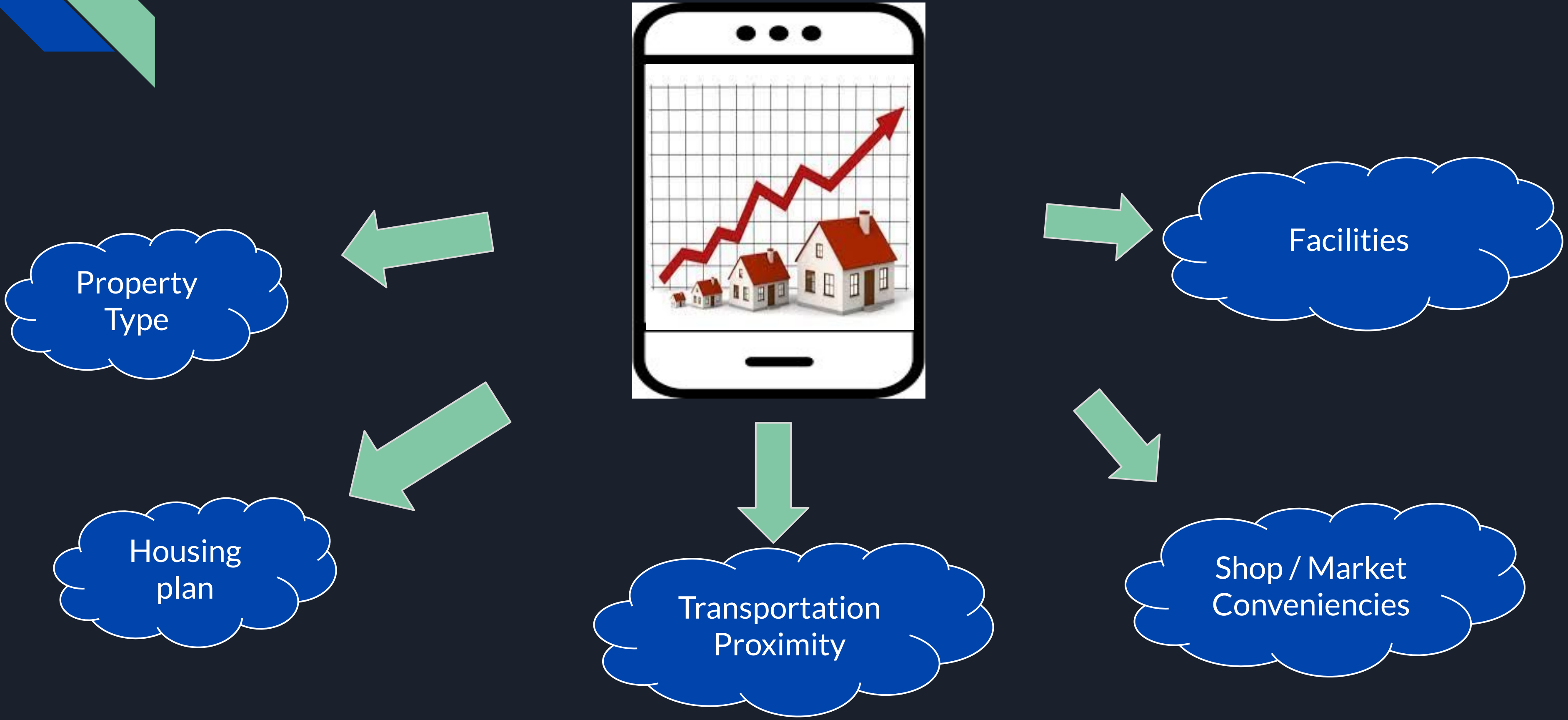
Bangkok Housing Price Prediction

What is the price of my property?

Problem Statement



Property Type

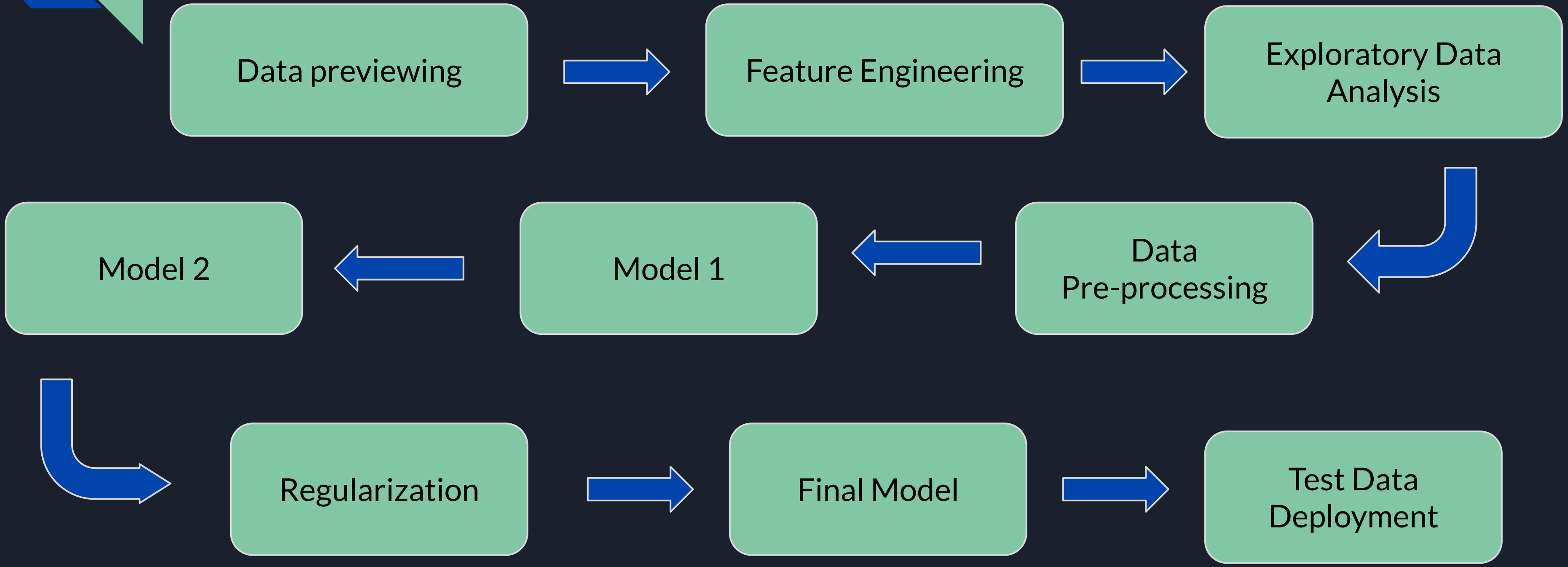
Housing plan

Transportation Proximity

Facilities

Shop / Market Conveniencies

Model Building Journey



Data previewing

Feature Engineering

Exploratory Data Analysis

Data Pre-processing

Model 1

Model 2

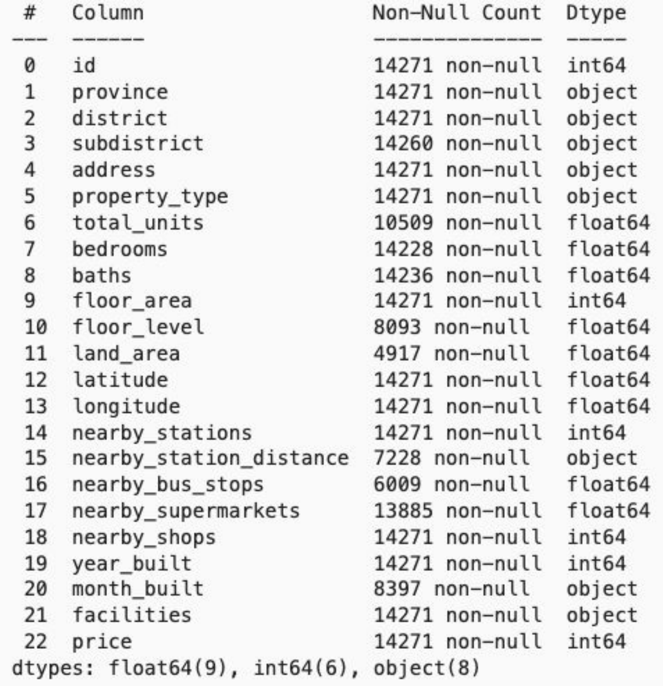
Regularization

Final Model

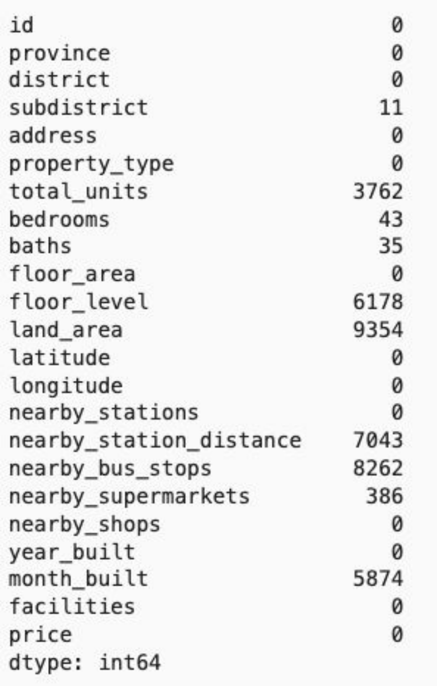
Test Data Deployment

Data Previewing

- Multiple missing values
- 8 object data columns



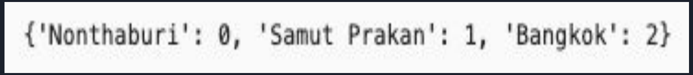
```
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   id                        14271 non-null  int64
 1   province                  14271 non-null  object
 2   district                  14271 non-null  object
 3   subdistrict               14260 non-null  object
 4   address                   14271 non-null  object
 5   property_type             14271 non-null  object
 6   total_units               10509 non-null  float64
 7   bedrooms                  14228 non-null  float64
 8   baths                     14236 non-null  float64
 9   floor_area                14271 non-null  int64
 10  floor_level               8093 non-null   float64
 11  land_area                 4917 non-null   float64
 12  latitude                  14271 non-null  float64
 13  longitude                 14271 non-null  float64
 14  nearby_stations           14271 non-null  int64
 15  nearby_station_distance   7228 non-null   object
 16  nearby_bus_stops          6009 non-null   float64
 17  nearby_supermarkets       13885 non-null  float64
 18  nearby_shops              14271 non-null  int64
 19  year_built                14271 non-null  int64
 20  month_built               8397 non-null   object
 21  facilities                14271 non-null  object
 22  price                     14271 non-null  int64
dtypes: float64(9), int64(6), object(8)
```



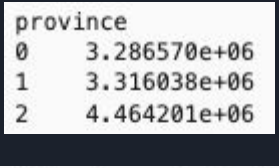
```
id                            0
province                      0
district                      0
subdistrict                  11
address                       0
property_type                 0
total_units                3762
bedrooms                     43
baths                        35
floor_area                    0
floor_level                6178
land_area                  9354
latitude                      0
longitude                     0
nearby_stations               0
nearby_station_distance    7043
nearby_bus_stops           8262
nearby_supermarkets         386
nearby_shops                  0
year_built                    0
month_built                5874
facilities                    0
price                         0
dtype: int64
```

Feature Engineering

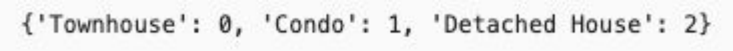
- Target Encoding: District, Subdistrict, Province, Property_type columns
- Numeric Encoding Month_built column
- Count_facilities column: Count each facility
- Closest_station_name and Closest_station_distance
- No removing of data



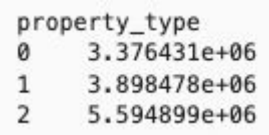
```
{'Nonthaburi': 0, 'Samut Prakan': 1, 'Bangkok': 2}
```



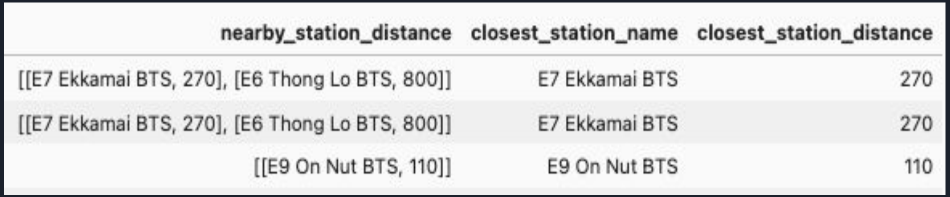
```
province
0    3.286570e+06
1    3.316038e+06
2    4.464201e+06
```



```
{'Townhouse': 0, 'Condo': 1, 'Detached House': 2}
```

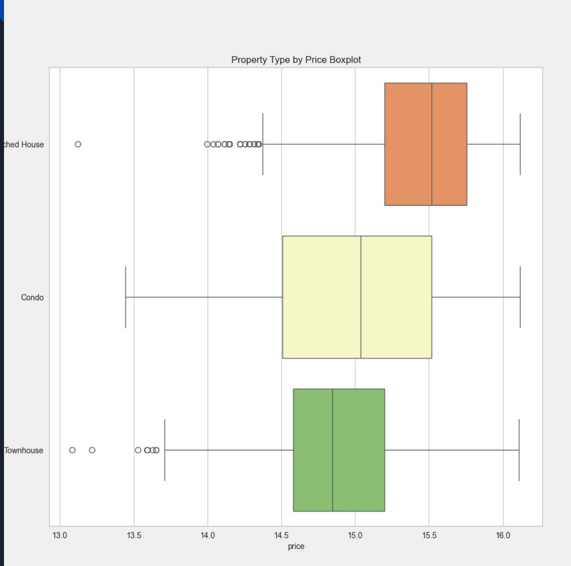


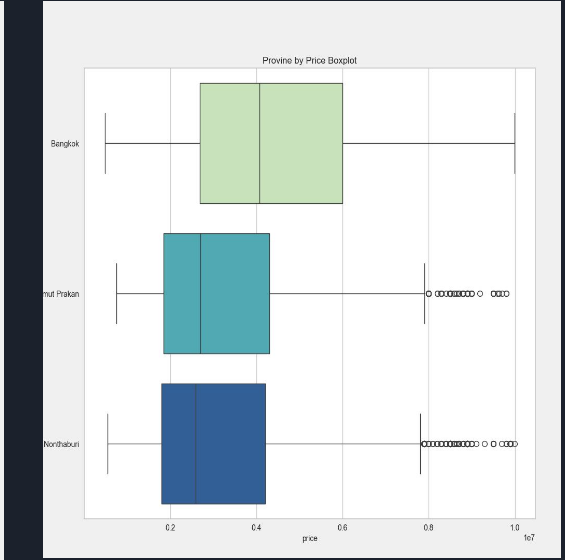
```
property_type
0    3.376431e+06
1    3.898478e+06
2    5.594899e+06
```

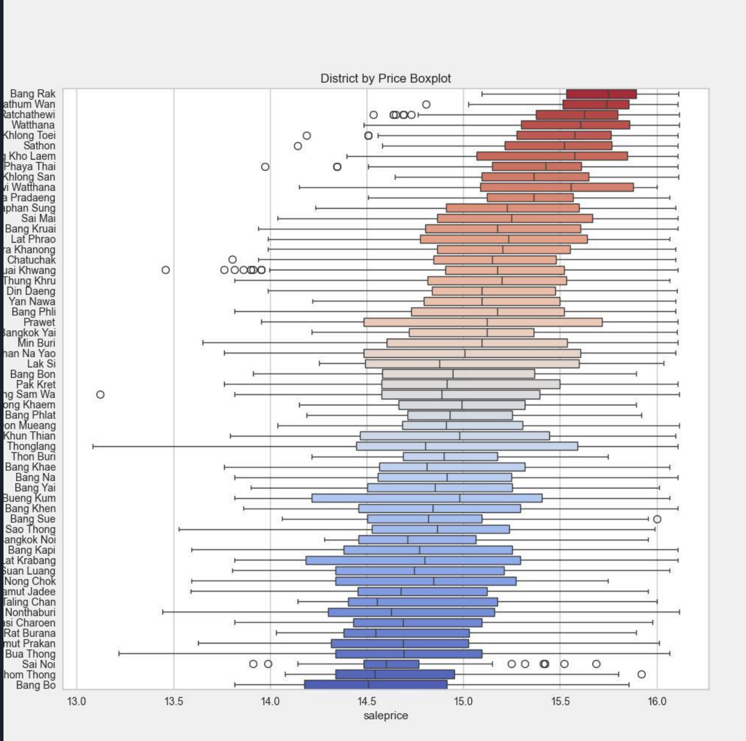


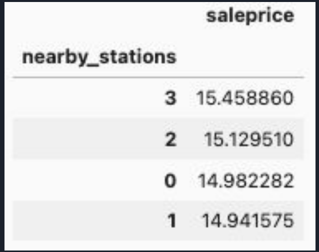
nearby_station_distance	closest_station_name	closest_station_distance
[[E7 Ekkamai BTS, 270], [E6 Thong Lo BTS, 800]]	E7 Ekkamai BTS	270
[[E7 Ekkamai BTS, 270], [E6 Thong Lo BTS, 800]]	E7 Ekkamai BTS	270
[[E9 On Nut BTS, 110]]	E9 On Nut BTS	110

Exploratory Data Analysis

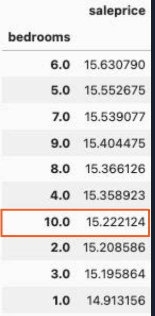




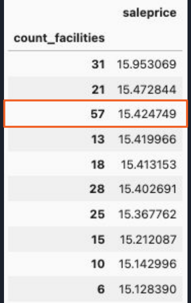




nearby_stations	saleprice
3	15.458860
2	15.129510
0	14.982282
1	14.941575

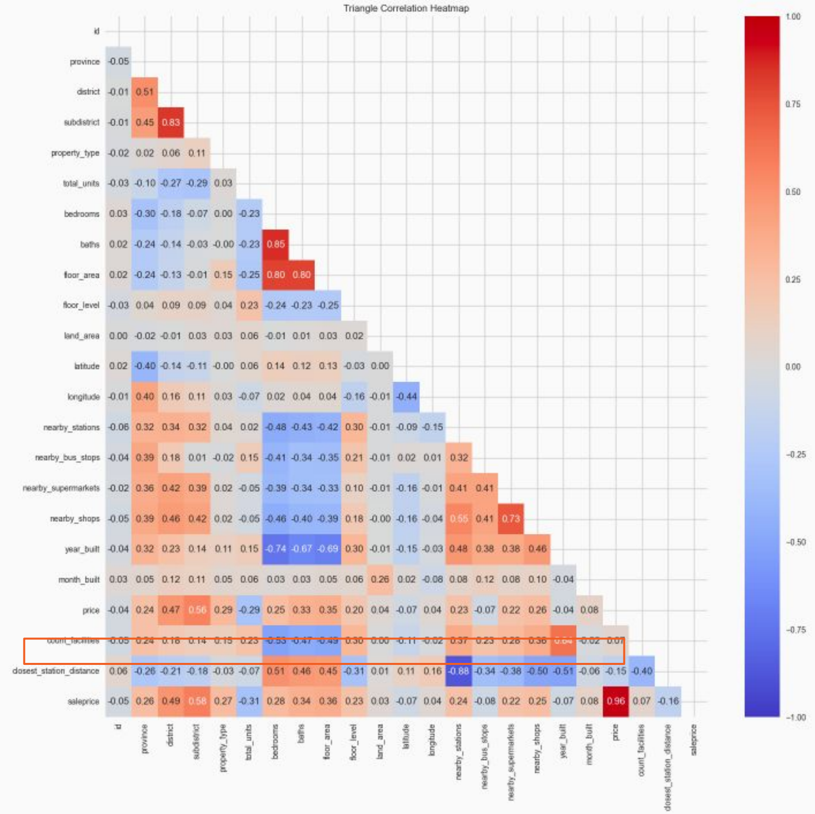


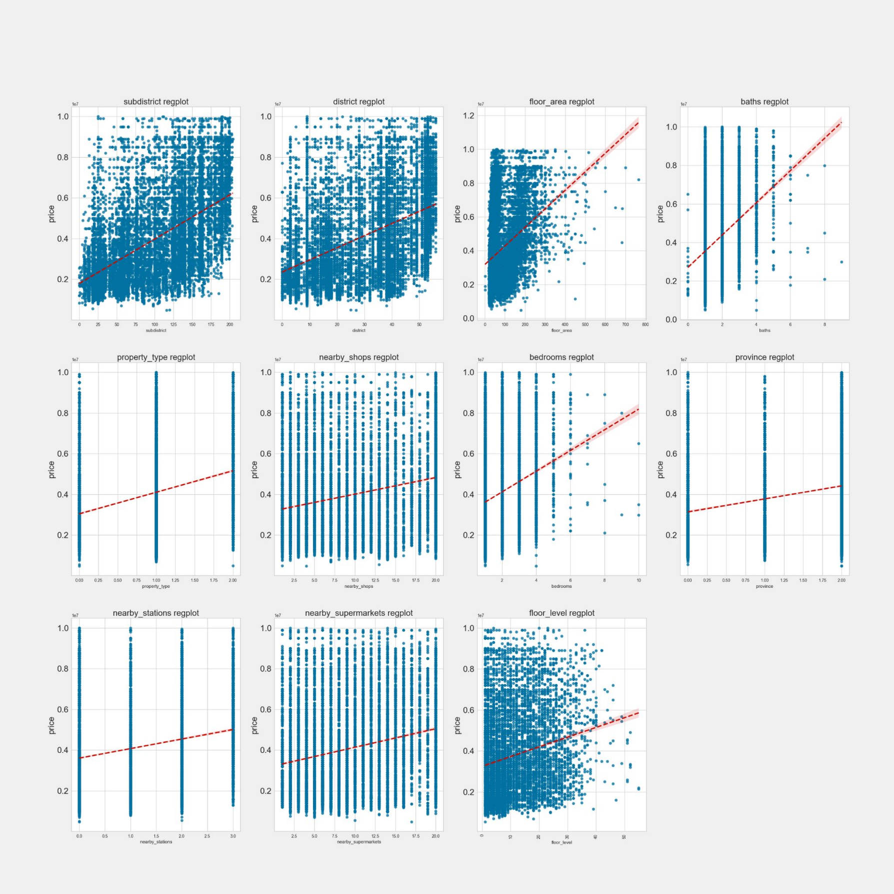
bedrooms	saleprice
6.0	15.630790
5.0	15.552675
7.0	15.539077
9.0	15.404475
8.0	15.366126
4.0	15.358923
10.0	15.222124
2.0	15.208586
3.0	15.195864
1.0	14.913156



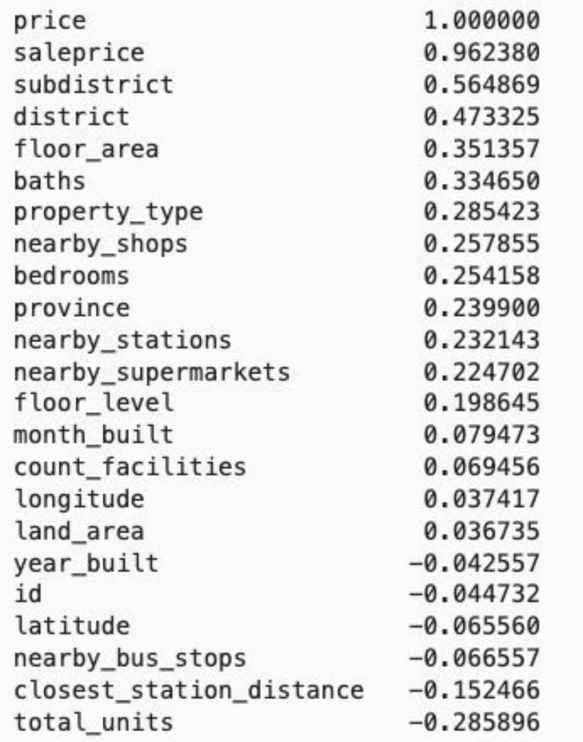
count_facilities	saleprice
31	15.953069
21	15.472844
57	15.424749
13	15.419966
18	15.413153
28	15.402691
25	15.367762
15	15.212087
10	15.142996
6	15.128390

Correlation Analysis

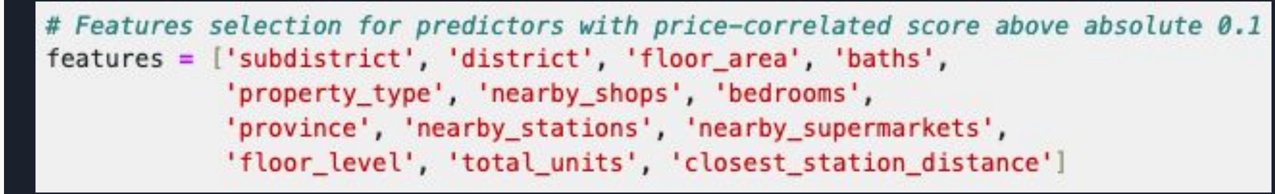




Feature Selection



```
price                      1.000000
saleprice                  0.962380
subdistrict                0.564869
district                   0.473325
floor_area                 0.351357
baths                      0.334650
property_type              0.285423
nearby_shops               0.257855
bedrooms                   0.254158
province                   0.239900
nearby_stations            0.232143
nearby_supermarkets        0.224702
floor_level                0.198645
month_built                0.079473
count_facilities           0.069456
longitude                  0.037417
land_area                  0.036735
year_built                -0.042557
id                        -0.044732
latitude                  -0.065560
nearby_bus_stops          -0.066557
closest_station_distance  -0.152466
total_units               -0.285896
```

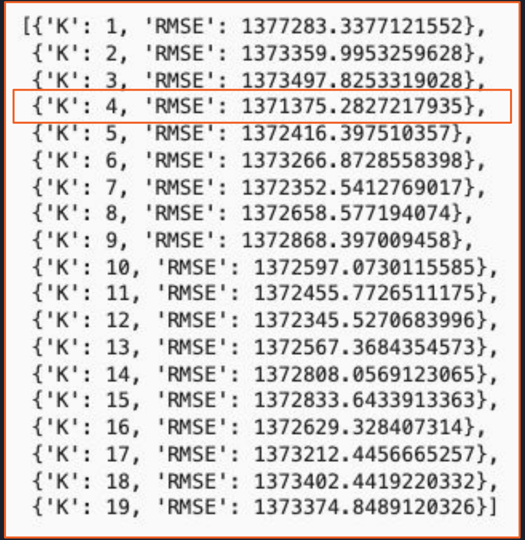


```
# Features selection for predictors with price-correlated score above absolute 0.1
features = ['subdistrict', 'district', 'floor_area', 'baths',
            'property_type', 'nearby_shops', 'bedrooms',
            'province', 'nearby_stations', 'nearby_supermarkets',
            'floor_level', 'total_units', 'closest_station_distance']
```

- Selected features are set for X dataframe
- Price for Y dataframe

Pre-processing

KNN-Imputer



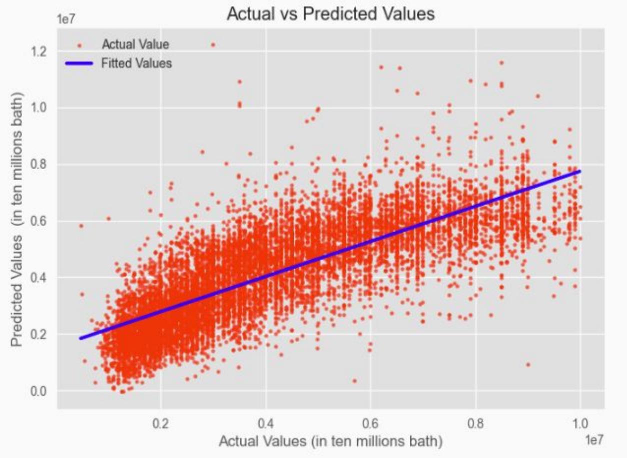
```
[{'K': 1, 'RMSE': 1377283.3377121552},
 {'K': 2, 'RMSE': 1373359.9953259628},
 {'K': 3, 'RMSE': 1373497.8253319028},
 {'K': 4, 'RMSE': 1371375.2827217935},
 {'K': 5, 'RMSE': 1372416.397510357},
 {'K': 6, 'RMSE': 1373266.8728558398},
 {'K': 7, 'RMSE': 1372352.5412769017},
 {'K': 8, 'RMSE': 1372658.577194074},
 {'K': 9, 'RMSE': 1372868.397009458},
 {'K': 10, 'RMSE': 1372597.0730115585},
 {'K': 11, 'RMSE': 1372455.7726511175},
 {'K': 12, 'RMSE': 1372345.5270683996},
 {'K': 13, 'RMSE': 1372567.3684354573},
 {'K': 14, 'RMSE': 1372808.0569123065},
 {'K': 15, 'RMSE': 1372833.6433913363},
 {'K': 16, 'RMSE': 1372629.328407314},
 {'K': 17, 'RMSE': 1373212.4456665257},
 {'K': 18, 'RMSE': 1373402.4419220332},
 {'K': 19, 'RMSE': 1373374.8489120326}]
```

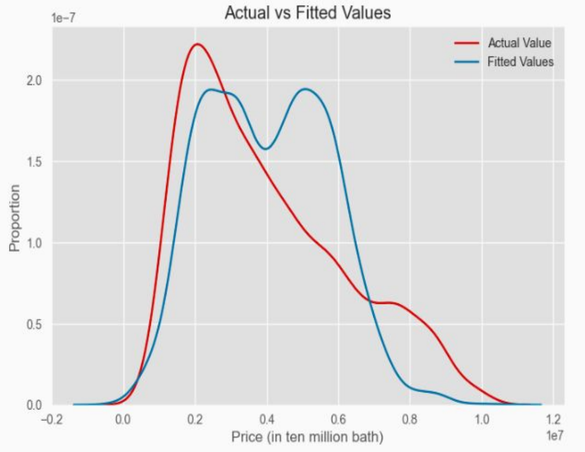
- Perform KNN Imputer from K:1-19, search the K with the lowest RMSE
- Step1: Transforming X_train with KNN Imputer
- Step2: Fit Train KNN with Linear Regression model and evaluate its RMSE

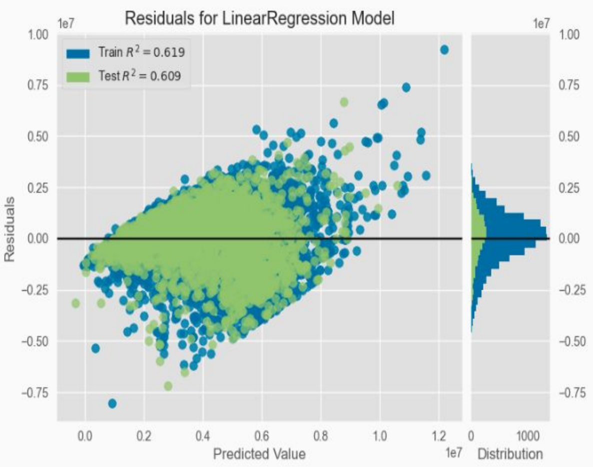
→

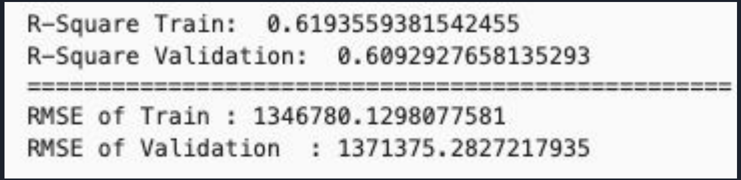
Standard-Scaler

Model1: Linear Regression





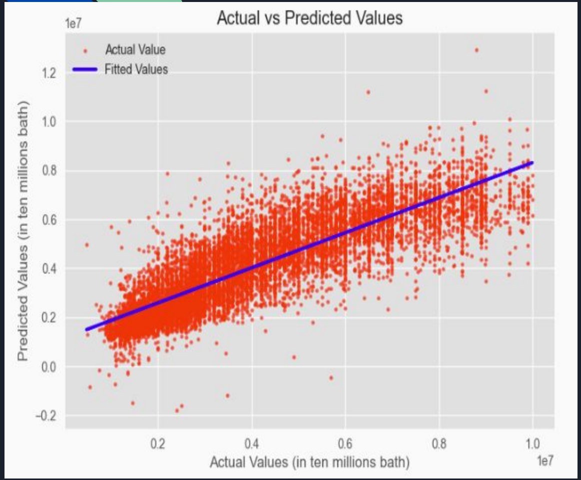


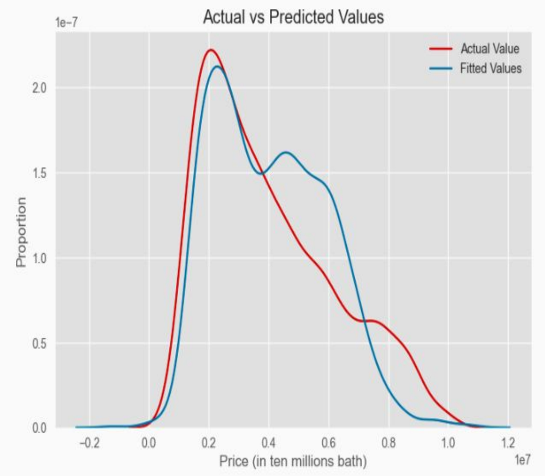


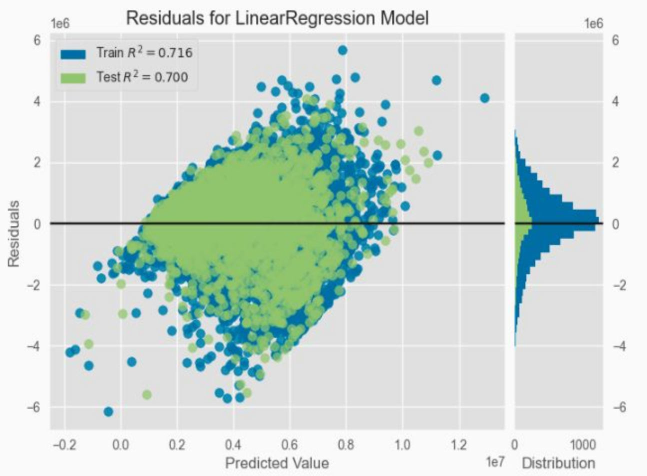
```
R-Square Train:  0.6193559381542455
R-Square Validation:  0.6092927658135293
==================================================
RMSE of Train : 1346780.1298077581
RMSE of Validation  : 1371375.2827217935
```

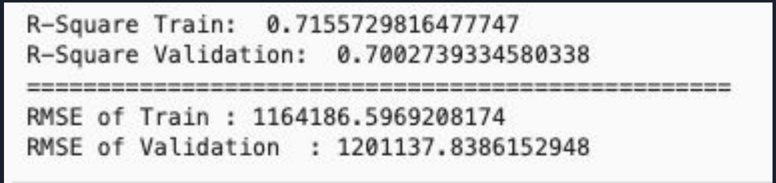
- The model is underperformed
- Performance on train and test data are resemblance
- Not overfit/underfit
- Data more varied/dispersed

Model2: Polynomial-Featured Linear Regression







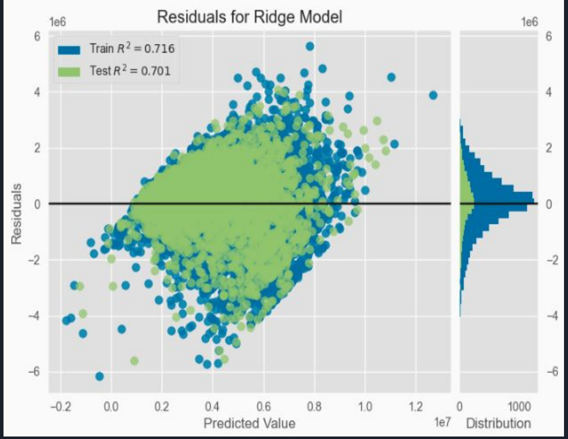


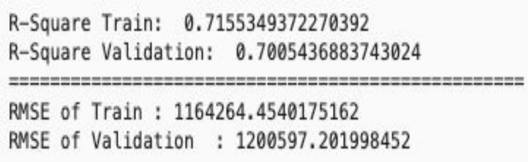
```
R-Square Train:  0.7155729816477747
R-Square Validation:  0.7002739334580338
=================================================
RMSE of Train : 1164186.5969208174
RMSE of Validation  : 1201137.8386152948
```

- The model is not overfit/underfit
- Performance on train and test data are resemblance
- Performance improved
- Data is less varied

Polynomial Regression Tuning

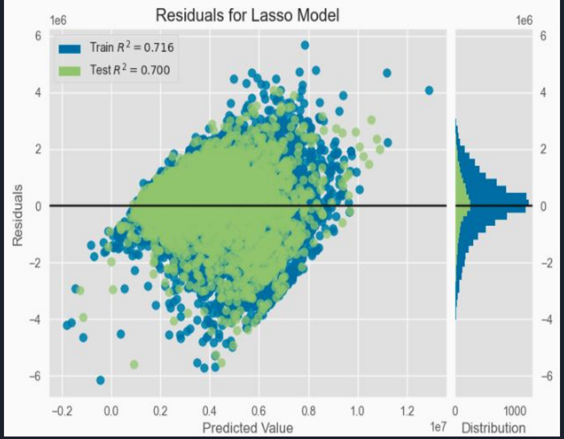
Ridge Regularization

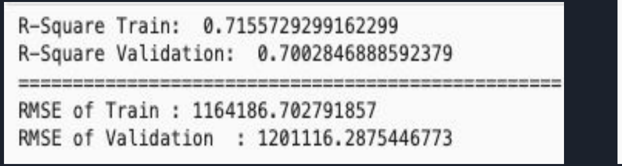




```
R-Square Train:  0.7155349372270392
R-Square Validation:  0.7005436883743024
================================================
RMSE of Train : 1164264.4540175162
RMSE of Validation  : 1200597.201998452
```

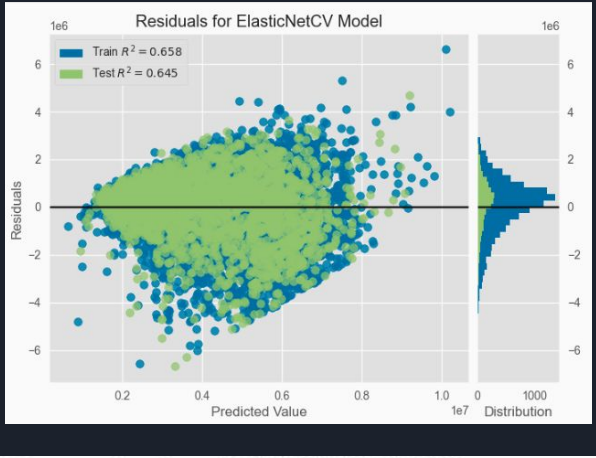
Lasso Regularization

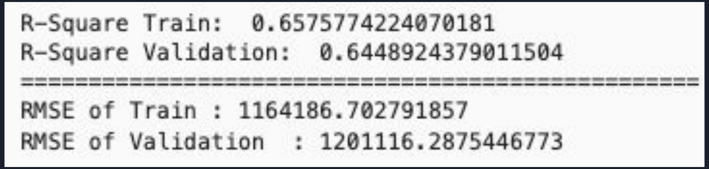




```
R-Square Train:  0.7155729299162299
R-Square Validation:  0.7002846888592379
================================================
RMSE of Train : 1164186.702791857
RMSE of Validation  : 1201116.2875446773
```

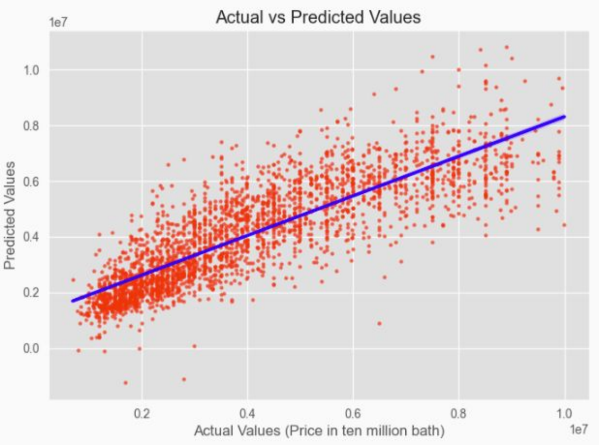
Elastic Net Regularization

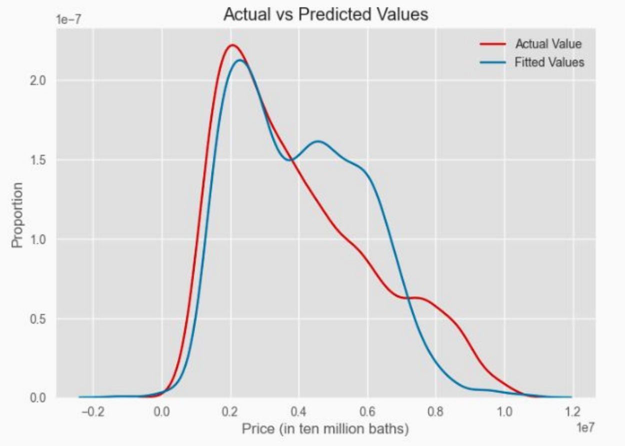


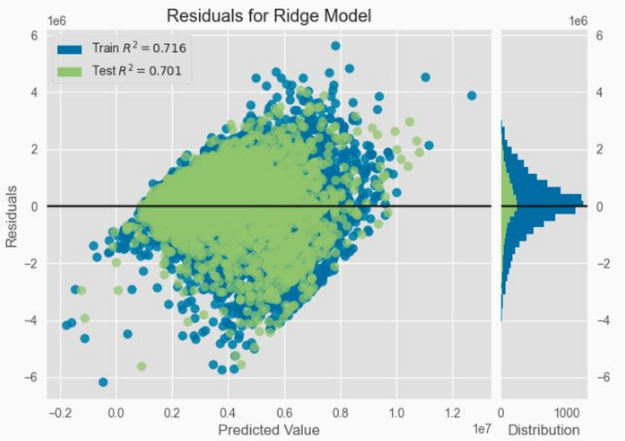


```
R-Square Train:  0.6575774224070181
R-Square Validation:  0.6448924379011504
================================================
RMSE of Train : 1164186.702791857
RMSE of Validation  : 1201116.2875446773
```

Polynomial Featured Linear Regression: Ridge







Model Evaluation: Validated Data

Linear Regression	0.609292765813529	1371375.2827217935
PolynomialFeatured LR	0.7002739334580338	1201137.8386152948
Poly LR (Ridge)	0.7005436883743024	1200597.201998452
Poly LR (Lasso)	0.7002846888592379	1201116.2875446773
Poly LR (Elastic Net)	0.6448924379011504	1201116.2875446773

- Important Features
- Sub-District, District, Property Type, Interior of the House, Location