF	0.051038	0.176961	0.101660	0.037998
OpenPorchSF	-0.050523	0.278700	0.226403	0.099160
EnclosedPorch	0.000917	-0.094774	-0.089001	0.062807
3SsnPorch	0.050830	0.045254	-0.010114	-0.013974
ScreenPorch	0.008851	-0.004024	0.065093	0.051035
PoolArea	0.023210	0.055757	0.024052	0.077270
MiscVal	-0.007833	-0.013450	0.005151	0.015004
SalePrice	-0.011109	0.554988	0.295592	0.158281
YearBuilt_Age	0.028161	-0.471264	-0.243227	0.080639
YearRemodAdd_Age	0.011375	-0.444446	-0.194943	0.035847
YrSold_Age	0.052576	0.037073	0.015796	0.036551
GarageYrBlt_Age	0.057151	-0.473720	-0.197800	0.088546

	KitchenAbvGr	TotRmsAbvGrd	Fireplaces	GarageCars
MSSubClass	0.283506	0.051179	-0.035792	-0.027639
LotArea	-0.013075	0.184546	0.285983	0.158313
OverallQual	-0.178220	0.432579	0.390067	0.596322
OverallCond	-0.076047	-0.039952	-0.013632	-0.161996
MasVnrArea	-0.038281	0.279391	0.243812	0.342553
BsmtFinSF1	-0.065450	0.043499	0.257482	0.197529
BsmtFinSF2	-0.034411	-0.033702	0.047945	-0.020806
BsmtUnfSF	0.015532	0.237043	0.040509	0.221097
TotalBsmtSF	-0.065410	0.273895	0.328241	0.423592
1stFlrSF	0.084392	0.399177	0.406537	0.414905
2ndFlrSF	0.040935	0.619871	0.201345	0.188522
LowQualFinSF	0.013767	0.103584	-0.041799	-0.089494

GrLivArea	0.097929	0.821845	0.464782	0.455707
BsmtFullBath	-0.034575	-0.055266	0.134348	0.105895
BsmtHalfBath	-0.049367	-0.021023	0.054955	-0.021730
FullBath	0.137740	0.544319	0.230161	0.468193
HalfBath	-0.075331	0.333965	0.200203	0.210440
BedroomAbvGr	0.204218	0.672542	0.100466	0.058834
KitchenAbvGr	1.000000	0.248418	-0.113977	-0.043343
TotRmsAbvGrd	0.248418	1.000000	0.329297	0.348490
Fireplaces	-0.113977	0.329297	1.000000	0.281100
GarageCars	-0.043343	0.348490	0.281100	1.000000
GarageArea	-0.063298	0.323087	0.252903	0.877542
WoodDeckSF	-0.085037	0.153871	0.177070	0.213252
OpenPorchSF	-0.071659	0.264800	0.173684	0.219427
EnclosedPorch	0.030293	0.018640	-0.023222	-0.130974
3SsnPorch	-0.026272	-0.005187	0.014982	0.036901
ScreenPorch	-0.050257	0.058885	0.189293	0.038549
PoolArea	-0.016128	0.094082	0.104895	0.022504
MiscVal	0.045887	0.030337	0.010342	-0.035777
SalePrice	-0.132108	0.528363	0.459611	0.628329
YearBuilt_Age	0.167869	-0.095476	-0.134313	-0.525346
YearRemodAdd_Age	0.139943	-0.206923	-0.118378	-0.428325
YrSold_Age	0.007908	0.060971	0.025018	0.057866
GarageYrBlt_Age	0.130364	-0.125829	-0.038997	-0.588880

GarageArea WoodDeckSF OpenPorchSF

```
              EnclosedPorch  \
MSSubClass       -0.092408    -0.022609     0.017468    -0.004252

LotArea           0.195162     0.216720     0.093080    -0.007446

OverallQual       0.566782     0.227137     0.341030    -0.098374

OverallCond      -0.126021     0.012290    -0.024899     0.056074

MasVnrArea        0.365849     0.151978     0.131850    -0.102321

BsmtFinSF1        0.286290     0.192939     0.108802    -0.082351

BsmtFinSF2       -0.002051     0.094690    -0.014103     0.032081

BsmtUnfSF         0.191177    -0.001966     0.138456    -0.013251

TotalBsmtSF       0.492980     0.234848     0.249284    -0.087751

1stFlrSF          0.475958     0.235467     0.211107    -0.047798

2ndFlrSF          0.135475     0.085662     0.251556     0.065049

LowQualFinSF     -0.063572    -0.033553     0.025591     0.073690

GrLivArea         0.459261     0.242525     0.368318     0.025861

BsmtFullBath      0.166060     0.161772     0.060848    -0.038337

BsmtHalfBath     -0.020305     0.051038    -0.050523     0.000917

FullBath          0.405734     0.176961     0.278700    -0.094774

HalfBath          0.159370     0.101660     0.226403    -0.089001

BedroomAbvGr      0.028543     0.037998     0.099160     0.062807

KitchenAbvGr     -0.063298    -0.085037    -0.071659     0.030293

TotRmsAbvGrd      0.323087     0.153871     0.264800     0.018640

Fireplaces        0.252903     0.177070     0.173684    -0.023222

GarageCars        0.877542     0.213252     0.219427    -0.130974

GarageArea        1.000000     0.215972     0.254685    -0.099955

WoodDeckSF        0.215972     1.000000     0.056290    -0.125435
```

OpenPorchSF	0.254685	0.056290	1.000000	-0.087114
EnclosedPorch	-0.099955	-0.125435	-0.087114	1.000000
3SsnPorch	0.035741	-0.029961	0.003635	-0.040127
ScreenPorch	0.033950	-0.079504	0.066200	-0.082195
PoolArea	0.066697	0.080366	0.067968	0.057362
MiscVal	-0.018672	-0.006860	-0.018066	0.021375
SalePrice	0.619000	0.315444	0.339500	-0.115004
YearBuilt_Age	-0.473216	-0.204830	-0.191069	0.373544
YearRemodAdd_Age	-0.387744	-0.197410	-0.238755	0.193574
YrSold_Age	0.037036	-0.030975	0.065735	0.005767
GarageYrBlt_Age	-0.567249	-0.220306	-0.236477	0.278205

	3SsnPorch	ScreenPorch	PoolArea	MiscVal	SalePrice
MSSubClass	-0.043210	-0.013291	0.009583	-0.023503	-0.060775
LotArea	0.025794	0.025256	0.097107	0.051679	0.249499
OverallQual	0.045919	0.059387	0.072247	-0.025786	0.789185
OverallCond	0.040476	0.069463	-0.003603	0.075178	-0.065642
MasVnrArea	0.018721	0.046509	0.013590	-0.027583	0.466386
BsmtFinSF1	0.025485	0.033490	0.154769	0.008314	0.362874
BsmtFinSF2	-0.031263	0.076561	0.045990	0.007915	-0.010151
BsmtUnfSF	0.025779	0.001076	-0.039029	-0.017266	0.215724
TotalBsmtSF	0.041295	0.064434	0.139252	-0.005920	0.595042
1stFlrSF	0.068344	0.070193	0.144006	-0.010792	0.587642
2ndFlrSF	-0.026226	0.047862	0.090189	0.015327	0.330386
LowQualFinSF	-0.004030	0.037403	0.065630	-0.003564	-

0.032381

	3SsnPorch	ScreenPorch	PoolArea	MiscVal	SalePrice
GrLivArea	0.028401	0.095457	0.188102	0.004425	0.707300
BsmtFullBath	-0.000783	0.013853	0.075230	-0.024692	0.212924
BsmtHalfBath	0.050830	0.008851	0.023210	-0.007833	-0.011109
FullBath	0.045254	-0.004024	0.055757	-0.013450	0.554988
HalfBath	-0.010114	0.065093	0.024052	0.005151	0.295592
BedroomAbvGr	-0.013974	0.051035	0.077270	0.015004	0.158281
KitchenAbvGr	-0.026272	-0.050257	-0.016128	0.045887	-0.132108
TotRmsAbvGrd	-0.005187	0.058885	0.094082	0.030337	0.528363
Fireplaces	0.014982	0.189293	0.104895	0.010342	0.459611
GarageCars	0.036901	0.038549	0.022504	-0.035777	0.628329
GarageArea	0.035741	0.033950	0.066697	-0.018672	0.619000
WoodDeckSF	-0.029961	-0.079504	0.080366	-0.006860	0.315444
OpenPorchSF	0.003635	0.066200	0.067968	-0.018066	0.339500
EnclosedPorch	-0.040127	-0.082195	0.057362	0.021375	-0.115004
3SsnPorch	1.000000	-0.034219	-0.009619	-0.010906	0.060119
ScreenPorch	-0.034219	1.000000	0.058121	0.040486	0.100284
PoolArea	-0.009619	0.058121	1.000000	0.029771	0.103280
MiscVal	-0.010906	0.040486	0.029771	1.000000	-0.013071
SalePrice	0.060119	0.100284	0.103280	-0.013071	1.000000
YearBuilt_Age	-0.037079	0.058760	-0.006408	0.030008	-0.514408
YearRemodAdd_Age	-0.064763	0.046220	-0.006874	0.001199	-0.507831
YrSold_Age	-0.014440	-0.017312	0.066063	0.008439	0.045508
GarageYrBlt_Age	-0.032576	0.086171	0.015095	0.035220	-0.474346

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age
GarageYrBlt_Age			

MSSubClass	-0.023988	-0.056618	0.038595	-0.077630
LotArea	-0.005506	-0.027228	0.035399	0.034981
OverallQual	-0.575800	-0.555945	0.048759	-0.541719
OverallCond	0.377731	-0.080669	-0.055517	0.318278
MasVnrArea	-0.323006	-0.181869	0.013493	-0.254547
BsmtFinSF1	-0.227933	-0.114430	-0.005614	-0.135558
BsmtFinSF2	0.027682	0.044694	-0.038438	0.071691
BsmtUnfSF	-0.155559	-0.174732	0.049734	-0.192237
TotalBsmtSF	-0.386265	-0.280720	0.030448	-0.313928
1stFlrSF	-0.279450	-0.233384	0.028604	-0.219750
2ndFlrSF	-0.011834	-0.155102	0.038241	-0.058220
LowQualFinSF	0.189044	0.072526	0.034952	0.037605
GrLivArea	-0.198644	-0.295048	0.056401	-0.210831
BsmtFullBath	-0.164983	-0.104643	-0.060557	-0.102533
BsmtHalfBath	0.028161	0.011375	0.052576	0.057151
FullBath	-0.471264	-0.444446	0.037073	-0.473720
HalfBath	-0.243227	-0.194943	0.015796	-0.197800
BedroomAbvGr	0.080639	0.035847	0.036551	0.088546
KitchenAbvGr	0.167869	0.139943	0.007908	0.130364
TotRmsAbvGrd	-0.095476	-0.206923	0.060971	-0.125829
Fireplaces	-0.134313	-0.118378	0.025018	-0.038997
GarageCars	-0.525346	-0.428325	0.057866	-0.588880
GarageArea	-0.473216	-0.387744	0.037036	-0.567249
WoodDeckSF	-0.204830	-0.197410	-0.030975	-0.220306
OpenPorchSF	-0.191069	-0.238755	0.065735	-0.236477

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age	GarageYrBlt_Age
EnclosedPorch	0.373544	0.193574	0.005767	0.278205
3SsnPorch	-0.037079	-0.064763	-0.014440	-0.032576
ScreenPorch	0.058760	0.046220	-0.017312	0.086171
PoolArea	-0.006408	-0.006874	0.066063	0.015095
MiscVal	0.030008	0.001199	0.008439	0.035220
SalePrice	-0.514408	-0.507831	0.045508	-0.474346
YearBuilt_Age	1.000000	0.592829	-0.013976	0.826366
YearRemodAdd_Age	0.592829	1.000000	0.033265	0.639153
YrSold_Age	-0.013976	0.033265	1.000000	-0.011431
GarageYrBlt_Age	0.826366	0.639153	-0.011431	1.000000

```python
corr_coef=corr_val[corr_val['SalePrice']> 0.5]
['SalePrice'].sort_values(ascending=False)
print(corr_coef[1:])
corr_coef_cols=[idx for idx in corr_coef.index]
```

```
OverallQual    0.789185
GrLivArea      0.707300
GarageCars     0.628329
GarageArea     0.619000
TotalBsmtSF    0.595042
1stFlrSF       0.587642
FullBath       0.554988
TotRmsAbvGrd   0.528363
Name: SalePrice, dtype: float64
```

```python
#draw the pair plot for correlated value
sns.pairplot(df,x_vars=corr_coef_cols[1:],y_vars=[corr_coef_cols[0]],kind="reg")
```

```
<seaborn.axisgrid.PairGrid at 0x225634c0400>
```
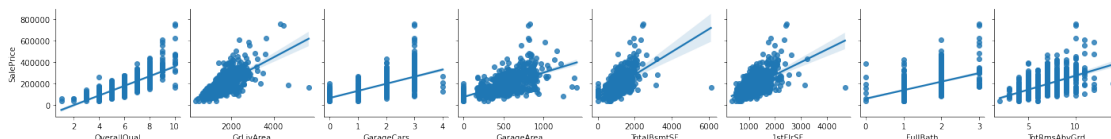


```python
# Let us check the SalePrice as well
f, axes = plt.subplots(1, 2, figsize=(15,6))
sns.boxplot(df['SalePrice'],  orient='v' , ax=axes[0])
```

```python
sns.distplot(df['SalePrice'], ax=axes[1])
plt.show()
```


Lable encoding
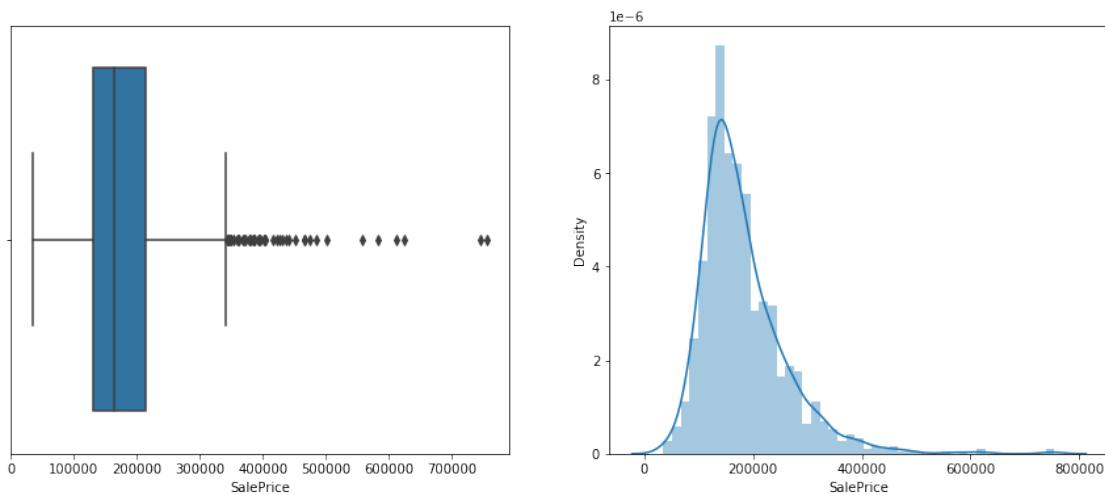
```python
def label_encoding(colNames):
    for colName in colNames:
        unique_vals = df[colName].unique()
        map_vals = {}
        for idx, val in enumerate(unique_vals):
            map_vals[val] = idx
        df[colName] = df[colName].map(map_vals)

cat_col_list = ['LandSlope', 'ExterQual', 'BsmtQual', 'BsmtCond',
'BsmtExposure',
                'BsmtFinType1', 'BsmtFinType2', 'HeatingQC',
'CentralAir', 'KitchenQual',
                'GarageFinish', 'GarageQual', 'GarageCond',
'ExterCond', 'LotShape']
label_encoding(cat_col_list)

df[cat_col_list].head()
```

```
   LandSlope  ExterQual  BsmtQual  BsmtCond  BsmtExposure
BsmtFinType1  \
0          0          0         0         0             0
0
1          1          1         1         1             1
0
2          0          1         0         0             2
1
3          0          0         0         0             0
2
4          0          1         0         0             0
0
```

```
       BsmtFinType2  HeatingQC  CentralAir  KitchenQual  GarageFinish
GarageQual  \
0                 0          0           0            0             0
0
1                 1          1           0            1             1
0
2                 0          1           0            0             1
0
3                 0          1           0            0             0
0
4                 0          2           0            1             2
0

       GarageCond  ExterCond  LotShape
0               0          0         0
1               0          1         0
2               0          0         0
3               0          0         0
4               0          0         0

df
       MSSubClass  LotArea  LotShape  LandSlope  OverallQual
OverallCond  \
0             120     4928         0          0            6
5
1              20    15865         0          1            8
6
2              60     9920         0          0            7
5
3              20    11751         0          0            6
6
4              20    16635         0          0            6
7
...           ...      ...       ...        ...          ...          .
..
1163           20     9819         0          0            5
5
1164           20     8777         1          0            4
5
1165          160     2280         1          0            6
6
1166           70     8500         1          0            4
4
1167           60     7861         0          0            6
5

       MasVnrArea  ExterQual  ExterCond  BsmtQual  BsmtCond
BsmtExposure  \
0             0.0          0          0         0         0
```

```
0
1          0.0         1          1          1          1
1
2          0.0         1          0          0          0
2
3        480.0         0          0          0          0
0
4        126.0         1          0          0          0
0
...        ...        ...        ...        ...        ...       .
..
1163      31.0         0          1          1          0
0
1164       0.0         0          0          3          3
4
1165       0.0         0          0          0          0
0
1166       0.0         0          2          1          0
0
1167       0.0         1          0          0          0
0

      BsmtFinType1  BsmtFinSF1  BsmtFinType2  BsmtFinSF2  BsmtUnfSF  \
0                0         120             0           0        958
1                0         351             1         823       1043
2                1         862             0           0        255
3                2         705             0           0       1139
4                0        1246             0           0        356
...            ...         ...           ...         ...        ...
1163             2         450             0           0        432
1164             6           0             4           0          0
1165             0         566             0           0        289
1166             3           0             0           0        649
1167             1         457             0           0        326

      TotalBsmtSF  HeatingQC  CentralAir  1stFlrSF  2ndFlrSF  \
LowQualFinSF  \
0            1078          0           0       958         0
0
1            2217          1           0      2217         0
0
2            1117          1           0      1127       886
0
3            1844          1           0      1844         0
0
4            1602          2           0      1602         0
0
...           ...        ...         ...       ...       ...
...
1163          882          0           0       900         0
```

```
0
1164            0            1            0      1126            0
0
1165          855            0            0       855          601
0
1166          649            0            1       649          668
0
1167          783            1            0       807          702
0

        GrLivArea  BsmtFullBath  BsmtHalfBath  FullBath  HalfBath
BedroomAbvGr  \
0             958             0             0         2         0
2
1            2217             1             0         2         0
4
2            2013             1             0         2         1
3
3            1844             0             0         2         0
3
4            1602             0             1         2         0
3
...           ...           ...           ...       ...       ...
...
1163          900             0             0         1         0
3
1164         1126             0             0         2         0
2
1165         1456             0             0         2         1
3
1166         1317             0             0         1         0
3
1167         1509             1             0         2         1
3

        KitchenAbvGr  KitchenQual  TotRmsAbvGrd  Fireplaces
GarageFinish  \
0                  1            0             5           1
0
1                  1            1             8           1
1
2                  1            0             8           1
1
3                  1            0             7           1
0
4                  1            1             8           1
2
...              ...          ...           ...         ...
.
1163               1            0             5           0
```

```
1
1164              1          1          5          0
2
1165              1          0          7          1
1
1166              1          0          6          0
1
1167              1          1          7          1
2
```

	GarageCars	GarageArea	GarageQual	GarageCond	WoodDeckSF	OpenPorchSF
0	2	440	0	0	0	205
1	2	621	0	0	81	207
2	2	455	0	0	180	130
3	2	546	0	0	0	122
4	2	529	0	0	240	0
...	...	...	...	...	...	...
1163	1	280	0	0	0	0
1164	2	520	0	0	0	96
1165	2	440	0	0	87	0
1166	1	250	0	1	0	54
1167	2	393	0	0	100	75

	EnclosedPorch	3SsnPorch	ScreenPorch	PoolArea	MiscVal	SalePrice
0	0	0	0	0	0	128000
1	0	0	224	0	0	268000
2	0	0	0	0	0	269790
3	0	0	0	0	0	190000
4	0	0	0	0	0	215000
...	...	...	...	...	...	...
1163	0	0	0	0	0	

122000					
1164	0	0	0	0	0
108000					
1165	0	0	0	0	0
148500					
1166	172	0	0	0	0
40000					
1167	0	0	0	0	0
183200					

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age	GarageYrBlt_Age \
0	34	34	3	33.0
1	40	40	3	40.0
2	14	13	3	13.0
3	33	33	0	33.0
4	33	10	1	33.0
...	...	...	...	...
1163	43	43	0	40.0
1164	61	7	1	8.0
1165	34	34	1	34.0
1166	90	60	2	90.0
1167	8	7	4	8.0

	MSZoning_FV	MSZoning_RH	MSZoning_RL	MSZoning_RM	LandContour_HLS \
0	0	0	1	0	0
1	0	0	1	0	0
2	0	0	1	0	0
3	0	0	1	0	0
4	0	0	1	0	0
...	...	...	...	...	...
1163	0	0	1	0	0
1164	0	0	1	0	0
1165	0	0	1	0	0
1166	0	0	0	0	0
1167	0	0	1	0	0

	LandContour_Low	LandContour_Lvl	LotConfig_CulDSac	LotConfig_FR2 \

```
0                   0                 1                 0
0
1                   0                 1                 0
0
2                   0                 1                 1
0
3                   0                 1                 0
0
4                   0                 1                 0
1
...                ...               ...               ...          .
..
1163                0                 1                 0
0
1164                0                 1                 0
0
1165                0                 1                 0
1
1166                0                 1                 0
0
1167                0                 1                 0
0

        LotConfig_FR3  LotConfig_Inside  Neighborhood_Blueste  \
0                   0                 1                     0
1                   0                 1                     0
2                   0                 0                     0
3                   0                 1                     0
4                   0                 0                     0
...               ...               ...                   ...
1163                0                 1                     0
1164                0                 1                     0
1165                0                 0                     0
1166                0                 1                     0
1167                0                 1                     0

        Neighborhood_BrDale  Neighborhood_BrkSide  Neighborhood_ClearCr
\
0                         0                     0                     0

1                         0                     0                     0

2                         0                     0                     0

3                         0                     0                     0

4                         0                     0                     0

...                     ...                   ...                   ...
```

```
1163                       0                    0                    0

1164                       0                    0                    0

1165                       0                    0                    0

1166                       0                    0                    0

1167                       0                    0                    0


      Neighborhood_CollgCr  Neighborhood_Crawfor  Neighborhood_Edwards
\
0                        0                     0                     0

1                        0                     0                     0

2                        0                     0                     0

3                        0                     0                     0

4                        0                     0                     0

...                    ...                   ...                   ...

1163                     0                     0                     0

1164                     0                     0                     1

1165                     0                     0                     0

1166                     0                     0                     0

1167                     0                     0                     0


      Neighborhood_Gilbert  Neighborhood_IDOTRR  Neighborhood_MeadowV
\
0                        0                    0                    0

1                        0                    0                    0

2                        0                    0                    0

3                        0                    0                    0

4                        0                    0                    0
```

	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	1	0
1167	1	0	0

	Neighborhood_Mitchel	Neighborhood_NAmes	Neighborhood_NPkVill \
0	0	0	1
1	0	1	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	1
1166	0	0	0
1167	0	0	0

	Neighborhood_NWAmes	Neighborhood_NoRidge	Neighborhood_NridgHt \
0	0	0	0
1	0	0	0
2	0	1	0
3	1	0	0

4	1	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_OldTown	Neighborhood_SWISU	Neighborhood_Sawyer \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	1
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Neighborhood_SawyerW	Neighborhood_Somerst	Neighborhood_StoneBr \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0

1166	0	0	0
1167	0	0	0

	Neighborhood_Timber	Neighborhood_Veenker	Condition1_Feedr \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	1
1165	0	0	0
1166	0	0	1
1167	0	0	0

	Condition1_Norm	Condition1_PosA	Condition1_PosN	Condition1_RRAe \
0	1	0	0	0
1	1	0	0	0
2	1	0	0	0
3	1	0	0	0
4	1	0	0	0
...	...	...	...	...
1163	1	0	0	0
1164	0	0	0	0
1165	1	0	0	0
1166	0	0	0	0
1167	1	0	0	0

	Condition1_RRAn	Condition1_RRNe	Condition1_RRNn	Condition2_Feedr \
0	0	0	0	0
1	0	0	0	0

2	0	0	0
	0		
3	0	0	0
	0		
4	0	0	0
	0		
...	...	...	...
	...		
1163	0	0	0
	0		
1164	0	0	0
	0		
1165	0	0	0
	0		
1166	0	0	0
	0		
1167	0	0	0
	0		

	Condition2_Norm	Condition2_PosA	Condition2_PosN
Condition2_RRAe	\		
0	1	0	0
	0		
1	1	0	0
	0		
2	1	0	0
	0		
3	1	0	0
	0		
4	1	0	0
	0		
...	...	...	...	.
..			
1163	1	0	0
	0		
1164	1	0	0
	0		
1165	1	0	0
	0		
1166	1	0	0
	0		
1167	1	0	0
	0		

	Condition2_RRAn	Condition2_RRNn	BldgType_2fmCon
BldgType_Duplex	\		
0	0	0	0
	0		
1	0	0	0
	0		

```
2                    0                0                0
0
3                    0                0                0
0
4                    0                0                0
0
...                ...              ...              ...              .
..
1163                 0                0                0
0
1164                 0                0                0
0
1165                 0                0                0
0
1166                 0                0                0
0
1167                 0                0                0
0

      BldgType_Twnhs  BldgType_TwnhsE  HouseStyle_1.5Unf
HouseStyle_1Story  \
0                  0                1                0
1
1                  0                0                0
1
2                  0                0                0
0
3                  0                0                0
1
4                  0                0                0
1
...              ...              ...              ...
...
1163               0                0                0
1
1164               0                0                0
1
1165               1                0                0
0
1166               0                0                0
0
1167               0                0                0
0

      HouseStyle_2.5Fin  HouseStyle_2.5Unf  HouseStyle_2Story  \
0                     0                  0                  0
1                     0                  0                  0
2                     0                  0                  1
3                     0                  0                  0
4                     0                  0                  0
```

```
...                 ...                ...                    ...
1163                  0                  0                      0
1164                  0                  0                      0
1165                  0                  0                      1
1166                  0                  0                      1
1167                  0                  0                      1

      HouseStyle_SFoyer  HouseStyle_SLvl  RoofStyle_Gable
RoofStyle_Gambrel  \
0                     0                0                    1
0
1                     0                0                    0
0
2                     0                0                    1
0
3                     0                0                    0
0
4                     0                0                    1
0
...                 ...              ...                  ...
...
1163                  0                0                    1
0
1164                  0                0                    1
0
1165                  0                0                    1
0
1166                  0                0                    0
1
1167                  0                0                    1
0

      RoofStyle_Hip  RoofStyle_Mansard  RoofStyle_Shed
RoofMatl_CompShg  \
0                 0                  0               0
1
1                 0                  0               0
0
2                 0                  0               0
1
3                 1                  0               0
1
4                 0                  0               0
1
...             ...                ...             ...            .
..
1163              0                  0               0
1
1164              0                  0               0
1
```

```
1165              0              0              0
1
1166              0              0              0
1
1167              0              0              0
1

      RoofMatl_Membran  RoofMatl_Metal  RoofMatl_Roll  RoofMatl_Tar&Grv  \
0                    0              0              0
0
1                    0              0              0
1
2                    0              0              0
0
3                    0              0              0
0
4                    0              0              0
0
...                ...            ...            ...               ..
.
1163                 0              0              0
0
1164                 0              0              0
0
1165                 0              0              0
0
1166                 0              0              0
0
1167                 0              0              0
0

      RoofMatl_WdShake  RoofMatl_WdShngl  Exterior1st_AsphShn  \
0                    0                 0                    0
1                    0                 0                    0
2                    0                 0                    0
3                    0                 0                    0
4                    0                 0                    0
...                ...               ...                  ...
1163                 0                 0                    0
1164                 0                 0                    0
1165                 0                 0                    0
1166                 0                 0                    0
1167                 0                 0                    0

      Exterior1st_BrkComm  Exterior1st_BrkFace  Exterior1st_CemntBd  \
0                       0                    0                    0
1                       0                    0                    0
2                       0                    0                    0
3                       0                    0                    0
```

4	0	0	1
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	1	0
1167	0	0	0

	Exterior1st_HdBoard	Exterior1st_ImStucc	Exterior1st_MetalSd \
0	0	0	0
1	0	0	0
2	0	0	1
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	1
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Exterior1st_Plywood	Exterior1st_Stone	Exterior1st_Stucco \
0	1	0	0
1	0	0	0
2	0	0	0
3	1	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	1	0	0
1166	0	0	0
1167	0	0	0

	Exterior1st_VinylSd	Exterior1st_Wd Sdng	Exterior1st_WdShing \
0	0	0	0
1	0	1	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	1	0	0
1165	0	0	0
1166	0	0	0
1167	1	0	0

	Exterior2nd_AsphShn	Exterior2nd_Brk Cmn	Exterior2nd_BrkFace \
0	0	0	0
1	0	0	0

	Exterior2nd_CmentBd	Exterior2nd_HdBoard	Exterior2nd_ImStucc
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	1	0
1166	0	0	1
1167	0	0	0

	Exterior2nd_CmentBd	Exterior2nd_HdBoard	Exterior2nd_ImStucc \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	1	0	0
...	...	...	...
1163	0	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Exterior2nd_MetalSd	Exterior2nd_Other	Exterior2nd_Plywood \
0	0	0	1
1	0	0	0
2	1	0	0
3	0	0	1
4	0	0	0
...	...	...	...
1163	1	0	0
1164	0	0	0
1165	0	0	0
1166	0	0	0
1167	0	0	0

	Exterior2nd_Stone	Exterior2nd_Stucco	Exterior2nd_VinylSd \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
...	...	...	...
1163	0	0	0
1164	0	0	1
1165	0	0	0
1166	0	0	0
1167	0	0	1

	Exterior2nd_Wd Sdng	Exterior2nd_Wd Shng	MasVnrType_BrkFace \

```
       0                       0                       0                       0
0                              0                       0                       0
1                              1                       0                       0
2                              0                       0                       0
3                              0                       0                       1
4                              0                       0                       0
...                          ...                     ...                     ...
1163                           0                       0                       1
1164                           0                       0                       0
1165                           0                       0                       0
1166                           0                       0                       0
1167                           0                       0                       0

        MasVnrType_None  MasVnrType_Stone  Foundation_CBlock  \
Foundation_PConc
0                     1                 0                  1
0
1                     1                 0                  0
1
2                     1                 0                  0
1
3                     0                 0                  1
0
4                     0                 1                  1
0
...                 ...               ...                ...
...
1163                  0                 0                  1
0
1164                  1                 0                  1
0
1165                  1                 0                  1
0
1166                  1                 0                  0
0
1167                  1                 0                  0
1

        Foundation_Slab  Foundation_Stone  Foundation_Wood  Heating_GasA
\
0                     0                 0                  0             1

1                     0                 0                  0             1

2                     0                 0                  0             1

3                     0                 0                  0             1

4                     0                 0                  0             1
```

```
...         ...         ...         ...         ...
1163          0           0           0           1
1164          0           0           0           1
1165          0           0           0           1
1166          0           0           0           1
1167          0           0           0           1

      Heating_GasW  Heating_Grav  Heating_OthW  Heating_Wall  \
0                0             0             0             0
1                0             0             0             0
2                0             0             0             0
3                0             0             0             0
4                0             0             0             0
...            ...           ...           ...           ...
1163             0             0             0             0
1164             0             0             0             0
1165             0             0             0             0
1166             0             0             0             0
1167             0             0             0             0

      Electrical_FuseF  Electrical_FuseP  Electrical_Mix
Electrical_SBrkr  \
0                    0                 0                 0
1
1                    0                 0                 0
1
2                    0                 0                 0
1
3                    0                 0                 0
1
4                    0                 0                 0
1
...                ...               ...               ...
...
1163                 0                 0                 0
1
1164                 0                 0                 0
1
1165                 0                 0                 0
1
1166                 0                 0                 0
1
1167                 0                 0                 0
```

1

	Functional_Maj2	Functional_Min1	Functional_Min2	Functional_Mod
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
...	...	...	...	...
1163	0	0	0	0
1164	0	0	0	0
1165	0	0	0	0
1166	0	0	0	0
1167	0	0	0	0

	Functional_Sev	Functional_Typ	GarageType_Attchd	GarageType_Basment
0	0	1	1	0
1	0	1	1	0
2	0	1	1	0
3	0	1	1	0
4	0	1	1	0
...	...	...	...	...
1163	0	1	0	0
1164	0	1	0	0
1165	0	1	1	0
1166	0	1	0	0
1167	0	1	1	

```
0

       GarageType_BuiltIn  GarageType_CarPort  GarageType_Detchd  \
PavedDrive_P
0                        0                   0                   0
0
1                        0                   0                   0
0
2                        0                   0                   0
0
3                        0                   0                   0
0
4                        0                   0                   0
0
...                    ...                 ...                 ...
...
1163                     0                   0                   1
0
1164                     0                   0                   1
0
1165                     0                   0                   0
0
1166                     0                   0                   1
0
1167                     0                   0                   0
0

       PavedDrive_Y  SaleType_CWD  SaleType_Con  SaleType_ConLD  \
0                 1             0             0               0
1                 1             0             0               0
2                 1             0             0               0
3                 1             0             0               0
4                 1             0             0               0
...             ...           ...           ...             ...
1163              1             0             0               0
1164              0             0             0               0
1165              1             0             0               0
1166              0             0             0               0
1167              1             0             0               0

       SaleType_ConLI  SaleType_ConLw  SaleType_New  SaleType_Oth  \
SaleType_WD
0                   0               0             0             0
1
1                   0               0             0             0
1
2                   0               0             0             0
1
3                   0               0             0             0
0
```

```
4                    0              0              0              0
1
...                  ...            ...            ...            ...
...
1163                 0              0              0              0
1
1164                 0              0              0              0
1
1165                 0              0              0              0
1
1166                 0              0              0              0
1
1167                 0              0              0              0
1

       SaleCondition_AdjLand  SaleCondition_Alloca
SaleCondition_Family  \
0                          0                     0
0
1                          0                     0
0
2                          0                     0
0
3                          0                     0
0
4                          0                     0
0
...                        ...                   ...                    ..
.
1163                       0                     0
0
1164                       0                     0
0
1165                       0                     0
0
1166                       0                     0
0
1167                       0                     0
0

       SaleCondition_Normal  SaleCondition_Partial
0                         1                      0
1                         1                      0
2                         1                      0
3                         1                      0
4                         1                      0
...                       ...                    ...
1163                      1                      0
1164                      1                      0
1165                      1                      0
```

```
1166                        1                          0
1167                        1                          0

[1168 rows x 193 columns]
```

df.shape

```
(1168, 193)
```

Target variable transformation

```python
# Transform SalePrice
df['SalePrice'] = np.log1p(df['SalePrice'])
```

Modle buildig

```python
# Create train and test data
x_train, x_test = train_test_split(df, train_size=0.7, test_size=0.3,
random_state=100)
```

```python
# Scale data
scaler_col = ['MSSubClass','LotArea','OverallQual','OverallCond',
'MasVnrArea','BsmtFinSF1',

'BsmtFinSF2','BsmtUnfSF','TotalBsmtSF','1stFlrSF','2ndFlrSF',
'LowQualFinSF',

'GrLivArea','BsmtFullBath','BsmtHalfBath','FullBath','HalfBath','Bedro
omAbvGr',

'KitchenAbvGr','TotRmsAbvGrd','Fireplaces','GarageCars','GarageArea','
WoodDeckSF',
             'OpenPorchSF','EnclosedPorch','3SsnPorch',
'ScreenPorch','PoolArea','MiscVal','SalePrice']

scaler = StandardScaler()
x_train[scaler_col] = scaler.fit_transform(x_train[scaler_col])
x_test[scaler_col] = scaler.transform(x_test[scaler_col])

x_train.fillna(0).head()
```

```
       MSSubClass    LotArea  LotShape  LandSlope  OverallQual
OverallCond   \
227     -0.292410 -0.580759         1          0    -1.508085
0.395781
247      2.430425 -0.929805         1          0     0.608935    -
0.515073
811     -0.884331 -0.238089         1          0    -0.802412    -
0.515073
1097     0.062742 -0.192156         0          0    -0.096739    -
0.515073
91       0.062742 -0.139138         1          0     1.314608    -
```

0.515073

	MasVnrArea	ExterQual	ExterCond	BsmtQual	BsmtCond
BsmtExposure \					
227	-0.567394	0	0	1	0
0					
247	-0.567394	1	0	0	0
0					
811	-0.567394	0	0	0	0
0					
1097	-0.567394	1	0	0	0
0					
91	1.585080	1	0	0	0
0					

	BsmtFinType1	BsmtFinSF1	BsmtFinType2	BsmtFinSF2	BsmtUnfSF \
227	3	-0.994911	0	-0.278136	0.637750
247	3	-0.994911	0	-0.278136	0.033907
811	0	-0.533544	0	-0.278136	0.706271
1097	4	0.131632	0	-0.278136	-0.477861
91	3	-0.994911	0	-0.278136	1.008193

	TotalBsmtSF	HeatingQC	CentralAir	1stFlrSF	2ndFlrSF
LowQualFinSF \					
227	-0.442216	1	0	-0.753512	-0.776351
0.121615					-
247	-1.099249	1	0	-1.679883	0.633001
1.504893					
811	0.112300	1	0	-0.144462	-0.776351
0.121615					-
1097	-0.484155	1	0	-0.799575	1.178192
0.121615					-
91	-0.039143	1	0	-0.310799	1.956389
0.121615					-

	GrLivArea	BsmtFullBath	BsmtHalfBath	FullBath	HalfBath
BedroomAbvGr \					
227	-1.219019	-0.809275	-0.215829	-1.047650	-0.786890
2.288905					-
247	-0.573160	-0.809275	-0.215829	0.750523	1.197336
1.069847					-
811	-0.768244	-0.809275	-0.215829	-1.047650	-0.786890
0.149212					
1097	0.383316	-0.809275	-0.215829	0.750523	1.197336
0.149212					
91	1.396613	-0.809275	-0.215829	0.750523	1.197336
0.149212					

| | KitchenAbvGr | KitchenQual | TotRmsAbvGrd | Fireplaces |
| GarageFinish \ | | | | |

227	-0.202266	0	-1.603787	-0.962658
3				
247	-0.202266	1	-1.603787	-0.962658
0				
811	-0.202266	0	-0.341461	-0.962658
3				
1097	-0.202266	1	0.289701	-0.962658
0				
91	-0.202266	1	0.289701	0.635902
2				

	GarageCars	GarageArea	GarageQual	GarageCond	WoodDeckSF
OpenPorchSF \					
227	-2.372932	-2.237248	2	3	-0.780074	-
0.710483					
247	0.286444	-0.001197	0	0	-0.780074
1.806157					
811	-2.372932	-2.237248	2	3	-0.780074	-
0.255668					
1097	0.286444	0.897881	0	0	0.966807
0.138504					
91	0.286444	1.978639	0	0	-0.780074	-
0.028261					

	EnclosedPorch	3SsnPorch	ScreenPorch	PoolArea	MiscVal
SalePrice \					
227	-0.349413	-0.12634	-0.263200	-0.077801	-0.080242	-
1.238454					
247	-0.349413	-0.12634	-0.263200	-0.077801	-0.080242	-
0.333927					
811	-0.349413	-0.12634	-0.263200	-0.077801	-0.080242	-
0.340728					
1097	-0.349413	-0.12634	-0.263200	-0.077801	-0.080242
0.510620					
91	-0.349413	-0.12634	3.391284	-0.077801	-0.080242
1.291715					

	YearBuilt_Age	YearRemodAdd_Age	YrSold_Age	GarageYrBlt_Age	\
227	54	54	3	0.0	
247	5	5	4	5.0	
811	3	3	3	0.0	
1097	7	7	2	7.0	
91	9	8	2	9.0	

	MSZoning_FV	MSZoning_RH	MSZoning_RL	MSZoning_RM
LandContour_HLS \				
227	0	0	1	0
0				
247	1	0	0	0
0				

	LandContour_Low	LandContour_Lvl	LotConfig_CulDSac	LotConfig_FR2
811	0	0	1	0
1097	1	0	0	0
91	0	0	1	0

	LandContour_Low	LandContour_Lvl	LotConfig_CulDSac	LotConfig_FR2
227	0	1	0	0
247	0	1	0	0
811	0	1	0	0
1097	0	1	0	0
91	0	1	0	0

	LotConfig_FR3	LotConfig_Inside	Neighborhood_Blueste
227	0	1	0
247	0	1	0
811	0	1	0
1097	0	1	0
91	0	1	0

	Neighborhood_BrDale	Neighborhood_BrkSide	Neighborhood_ClearCr
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	Neighborhood_CollgCr	Neighborhood_Crawfor	Neighborhood_Edwards
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0

```
91                    1                    0                    0


      Neighborhood_Gilbert  Neighborhood_IDOTRR  Neighborhood_MeadowV
\
227                      0                    0                    0

247                      0                    0                    0

811                      0                    0                    0

1097                     0                    0                    0

91                       0                    0                    0


      Neighborhood_Mitchel  Neighborhood_NAmes
Neighborhood_NPkVill  \
227                      0                    0                    0

247                      0                    0                    0

811                      1                    0                    0

1097                     0                    0                    0

91                       0                    0                    0


      Neighborhood_NWAmes  Neighborhood_NoRidge  Neighborhood_NridgHt
\
227                      0                    0                    0

247                      0                    0                    0

811                      0                    0                    0

1097                     0                    0                    0

91                       0                    0                    0


      Neighborhood_OldTown  Neighborhood_SWISU  Neighborhood_Sawyer  \
227                      1                    0                    0
247                      0                    0                    0
811                      0                    0                    0
1097                     0                    0                    0
```

91	0	0	0

	Neighborhood_SawyerW	Neighborhood_Somerst	Neighborhood_StoneBr \
227	0	0	0
247	0	1	0
811	0	0	0
1097	0	1	0
91	0	0	0

	Neighborhood_Timber	Neighborhood_Veenker	Condition1_Feedr \
227	0	0	0
247	0	0	0
811	0	0	1
1097	0	0	0
91	0	0	0

	Condition1_Norm	Condition1_PosA	Condition1_PosN	Condition1_RRAe \
227	1	0	0	0
247	1	0	0	0
811	0	0	0	0
1097	1	0	0	0
91	1	0	0	0

	Condition1_RRAn	Condition1_RRNe	Condition1_RRNn	Condition2_Feedr \
227	0	0	0	0
247	0	0	0	0
811	0	0	0	0
1097	0	0	0	0
91	0	0	0	0

	Condition2_Norm	Condition2_PosA	Condition2_PosN

```
     Condition2_RRAe  \
227                 1                0                0
0
247                 1                0                0
0
811                 1                0                0
0
1097                1                0                0
0
91                  1                0                0
0

      Condition2_RRAn  Condition2_RRNn  BldgType_2fmCon
BldgType_Duplex  \
227                 0                0                0
0
247                 0                0                0
0
811                 0                0                0
0
1097                0                0                0
0
91                  0                0                0
0

      BldgType_Twnhs  BldgType_TwnhsE  HouseStyle_1.5Unf
HouseStyle_1Story  \
227                0                0                1
0
247                1                0                0
0
811                0                0                0
1
1097               0                0                0
0
91                 0                0                0
0

      HouseStyle_2.5Fin  HouseStyle_2.5Unf  HouseStyle_2Story  \
227                   0                  0                  0
247                   0                  0                  1
811                   0                  0                  0
1097                  0                  0                  1
91                    0                  0                  1

      HouseStyle_SFoyer  HouseStyle_SLvl  RoofStyle_Gable
RoofStyle_Gambrel  \
227                   0                0                1
0
247                   0                0                1
```

```
0
811                      0                0                1
0
1097                     0                0                1
0
91                       0                0                1
0

      RoofStyle_Hip  RoofStyle_Mansard  RoofStyle_Shed
RoofMatl_CompShg  \
227               0                0                0
1
247               0                0                0
1
811               0                0                0
1
1097              0                0                0
1
91                0                0                0
1

      RoofMatl_Membran  RoofMatl_Metal  RoofMatl_Roll
RoofMatl_Tar&Grv  \
227               0                0                0
0
247               0                0                0
0
811               0                0                0
0
1097              0                0                0
0
91                0                0                0
0

      RoofMatl_WdShake  RoofMatl_WdShngl  Exterior1st_AsphShn  \
227               0                0                0
247               0                0                0
811               0                0                0
1097              0                0                0
91                0                0                0

      Exterior1st_BrkComm  Exterior1st_BrkFace  Exterior1st_CemntBd  \
227                 0                0                0
247                 0                0                0
811                 0                0                0
1097                0                0                0
91                  0                0                0

      Exterior1st_HdBoard  Exterior1st_ImStucc  Exterior1st_MetalSd  \
227                 0                0                1
```

	Exterior1st_Plywood	Exterior1st_Stone	Exterior1st_Stucco \
247	0	0	1
811	0	0	0
1097	0	0	0
91	0	0	0

	Exterior1st_Plywood	Exterior1st_Stone	Exterior1st_Stucco \
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	Exterior1st_VinylSd	Exterior1st_Wd Sdng	Exterior1st_WdShing \
227	0	0	0
247	0	0	0
811	1	0	0
1097	1	0	0
91	1	0	0

	Exterior2nd_AsphShn	Exterior2nd_Brk Cmn	Exterior2nd_BrkFace \
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	Exterior2nd_CmentBd	Exterior2nd_HdBoard	Exterior2nd_ImStucc \
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	Exterior2nd_MetalSd	Exterior2nd_Other	Exterior2nd_Plywood \
227	1	0	0
247	1	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	Exterior2nd_Stone	Exterior2nd_Stucco	Exterior2nd_VinylSd \
227	0	0	0
247	0	0	0
811	0	0	1
1097	0	0	1
91	0	0	1

	Exterior2nd_Wd Sdng	Exterior2nd_Wd Shng	MasVnrType_BrkFace \
227	0	0	0

247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	1

	MasVnrType_None	MasVnrType_Stone	Foundation_CBlock	Foundation_PConc \
227	1	0	1	0
247	1	0	0	1
811	1	0	0	1
1097	1	0	0	1
91	0	0	0	1

	Foundation_Slab	Foundation_Stone	Foundation_Wood	Heating_GasA \
227	0	0	0	1
247	0	0	0	1
811	0	0	0	1
1097	0	0	0	1
91	0	0	0	1

	Heating_GasW	Heating_Grav	Heating_OthW	Heating_Wall \
227	0	0	0	0
247	0	0	0	0
811	0	0	0	0
1097	0	0	0	0
91	0	0	0	0

	Electrical_FuseF	Electrical_FuseP	Electrical_Mix	Electrical_SBrkr \
227	0	0	0	1
247	0	0	0	1
811	0	0	0	1
1097	0	0	0	1
91	0	0	0	

1

	Functional_Maj2	Functional_Min1	Functional_Min2	Functional_Mod \
227	0	0	0	0
247	0	0	0	0
811	0	0	0	0
1097	0	0	0	0
91	0	0	0	0

	Functional_Sev	Functional_Typ	GarageType_Attchd	GarageType_Basment \
227	0	1	0	0
247	0	1	0	0
811	0	1	0	0
1097	0	1	1	0
91	0	1	0	0

	GarageType_BuiltIn	GarageType_CarPort	GarageType_Detchd	PavedDrive_P \
227	0	0	0	0
247	0	0	1	0
811	0	0	0	0
1097	0	0	0	0
91	1	0	0	0

	PavedDrive_Y	SaleType_CWD	SaleType_Con	SaleType_ConLD \
227	1	0	0	0
247	1	0	0	0
811	1	0	0	0
1097	1	0	0	0
91	1	0	0	0

| | SaleType_ConLI | SaleType_ConLw | SaleType_New | SaleType_Oth | SaleType_WD \ |

	SaleCondition_AdjLand	SaleCondition_Alloca	SaleCondition_Family
227	0	0	0
247	0	0	0
811	0	0	0
1097	0	0	0
91	0	0	0

	SaleCondition_Normal	SaleCondition_Partial
227	1	0
247	1	0
811	0	1
1097	1	0
91	1	0

```python
x_train.isnull().sum()
```

```
MSSubClass               0
LotArea                  0
LotShape                 0
LandSlope                0
OverallQual              0
                        ..
SaleCondition_AdjLand    0
SaleCondition_Alloca     0
SaleCondition_Family     0
SaleCondition_Normal     0
SaleCondition_Partial    0
Length: 193, dtype: int64
```

```python
# Let us check if the target variable is normal in both train and test
dataset
plt.figure(figsize=(16,6))
plt.subplot(121)
sns.distplot(x_train.SalePrice)
```

```
plt.subplot(122)
sns.distplot(x_test.SalePrice)
```

<AxesSubplot:xlabel='SalePrice', ylabel='Density'>
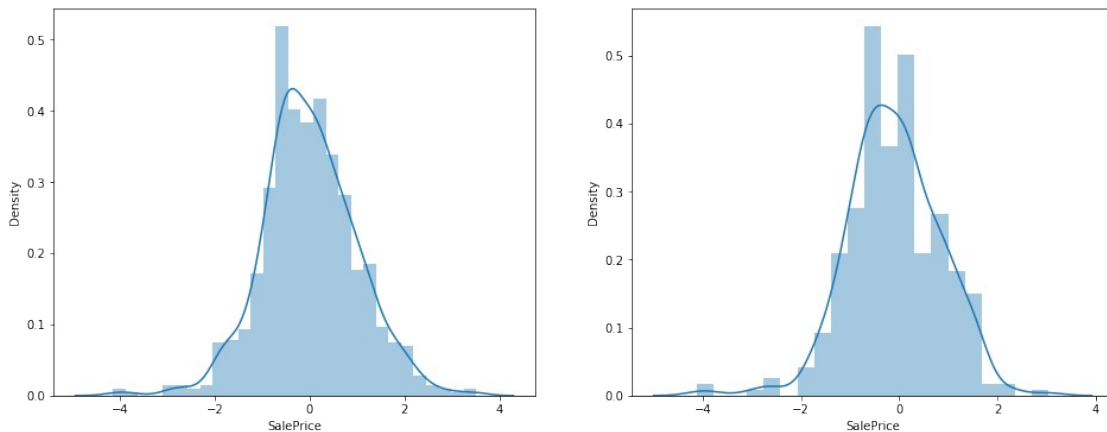

```
# Create X and y
y_train = x_train.pop('SalePrice')
X_train = x_train

y_test = x_test.pop('SalePrice')
X_test = x_test
```

```
---------------------------------------------------------------------
-----
KeyError                                 Traceback (most recent call
last)
~\anaconda3\lib\site-packages\pandas\core\indexes\base.py in
get_loc(self, key, method, tolerance)
   3360            try:
-> 3361                return self._engine.get_loc(casted_key)
   3362            except KeyError as err:

~\anaconda3\lib\site-packages\pandas\_libs\index.pyx in
pandas._libs.index.IndexEngine.get_loc()

~\anaconda3\lib\site-packages\pandas\_libs\index.pyx in
pandas._libs.index.IndexEngine.get_loc()

pandas\_libs\hashtable_class_helper.pxi in
pandas._libs.hashtable.PyObjectHashTable.get_item()

pandas\_libs\hashtable_class_helper.pxi in
pandas._libs.hashtable.PyObjectHashTable.get_item()

KeyError: 'SalePrice'

The above exception was the direct cause of the following exception:
```

```
KeyError                                    Traceback (most recent call
last)
~\AppData\Local\Temp/ipykernel_16504/1506814448.py in <module>
      1 # Create X and y
----> 2 y_train = x_train.pop('SalePrice')
      3 X_train = x_train
      4
      5 y_test = x_test.pop('SalePrice')

~\anaconda3\lib\site-packages\pandas\core\frame.py in pop(self, item)
   5224         3   monkey        NaN
   5225         """
-> 5226         return super().pop(item=item)
   5227
   5228     @doc(NDFrame.replace, **_shared_doc_kwargs)

~\anaconda3\lib\site-packages\pandas\core\generic.py in pop(self,
item)
    868
    869     def pop(self, item: Hashable) -> Series | Any:
--> 870         result = self[item]
    871         del self[item]
    872

~\anaconda3\lib\site-packages\pandas\core\frame.py in
__getitem__(self, key)
   3456             if self.columns.nlevels > 1:
   3457                 return self._getitem_multilevel(key)
-> 3458             indexer = self.columns.get_loc(key)
   3459             if is_integer(indexer):
   3460                 indexer = [indexer]

~\anaconda3\lib\site-packages\pandas\core\indexes\base.py in
get_loc(self, key, method, tolerance)
   3361                 return self._engine.get_loc(casted_key)
   3362             except KeyError as err:
-> 3363                 raise KeyError(key) from err
   3364
   3365         if is_scalar(key) and isna(key) and not self.hasnans:

KeyError: 'SalePrice'

np.all(np.isfinite(x_train))

True

np.any(np.isnan(x_train))

False
```

```
x_train=x_train.dropna()
x_train
```

```
      MSSubClass    LotArea  LotShape  LandSlope  OverallQual
OverallCond  \
247      2.430425 -0.929805         1          0     0.608935    -
0.515073
1097     0.062742 -0.192156         0          0    -0.096739    -
0.515073
91       0.062742 -0.139138         1          0     1.314608    -
0.515073
784      0.062742  0.305435         0          0     0.608935
1.306635
1016    -0.884331 -0.238326         1          0     0.608935    -
0.515073
...           ...        ...       ...        ...          ...
...
802      1.483352 -0.698840         1          0    -0.096739    -
0.515073
53      -0.884331 -0.201484         0          0    -0.802412
1.306635
350      0.417894 -0.380022         1          0    -0.802412
1.306635
79      -0.884331  0.682230         3          0     0.608935    -
0.515073
792     -0.884331 -0.001928         0          0     0.608935    -
0.515073

        MasVnrArea  ExterQual  ExterCond  BsmtQual  BsmtCond
BsmtExposure  \
247      -0.567394          1          0         0         0
0
1097     -0.567394          1          0         0         0
0
91        1.585080          1          0         0         0
0
784       0.943686          1          0         0         0
0
1016      0.025080          1          0         0         0
2
...            ...        ...        ...       ...       ...
..
802       1.840550          0          1         2         1
0
53       -0.567394          0          1         1         0
3
350      -0.567394          0          0         1         2
0
79       -0.567394          1          0         0         0
1
```

```
792    -0.567394          0         0         0         0
0

      BsmtFinType1  BsmtFinSF1  BsmtFinType2  BsmtFinSF2  BsmtUnfSF  \
247              3   -0.994911             0   -0.278136   0.033907
1097             4    0.131632             0   -0.278136  -0.477861
91               3   -0.994911             0   -0.278136   1.008193
784              1    0.554926             0   -0.278136  -0.923249
1016             1    0.599719             0   -0.278136   0.378654
...            ...         ...           ...         ...        ...
802              1    1.694907             0   -0.278136  -1.173779
53               2    0.931187             0   -0.278136  -0.968216
350              3   -0.994911             0   -0.278136  -0.115983
79               1    2.236902             0   -0.278136  -1.167356
792              3   -0.994911             0   -0.278136   1.374353

      TotalBsmtSF  HeatingQC  CentralAir   1stFlrSF   2ndFlrSF
LowQualFinSF  \
247     -1.099249          1           0  -1.679883   0.633001
1.504893
1097    -0.484155          1           0  -0.799575   1.178192      -
0.121615
91      -0.039143          1           0  -0.310799   1.956389      -
0.121615
784     -0.528423          0           0  -0.060014   1.938292      -
0.121615
1016     0.934755          1           0   0.787027  -0.776351      -
0.121615
...           ...        ...         ...        ...        ...
...
802      0.384899          1           0   0.410849  -0.776351      -
0.121615
53      -0.185927          0           0   0.331519  -0.776351      -
0.121615
350     -1.262342          0           1  -1.523782   0.422616      -
0.121615
79       0.955724          1           0   0.812618  -0.776351      -
0.121615
792      0.359270          1           0   0.126796  -0.776351      -
0.121615

      GrLivArea  BsmtFullBath  BsmtHalfBath  FullBath  HalfBath
BedroomAbvGr  \
247    -0.573160     -0.809275     -0.215829  0.750523  1.197336      -
1.069847
1097    0.383316     -0.809275     -0.215829  0.750523  1.197336
0.149212
91      1.396613     -0.809275     -0.215829  0.750523  1.197336
0.149212
784     1.567074      1.112753     -0.215829  0.750523  1.197336
```

1.368270
1016   -0.078823   1.112753   -0.215829 0.750523 -0.786890
0.149212

...   .
...
802   -0.357243   1.112753   -0.215829 0.750523 -0.786890   -
1.069847
53   -0.415957   1.112753   -0.215829 -1.047650 -0.786890   -
1.069847
350   -0.785290   -0.809275   -0.215829 -1.047650 -0.786890
0.149212
79   -0.059883   1.112753   -0.215829 0.750523 -0.786890
0.149212
792   -0.567478   -0.809275   -0.215829 0.750523 -0.786890
0.149212

        KitchenAbvGr   KitchenQual   TotRmsAbvGrd   Fireplaces
GarageFinish \
247   -0.202266   1   -1.603787   -0.962658
0
1097   -0.202266   1   0.289701   -0.962658
0
91   -0.202266   1   0.289701   0.635902
2
784   -0.202266   2   2.183189   0.635902
0
1016   -0.202266   1   0.289701   -0.962658
0
...   .
.
802   -0.202266   0   -0.972624   -0.962658
2
53   -0.202266   0   -0.972624   -0.962658
1
350   -0.202266   3   -0.341461   -0.962658
1
79   -0.202266   1   -0.972624   0.635902
0
792   -0.202266   1   -0.341461   -0.962658
0

        GarageCars   GarageArea   GarageQual   GarageCond   WoodDeckSF
OpenPorchSF \
247   0.286444   -0.001197   0   0   -0.780074
1.806157
1097   0.286444   0.897881   0   0   0.966807
0.138504
91   0.286444   1.978639   0   0   -0.780074   -
0.028261
784   0.286444   0.017436   0   0   1.549101

2.245812
1016   0.286444   0.585766   0   0   -0.780074   -
0.179866
...   .
...
802   0.286444   -0.350580   0   0   -0.780074
2.306453
53   -1.043244   1.284532   0   0   -0.780074   -
0.710483
350   -1.043244   -0.895618   0   0   -0.780074   -
0.710483
79   0.286444   0.157190   0   0   2.471067   -
0.331471
792   1.616133   1.209997   0   0   -0.780074   -
0.164706

        EnclosedPorch 3SsnPorch ScreenPorch PoolArea   MiscVal \
247   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
1097   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
91   -0.349413 -0.126340   3.391284 -0.077801 -0.080242
784   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
1016   -0.349413   4.428881   -0.263200 -0.077801 -0.080242
...   .
802   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
53   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
350   1.943010 -0.126340   -0.263200 -0.077801 -0.080242
79   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242
792   -0.349413 -0.126340   -0.263200 -0.077801 -0.080242

        YearBuilt_Age YearRemodAdd_Age YrSold_Age GarageYrBlt_Age \
247   5   5   4   5.0
1097   7   7   2   7.0
91   9   8   2   9.0
784   30   30   1   27.0
1016   6   5   0   6.0
...   .
802   12   12   4   12.0
53   53   10   1   42.0
350   90   14   3   75.0
79   12   12   3   12.0
792   1   1   0   1.0

        MSZoning_FV MSZoning_RH MSZoning_RL MSZoning_RM
LandContour_HLS \
247   1   0   0   0
0
1097   1   0   0   0
0
91   0   0   1   0
0

```
784            0            0            1            0
0
1016           0            0            1            0
0
...           ...          ...          ...          ...
...
802            0            0            0            1
0
53             0            0            1            0
0
350            0            0            0            1
0
79             0            0            1            0
0
792            0            0            1            0
0

        LandContour_Low  LandContour_Lvl  LotConfig_CulDSac
LotConfig_FR2  \
247                   0                1                    0
0
1097                  0                1                    0
0
91                    0                1                    0
0
784                   0                1                    0
0
1016                  0                1                    0
0
...                  ...              ...                  ...          .
..
802                   0                1                    0
1
53                    0                1                    0
0
350                   0                1                    0
0
79                    1                0                    0
0
792                   0                1                    0
0

        LotConfig_FR3  LotConfig_Inside  Neighborhood_Blueste  \
247                 0                 1                     0
1097                0                 1                     0
91                  0                 1                     0
784                 0                 0                     0
1016                0                 1                     0
...                ...               ...                   ...
802                 0                 0                     0
```

53	0	1	0
350	0	1	0
79	0	1	0
792	0	0	0

	Neighborhood_BrDale	Neighborhood_BrkSide	Neighborhood_ClearCr \
247	0	0	0
1097	0	0	0
91	0	0	0
784	0	0	0
1016	0	0	0
...	...	...	...
802	0	0	0
53	0	0	0
350	0	0	0
79	0	0	0
792	0	0	0

	Neighborhood_CollgCr	Neighborhood_Crawfor	Neighborhood_Edwards \
247	0	0	0
1097	0	0	0
91	1	0	0
784	0	0	0
1016	1	0	0
...	...	...	...
802	0	0	0
53	0	0	0

350	0	0	0
79	0	0	0
792	1	0	0

	Neighborhood_Gilbert	Neighborhood_IDOTRR	Neighborhood_MeadowV \
247	0	0	0
1097	0	0	0
91	0	0	0
784	0	0	0
1016	0	0	0
...	...	...	...
802	0	0	0
53	0	0	0
350	0	1	0
79	0	0	0
792	0	0	0

	Neighborhood_Mitchel	Neighborhood_NAmes	Neighborhood_NPkVill \
247	0	0	0
1097	0	0	0
91	0	0	0
784	0	0	0
1016	0	0	0
...	...	...	...
802	1	0	0

	Neighborhood_NWAmes	Neighborhood_NoRidge	Neighborhood_NridgHt
53	0	1	0
350	0	0	0
79	0	0	0
792	0	0	0

	Neighborhood_NWAmes	Neighborhood_NoRidge	Neighborhood_NridgHt \
247	0	0	0
1097	0	0	0
91	0	0	0
784	1	0	0
1016	0	0	0
...	...	...	...
802	0	0	0
53	0	0	0
350	0	0	0
79	0	0	0
792	0	0	0

	Neighborhood_OldTown	Neighborhood_SWISU	Neighborhood_Sawyer \
247	0	0	0
1097	0	0	0
91	0	0	0
784	0	0	0
1016	0	0	0
...	...	...	...
802	0	0	0
53	0	0	0
350	0	0	0
79	0	0	0
792	0	0	0

	Neighborhood_SawyerW	Neighborhood_Somerst	Neighborhood_StoneBr

```
\
247                              0                          1                          0

1097                             0                          1                          0

91                               0                          0                          0

784                              0                          0                          0

1016                             0                          0                          0

...                            ...                        ...                        ...

802                              0                          0                          0

53                               0                          0                          0

350                              0                          0                          0

79                               1                          0                          0

792                              0                          0                          0


      Neighborhood_Timber  Neighborhood_Veenker  Condition1_Feedr  \
247                     0                     0                 0
1097                    0                     0                 0
91                      0                     0                 0
784                     0                     0                 0
1016                    0                     0                 0
...                   ...                   ...               ...
802                     0                     0                 0
53                      0                     0                 0
350                     0                     0                 0
79                      0                     0                 0
792                     0                     0                 0


      Condition1_Norm  Condition1_PosA  Condition1_PosN
Condition1_RRAe  \
247                 1                0                0
0
1097                1                0                0
0
91                  1                0                0
0
784                 1                0                0
0
1016                1                0                0
0
```

```
     ...            ...           ...             ...               .
..
802              1             0               0
0
53               1             0               0
0
350              1             0               0
0
79               1             0               0
0
792              1             0               0
0

     Condition1_RRAn  Condition1_RRNe  Condition1_RRNn
Condition2_Feedr  \
247              0             0               0
0
1097             0             0               0
0
91               0             0               0
0
784              0             0               0
0
1016             0             0               0
0
...            ...           ...             ...
...
802              0             0               0
0
53               0             0               0
0
350              0             0               0
0
79               0             0               0
0
792              0             0               0
0

     Condition2_Norm  Condition2_PosA  Condition2_PosN
Condition2_RRAe  \
247              1             0               0
0
1097             1             0               0
0
91               1             0               0
0
784              1             0               0
0
1016             1             0               0
0
```

```
...              ...              ...              ...            .
..
802              1                0                0
0
53               1                0                0
0
350              1                0                0
0
79               1                0                0
0
792              1                0                0
0

     Condition2_RRAn  Condition2_RRNn  BldgType_2fmCon
BldgType_Duplex  \
247              0                0                0
0
1097             0                0                0
0
91               0                0                0
0
784              0                0                0
0
1016             0                0                0
0
...              ...              ...              ...            .
..
802              0                0                0
0
53               0                0                0
0
350              0                0                0
0
79               0                0                0
0
792              0                0                0
0

     BldgType_Twnhs  BldgType_TwnhsE  HouseStyle_1.5Unf
HouseStyle_1Story  \
247              1                0                0
0
1097             0                0                0
0
91               0                0                0
0
784              0                0                0
0
1016             0                0                0
1
```

```
        ...         ...         ...         ...
...
802          0           1           0
1
53           0           0           0
1
350          0           0           0
0
79           0           0           0
1
792          0           0           0
1

      HouseStyle_2.5Fin  HouseStyle_2.5Unf  HouseStyle_2Story  \
247                  0                  0                  1
1097                 0                  0                  1
91                   0                  0                  1
784                  0                  0                  1
1016                 0                  0                  0
...                ...                ...                ...
802                  0                  0                  0
53                   0                  0                  0
350                  0                  1                  0
79                   0                  0                  0
792                  0                  0                  0

      HouseStyle_SFoyer  HouseStyle_SLvl  RoofStyle_Gable  \
RoofStyle_Gambrel  \
247                  0                0                1
0
1097                 0                0                1
0
91                   0                0                1
0
784                  0                0                1
0
1016                 0                0                1
0
...                ...              ...              ...
...
802                  0                0                0
0
53                   0                0                0
0
350                  0                0                1
0
79                   0                0                1
0
792                  0                0                1
0
```

	RoofStyle_Hip	RoofStyle_Mansard	RoofStyle_Shed	RoofMatl_CompShg
247	0	0	0	1
1097	0	0	0	1
91	0	0	0	1
784	0	0	0	1
1016	0	0	0	1
...	...	...	...	...
802	1	0	0	1
53	1	0	0	1
350	0	0	0	1
79	0	0	0	1
792	0	0	0	1

	RoofMatl_Membran	RoofMatl_Metal	RoofMatl_Roll	RoofMatl_Tar&Grv
247	0	0	0	0
1097	0	0	0	0
91	0	0	0	0
784	0	0	0	0
1016	0	0	0	0
...	...	...	...	...
802	0	0	0	0
53	0	0	0	0
350	0	0	0	0
79	0	0	0	0
792	0	0	0	0

	RoofMatl_WdShake	RoofMatl_WdShngl	Exterior1st_AsphShn	\
247	0	0	0	
1097	0	0	0	
91	0	0	0	
784	0	0	0	
1016	0	0	0	
...	...	...	...	
802	0	0	0	
53	0	0	0	
350	0	0	0	
79	0	0	0	
792	0	0	0	

	Exterior1st_BrkComm	Exterior1st_BrkFace	Exterior1st_CemntBd	\
247	0	0	0	
1097	0	0	0	
91	0	0	0	
784	0	0	1	
1016	0	0	0	
...	...	...	...	
802	0	0	0	
53	0	0	0	
350	0	0	0	
79	0	0	0	
792	0	0	0	

	Exterior1st_HdBoard	Exterior1st_ImStucc	Exterior1st_MetalSd	\
247	0	0	1	
1097	0	0	0	
91	0	0	0	
784	0	0	0	
1016	0	0	0	
...	...	...	...	
802	0	0	0	
53	0	0	1	
350	0	0	1	
79	0	0	0	
792	0	0	0	

	Exterior1st_Plywood	Exterior1st_Stone	Exterior1st_Stucco	\
247	0	0	0	
1097	0	0	0	
91	0	0	0	
784	0	0	0	
1016	0	0	0	
...	...	...	...	
802	0	0	0	
53	0	0	0	
350	0	0	0	

```
79                               0                    0                    0
792                              0                    0                    0

      Exterior1st_VinylSd  Exterior1st_Wd Sdng  Exterior1st_WdShing  \
247                     0                    0                    0
1097                    1                    0                    0
91                      1                    0                    0
784                     0                    0                    0
1016                    1                    0                    0
...                   ...                  ...                  ...
802                     1                    0                    0
53                      0                    0                    0
350                     0                    0                    0
79                      1                    0                    0
792                     1                    0                    0

      Exterior2nd_AsphShn  Exterior2nd_Brk Cmn  Exterior2nd_BrkFace  \
247                     0                    0                    0
1097                    0                    0                    0
91                      0                    0                    0
784                     0                    0                    0
1016                    0                    0                    0
...                   ...                  ...                  ...
802                     0                    0                    0
53                      0                    0                    0
350                     0                    0                    0
79                      0                    0                    0
792                     0                    0                    0

      Exterior2nd_CmentBd  Exterior2nd_HdBoard  Exterior2nd_ImStucc  \
247                     0                    0                    0
1097                    0                    0                    0
91                      0                    0                    0
784                     1                    0                    0
1016                    0                    0                    0
...                   ...                  ...                  ...
802                     0                    0                    0
53                      0                    0                    0
350                     0                    0                    0
79                      0                    0                    0
792                     0                    0                    0

      Exterior2nd_MetalSd  Exterior2nd_Other  Exterior2nd_Plywood  \
247                     1                  0                    0
1097                    0                  0                    0
91                      0                  0                    0
784                     0                  0                    0
1016                    0                  0                    0
...                   ...                ...                  ...
802                     0                  0                    0
```

53	1	0	0
350	1	0	0
79	0	0	0
792	0	0	0

	Exterior2nd_Stone	Exterior2nd_Stucco	Exterior2nd_VinylSd \
247	0	0	0
1097	0	0	1
91	0	0	1
784	0	0	0
1016	0	0	1
...	...	...	...
802	0	0	1
53	0	0	0
350	0	0	0
79	0	0	1
792	0	0	1

	Exterior2nd_Wd Sdng	Exterior2nd_Wd Shng	MasVnrType_BrkFace \
247	0	0	0
1097	0	0	0
91	0	0	1
784	0	0	1
1016	0	0	1
...	...	...	...
802	0	0	1
53	0	0	0
350	0	0	0
79	0	0	0
792	0	0	0

	MasVnrType_None	MasVnrType_Stone	Foundation_CBlock	Foundation_PConc \
247	1	0	0	1
1097	1	0	0	1
91	0	0	0	1
784	0	0	1	0
1016	0	0	0	1
...	...	...	...	...
802	0	0	0	1
53	1	0	1	0
350	1	0	0	

```
0
79                   1                 0                      0
1
792                  1                 0                      0
1

      Foundation_Slab  Foundation_Stone  Foundation_Wood  Heating_GasA
\
247                 0                 0                      0            1

1097                0                 0                      0            1

91                  0                 0                      0            1

784                 0                 0                      0            1

1016                0                 0                      0            1

...               ...               ...                    ...          ...

802                 0                 0                      0            1

53                  0                 0                      0            1

350                 0                 0                      0            1

79                  0                 0                      0            1

792                 0                 0                      0            1


      Heating_GasW  Heating_Grav  Heating_OthW  Heating_Wall  \
247              0             0             0             0
1097             0             0             0             0
91               0             0             0             0
784              0             0             0             0
1016             0             0             0             0
...            ...           ...           ...           ...
802              0             0             0             0
53               0             0             0             0
350              0             0             0             0
79               0             0             0             0
792              0             0             0             0


      Electrical_FuseF  Electrical_FuseP  Electrical_Mix
Electrical_SBrkr  \
247                  0                 0               0
1
1097                 0                 0               0
```

```
1
91                      0                  0                  0
1
784                     0                  0                  0
1
1016                    0                  0                  0
1
...                   ...                ...                ...
...
802                     0                  0                  0
1
53                      0                  0                  0
1
350                     0                  0                  0
1
79                      0                  0                  0
1
792                     0                  0                  0
1

      Functional_Maj2  Functional_Min1  Functional_Min2
Functional_Mod  \
247                   0                  0                  0
0
1097                  0                  0                  0
0
91                    0                  0                  0
0
784                   0                  0                  0
0
1016                  0                  0                  0
0
...                 ...                ...                ...         ..
.
802                   0                  0                  0
0
53                    0                  0                  0
0
350                   0                  0                  0
0
79                    0                  0                  0
0
792                   0                  0                  0
0

      Functional_Sev  Functional_Typ  GarageType_Attchd
GarageType_Basment  \
247                  0               1                  0
0
1097                 0               1                  1
```

```
0
91                   0                  1                  0
0
784                  0                  1                  1
0
1016                 0                  1                  1
0
...                ...                ...                ...
...
802                  0                  1                  1
0
53                   0                  1                  0
0
350                  0                  1                  0
0
79                   0                  1                  1
0
792                  0                  1                  1
0

      GarageType_BuiltIn  GarageType_CarPort  GarageType_Detchd  PavedDrive_P  \
247                    0                   0                  1
0
1097                   0                   0                  0
0
91                     1                   0                  0
0
784                    0                   0                  0
0
1016                   0                   0                  0
0
...                  ...                 ...                ...
...
802                    0                   0                  0
0
53                     0                   0                  1
0
350                    0                   0                  1
0
79                     0                   0                  0
0
792                    0                   0                  0
0

      PavedDrive_Y  SaleType_CWD  SaleType_Con  SaleType_ConLD  \
247              1             0             0               0
1097             1             0             0               0
91               1             0             0               0
784              1             0             0               0
```

```
1016              1              0              0              0
...            ...            ...            ...            ...
802              1              0              0              0
53               1              0              0              0
350              0              0              0              0
79               1              0              0              0
792              1              0              0              0

      SaleType_ConLI  SaleType_ConLw  SaleType_New  SaleType_Oth  \
SaleType_WD
247              0              0              0              0
1
1097             0              0              0              0
1
91               0              0              0              0
1
784              0              0              0              0
1
1016             0              0              0              0
1
...            ...            ...            ...            ...
...
802              0              0              0              0
1
53               0              0              0              0
1
350              0              0              0              0
1
79               0              0              0              0
1
792              0              0              0              0
1

      SaleCondition_AdjLand  SaleCondition_Alloca
SaleCondition_Family  \
247                      0                     0
0
1097                     0                     0
0
91                       0                     0
0
784                      0                     0
0
1016                     0                     0
0
...                    ...                   ...            ..
.
802                      0                     0
0
53                       0                     0
```

```
0
350                        0                    0
0
79                         0                    0
0
792                        0                    0
0

        SaleCondition_Normal  SaleCondition_Partial
247                        1                    0
1097                       1                    0
91                         1                    0
784                        1                    0
1016                       1                    0
...                      ...                  ...
802                        1                    0
53                         1                    0
350                        1                    0
79                         1                    0
792                        1                    0

[765 rows x 192 columns]
```

```python
#Lasso
lm = Lasso(alpha=0.001)
lm.fit(X_train,y_train)

# train score
y_train_pred = lm.predict(X_train)
print(metrics.r2_score(y_true=y_train,y_pred=y_train_pred))

# test score
y_test_pred  = lm.predict(X_test)
print(metrics.r2_score(y_true=y_test,y_pred=y_test_pred))
```

```
---------------------------------------------------------------------
-----
ValueError                                Traceback (most recent call
last)
~\AppData\Local\Temp/ipykernel_16504/4058928664.py in <module>
      1 #Lasso
      2 lm = Lasso(alpha=0.001)
----> 3 lm.fit(X_train,y_train)
      4
      5 # train score

~\anaconda3\lib\site-packages\sklearn\linear_model\
_coordinate_descent.py in fit(self, X, y, sample_weight, check_input)
    769         if check_input:
    770             X_copied = self.copy_X and self.fit_intercept
```

```
--> 771                 X, y = self._validate_data(X, y,
accept_sparse='csc',
    772                                          order='F',
    773                                          dtype=[np.float64,
np.float32],

~\anaconda3\lib\site-packages\sklearn\base.py in _validate_data(self,
X, y, reset, validate_separately, **check_params)
    431                 y = check_array(y, **check_y_params)
    432             else:
--> 433                 X, y = check_X_y(X, y, **check_params)
    434             out = X, y
    435

~\anaconda3\lib\site-packages\sklearn\utils\validation.py in
inner_f(*args, **kwargs)
    61             extra_args = len(args) - len(all_args)
    62             if extra_args <= 0:
---> 63                 return f(*args, **kwargs)
    64
    65             # extra_args > 0

~\anaconda3\lib\site-packages\sklearn\utils\validation.py in
check_X_y(X, y, accept_sparse, accept_large_sparse, dtype, order,
copy, force_all_finite, ensure_2d, allow_nd, multi_output,
ensure_min_samples, ensure_min_features, y_numeric, estimator)
    869         raise ValueError("y cannot be None")
    870
--> 871     X = check_array(X, accept_sparse=accept_sparse,
    872                     accept_large_sparse=accept_large_sparse,
    873                     dtype=dtype, order=order, copy=copy,

~\anaconda3\lib\site-packages\sklearn\utils\validation.py in
inner_f(*args, **kwargs)
    61             extra_args = len(args) - len(all_args)
    62             if extra_args <= 0:
---> 63                 return f(*args, **kwargs)
    64
    65             # extra_args > 0

~\anaconda3\lib\site-packages\sklearn\utils\validation.py in
check_array(array, accept_sparse, accept_large_sparse, dtype, order,
copy, force_all_finite, ensure_2d, allow_nd, ensure_min_samples,
ensure_min_features, estimator)
    718
    719         if force_all_finite:
--> 720             _assert_all_finite(array,
    721                                allow_nan=force_all_finite ==
'allow-nan')
    722
```

```
~\anaconda3\lib\site-packages\sklearn\utils\validation.py in
_assert_all_finite(X, allow_nan, msg_dtype)
    101                 not allow_nan and not np.isfinite(X).all()):
    102             type_err = 'infinity' if allow_nan else 'NaN,
infinity'
--> 103             raise ValueError(
    104                     msg_err.format
    105                     (type_err,

ValueError: Input contains NaN, infinity or a value too large for
dtype('float64').
```