Assignment II - Kaggle Submission

November 15, 2020

[23]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import mean_squared_error, mean_absolute_error
```

[2]:
```
url = '../../Datasets/house-prices-advanced-regression-techniques/train.csv'
train = pd.read_csv(url, sep=",")
train.head(10)
```

[2]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	\
0	1	60	RL	65.0	8450	Pave	NaN	Reg	
1	2	20	RL	80.0	9600	Pave	NaN	Reg	
2	3	60	RL	68.0	11250	Pave	NaN	IR1	
3	4	70	RL	60.0	9550	Pave	NaN	IR1	
4	5	60	RL	84.0	14260	Pave	NaN	IR1	
5	6	50	RL	85.0	14115	Pave	NaN	IR1	
6	7	20	RL	75.0	10084	Pave	NaN	Reg	
7	8	60	RL	NaN	10382	Pave	NaN	IR1	
8	9	50	RM	51.0	6120	Pave	NaN	Reg	
9	10	190	RL	50.0	7420	Pave	NaN	Reg	

	LandContour	Utilities	…	PoolArea	PoolQC	Fence	MiscFeature	MiscVal	\
0	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
1	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
2	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
3	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
4	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
5	Lvl	AllPub	…	0	NaN	MnPrv	Shed	700	
6	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
7	Lvl	AllPub	…	0	NaN	NaN	Shed	350	
8	Lvl	AllPub	…	0	NaN	NaN	NaN	0	
9	Lvl	AllPub	…	0	NaN	NaN	NaN	0	

	MoSold	YrSold	SaleType	SaleCondition	SalePrice
0	2	2008	WD	Normal	208500
1	5	2007	WD	Normal	181500

```
2      9   2008        WD         Normal     223500
3      2   2006        WD        Abnorml     140000
4     12   2008        WD         Normal     250000
5     10   2009        WD         Normal     143000
6      8   2007        WD         Normal     307000
7     11   2009        WD         Normal     200000
8      4   2008        WD        Abnorml     129900
9      1   2008        WD         Normal     118000

[10 rows x 81 columns]
```

[3]:
```
y_train = train.SalePrice
y_train.head()
```

[3]:
```
0    208500
1    181500
2    223500
3    140000
4    250000
Name: SalePrice, dtype: int64
```

Mostly correlated columns with SalePrice

[4]:
```
corr_abs = train.corr().abs().sort_values(by=['SalePrice'], ascending=False)
mostly_corr = corr_abs[corr_abs.iloc[:,-1] > 0.5]
mostly_corr.columns
train[mostly_corr.columns].isnull().any()
#mostly_corr.isnull().any()
```

[4]:
```
Id              False
MSSubClass      False
LotFrontage      True
LotArea         False
OverallQual     False
OverallCond     False
YearBuilt       False
YearRemodAdd    False
MasVnrArea       True
BsmtFinSF1      False
BsmtFinSF2      False
BsmtUnfSF       False
TotalBsmtSF     False
1stFlrSF        False
2ndFlrSF        False
LowQualFinSF    False
GrLivArea       False
BsmtFullBath    False
```

```
BsmtHalfBath     False
FullBath         False
HalfBath         False
BedroomAbvGr     False
KitchenAbvGr     False
TotRmsAbvGrd     False
Fireplaces       False
GarageYrBlt       True
GarageCars       False
GarageArea       False
WoodDeckSF       False
OpenPorchSF      False
EnclosedPorch    False
3SsnPorch        False
ScreenPorch      False
PoolArea         False
MiscVal          False
MoSold           False
YrSold           False
SalePrice        False
dtype: bool
```

cleaning NaN values

[6]:
```
train[mostly_corr.columns] = train[mostly_corr.columns].fillna(0)
```

[7]:
```
train[mostly_corr.columns].isnull().any()
```

[7]:
```
Id               False
MSSubClass       False
LotFrontage      False
LotArea          False
OverallQual      False
OverallCond      False
YearBuilt        False
YearRemodAdd     False
MasVnrArea       False
BsmtFinSF1       False
BsmtFinSF2       False
BsmtUnfSF        False
TotalBsmtSF      False
1stFlrSF         False
2ndFlrSF         False
LowQualFinSF     False
GrLivArea        False
BsmtFullBath     False
BsmtHalfBath     False
```

```
FullBath         False
HalfBath         False
BedroomAbvGr     False
KitchenAbvGr     False
TotRmsAbvGrd     False
Fireplaces       False
GarageYrBlt      False
GarageCars       False
GarageArea       False
WoodDeckSF       False
OpenPorchSF      False
EnclosedPorch    False
3SsnPorch        False
ScreenPorch      False
PoolArea         False
MiscVal          False
MoSold           False
YrSold           False
SalePrice        False
dtype: bool
```

[8]:
```
del train[mostly_corr.columns]['SalePrice']
```

removing SalePrice column, lets check if NaN values exist

[20]:
```
mostly_corr.isnull().any()
```

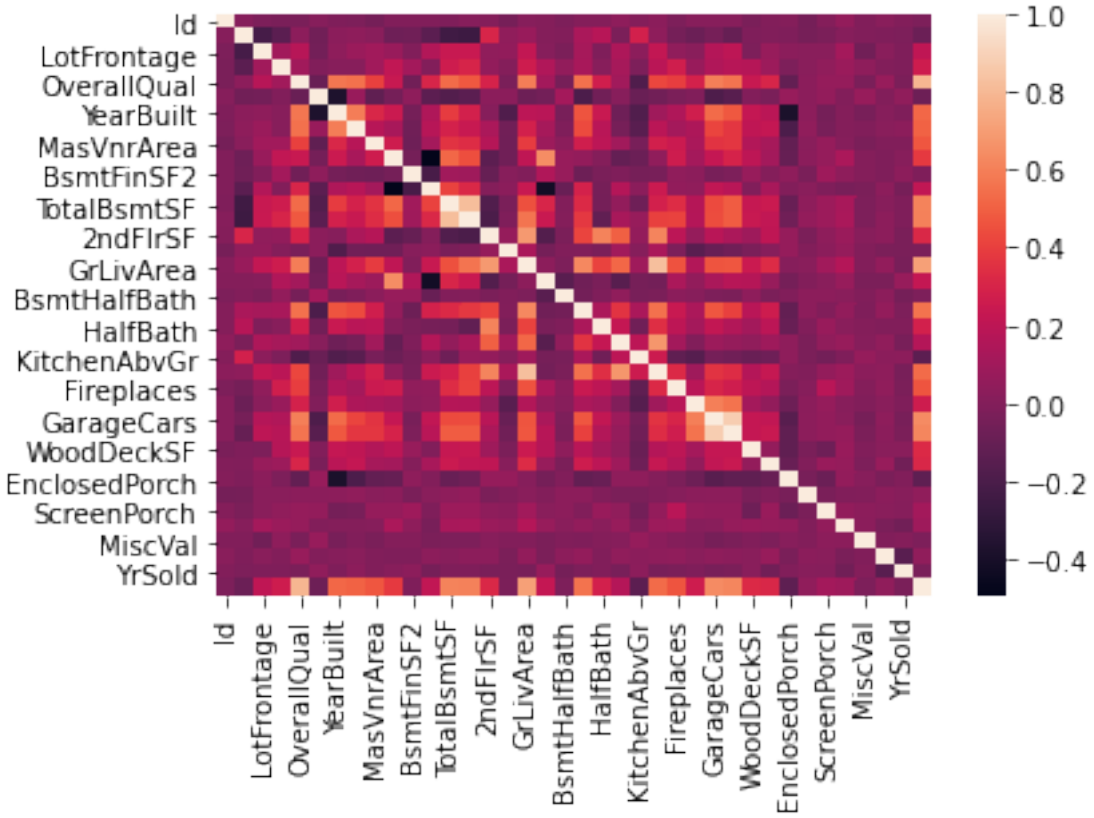
[20]:
```
Id               False
MSSubClass       False
LotFrontage      False
LotArea          False
OverallQual      False
OverallCond      False
YearBuilt        False
YearRemodAdd     False
MasVnrArea       False
BsmtFinSF1       False
BsmtFinSF2       False
BsmtUnfSF        False
TotalBsmtSF      False
1stFlrSF         False
2ndFlrSF         False
LowQualFinSF     False
GrLivArea        False
BsmtFullBath     False
BsmtHalfBath     False
FullBath         False
```

```
HalfBath         False
BedroomAbvGr     False
KitchenAbvGr     False
TotRmsAbvGrd     False
Fireplaces       False
GarageYrBlt      False
GarageCars       False
GarageArea       False
WoodDeckSF       False
OpenPorchSF      False
EnclosedPorch    False
3SsnPorch        False
ScreenPorch      False
PoolArea         False
MiscVal          False
MoSold           False
YrSold           False
SalePrice        False
dtype: bool
```

[82]:
```
cols = train[mostly_corr.columns].columns
```

[22]:
```
sns.heatmap(train[mostly_corr.columns].corr())
```

[22]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff9d90697c0>
```



[39]:
```
cols = cols[:-1]
```

[40]:
```
X_train = train[cols]
X_train.head()
```

[40]:

	Id	MSSubClass	LotFrontage	LotArea	OverallQual	OverallCond	YearBuilt	\
0	1	60	65.0	8450	7	5	2003	
1	2	20	80.0	9600	6	8	1976	
2	3	60	68.0	11250	7	5	2001	
3	4	70	60.0	9550	7	5	1915	
4	5	60	84.0	14260	8	5	2000	

	YearRemodAdd	MasVnrArea	BsmtFinSF1	…	GarageArea	WoodDeckSF	\
0	2003	196.0	706	…	548	0	
1	1976	0.0	978	…	460	298	
2	2002	162.0	486	…	608	0	
3	1970	0.0	216	…	642	0	
4	2000	350.0	655	…	836	192	

	OpenPorchSF	EnclosedPorch	3SsnPorch	ScreenPorch	PoolArea	MiscVal	\
0	61	0	0	0	0	0	

```
1            0            0          0            0         0
2           42            0          0            0         0
3           35          272          0            0         0
4           84            0          0            0         0

   MoSold  YrSold
0       2    2008
1       5    2007
2       9    2008
3       2    2006
4      12    2008

[5 rows x 37 columns]
```

NaN values fixed and SalePrice column removed

[80]:
```
from sklearn import linear_model
model = linear_model.LinearRegression()
model = model.fit(X_train, y_train)
train_predictions = model.predict(X_train)
train_predictions
```

[80]:
```
array([227286.82182012, 196557.96053216, 222772.94061721, …,
       223960.77437461, 131513.95653513, 152162.43258722])
```

[52]:
```
test_url = '../../Datasets/house-prices-advanced-regression-techniques/test.csv'
test = pd.read_csv(test_url)
test_cols = test[cols]
print(test_cols.head())
test_predictions = model.predict(test_cols.fillna(0))
print(test_predictions)
```

```
     Id  MSSubClass  LotFrontage  LotArea  OverallQual  OverallCond  \
0  1461          20         80.0    11622            5            6
1  1462          20         81.0    14267            6            6
2  1463          60         74.0    13830            5            5
3  1464          60         78.0     9978            6            6
4  1465         120         43.0     5005            8            5

   YearBuilt  YearRemodAdd  MasVnrArea  BsmtFinSF1  …  GarageArea  \
0       1961          1961         0.0       468.0  …       730.0
1       1958          1958       108.0       923.0  …       312.0
2       1997          1998         0.0       791.0  …       482.0
3       1998          1998        20.0       602.0  …       470.0
4       1992          1992         0.0       263.0  …       506.0

   WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  ScreenPorch  PoolArea  \
0         140            0              0          0          120         0
```

```
1          393           36            0          0            0         0
2          212           34            0          0            0         0
3          360           36            0          0            0         0
4            0           82            0          0          144         0

   MiscVal  MoSold  YrSold
0        0       6    2010
1    12500       6    2010
2        0       3    2010
3        0       6    2010
4        0       1    2010

[5 rows x 37 columns]
[118737.46828848 151477.84287532 172107.58179321 … 177506.58878017
 116639.38809339 255814.0829085 ]
```

Creating submission csv-file for test data

[81]:
```
submission = pd.DataFrame({'Id': test.Id, 'SalePrice': test_predictions})
submission.to_csv('submission.csv', index=False)
```

[66]:
```
print("Training MAE:", mean_absolute_error(y_train, train_predictions))

def mean_absolute_percentage_error(y_true, y_pred):
    return np.mean(np.abs((y_true - y_pred) / y_true)) * 100
print("Training MAPE:", mean_absolute_percentage_error(y_train,␣
 ↪train_predictions))
```

```
Training MAE: 20932.41489548892
Training MAPE: 12.474388904327395
```