CS 514
Applied Artificial Intelligence
Project 5
Codename - Purple

Zillow Prize: Zillow's Home Value Prediction (Zestimate)

(Can you improve the algorithm that changed the world of real estate?)

https://www.kaggle.com/c/zillow-prize-1

INDEX

Note: *Suitable links have been provided for additional information wherever necessary in RULES AND DESCRIPTION.*

ABSTRACT

Zillow's Zestimate home valuation has shaken up the U.S. real estate industry since first released 11 years ago.

A home is often the largest and most expensive purchase a person makes in his or her lifetime. Ensuring homeowners have a trusted way to monitor this asset is incredibly important. The Zestimate was created to give consumers as much information as possible about homes and the housing market, marking the first time consumers had access to this type of home value information at no cost.

"Zestimates" are estimated home values based on 7.5 million statistical and machine learning models that analyze hundreds of data points on each property. And, by continually improving the median margin of error (from 14% at the onset to 5% today), Zillow has since become established as one of the largest, most trusted marketplaces for real estate information in the U.S. and a leading example of impactful machine learning.

Zillow Prize, a competition with a one million dollar grand prize, is challenging the data science community to help push the accuracy of the Zestimate even further. Winning algorithms stand to impact the home values of 110M homes across the U.S.

In this million-dollar competition, participants will develop an algorithm that makes predictions about the future sale prices of homes. The contest is structured into two rounds, the qualifying round which opens May 24, 2017 and the private round for the 100 top qualifying teams that opens on Feb 1st, 2018. In the qualifying round, you'll be building a model to improve the Zestimate residual error. In the final round, you'll build a home valuation algorithm from the ground up, using external data sources to help engineer new features that give your model an edge over the competition.

Because real estate transaction data is public information, there will be a three-month sales tracking period after each competition round closes where your predictions will be evaluated against the actual sale prices of the homes. The final leaderboard won't be revealed until the close of the sales tracking period.

USAGE MANUAL

INSTRUCTIONS:

Download the code from https://www.kaggle.com/cpvirani/draft-random/notebook or from the zip folder attached. Unzip it and run the notebook code.

Requirements:

To run the source code, you must have the below software installed in your machine.

Software	Download link
Python 3.5	https://www.python.org/downloads/
sklearn	http://scikit-learn.org/stable/install.html
matplotlib	http://matplotlib.org/downloads.html
numpy	http://www.scipy.org/scipylib/download.html
Pandas	
Xgboost	
Lightbgm	
gc	
random	
datetime	
seaborn	

Results

XGBoost

```
Predicting with XGBoost ...
First XGBoost predictions:
          0
0 -0.029928
1 -0.021941
2  0.025714
3  0.072211
4  0.010145

Setting up data for XGBoost ...
num_boost_rounds=150

Training XGBoost again ...
Predicting with XGBoost again ...
Second XGBoost predictions:
          0
0 -0.084468
1 -0.033246
2  0.017929
3  0.067383
4  0.034122

Combined XGBoost predictions:
0
0 -0.040384
1 -0.024108
2  0.024222
3  0.071285
4  0.014741
63157
```

LightBGM

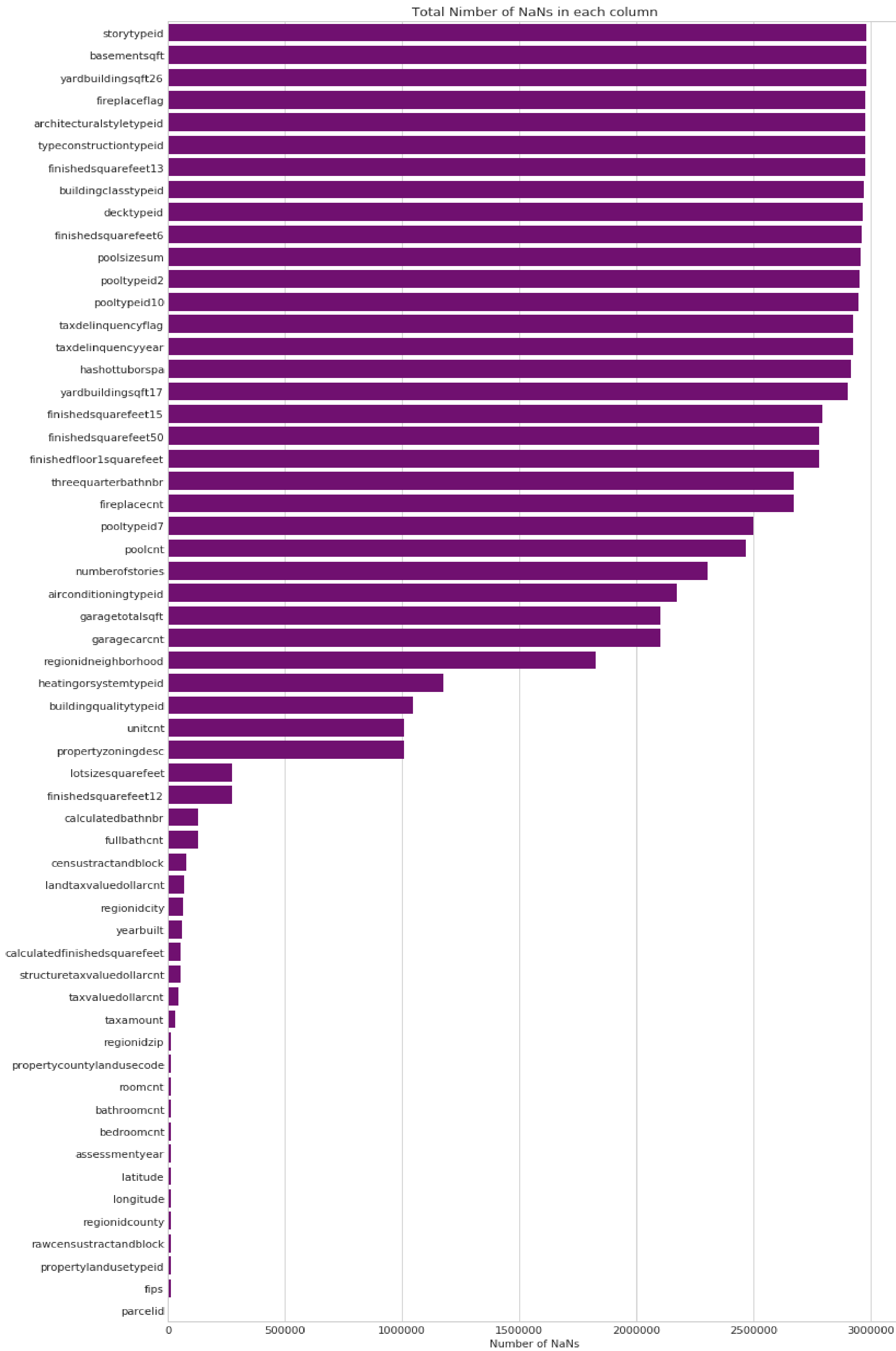
```
Start LightGBM prediction ...
Unadjusted LightGBM predictions:
          0
0  0.029938
1  0.032608
2  0.010775
3  0.009892
4  0.009784
```

Combined

```
Combining XGBoost, LightGBM, and baseline predicitons ...

Combined XGB/LGB/baseline predictions:
          0
0 -0.016695
1 -0.004245
2  0.021221
3  0.053898
4  0.014187

Predicting with OLS and combining with XGB/LGB/baseline predicitons: ...
predict... 0
predict... 1
predict... 2
predict... 3
predict... 4
predict... 5

Combined XGB/LGB/baseline/OLS predictions:
   ParcelId  201610  201611  201612  201710  201711  201712
0  10754147 -0.0181 -0.0181 -0.0181 -0.0181 -0.0181 -0.0181
1  10759547 -0.0072 -0.0072 -0.0073 -0.0072 -0.0072 -0.0073
2  10843547  0.0749  0.0749  0.0749  0.0749  0.0749  0.0749
3  10859147  0.0526  0.0526  0.0526  0.0526  0.0526  0.0526
4  10879947  0.0156  0.0156  0.0155  0.0156  0.0156  0.0155
```

Plot # 1: Total Number of NaN’s in each column

```
parcelid airconditioningtypeid architecturalstyletypeid  basementsqft  \
0  10754147                   NaN                      NaN           NaN
1  10759547                   NaN                      NaN           NaN
2  10843547                   NaN                      NaN           NaN
3  10859147                   NaN                      NaN           NaN
4  10879947                   NaN                      NaN           NaN

   bathroomcnt  bedroomcnt buildingclasstypeid buildingqualitytypeid  \
0          0.0         0.0                 NaN                   NaN
1          0.0         0.0                 NaN                   NaN
2          0.0         0.0                 NaN                   NaN
3          0.0         0.0                   3                     7
4          0.0         0.0                   4                   NaN

   calculatedbathnbr decktypeid         ...            numberofstories  \
0                NaN        NaN         ...                        NaN
1                NaN        NaN         ...                        NaN
2                NaN        NaN         ...                        NaN
3                NaN        NaN         ...                        1.0
4                NaN        NaN         ...                        NaN

   fireplaceflag  structuretaxvaluedollarcnt  taxvaluedollarcnt  \
0            NaN                         NaN                9.0
1            NaN                         NaN            27516.0
2            NaN                    650756.0          1413387.0
3            NaN                    571346.0          1156834.0
4            NaN                    193796.0           433491.0

   assessmentyear  landtaxvaluedollarcnt  taxamount taxdelinquencyflag  \
0          2015.0                    9.0        NaN                NaN
1          2015.0                27516.0        NaN                NaN
2          2015.0               762631.0   20800.37                NaN
3          2015.0               585488.0   14557.57                NaN
4          2015.0               239695.0    5725.17                NaN

   taxdelinquencyyear  censustractandblock
0                 NaN                  NaN
1                 NaN                  NaN
2                 NaN                  NaN
3                 NaN                  NaN
4                 NaN                  NaN

[5 rows x 58 columns]
```



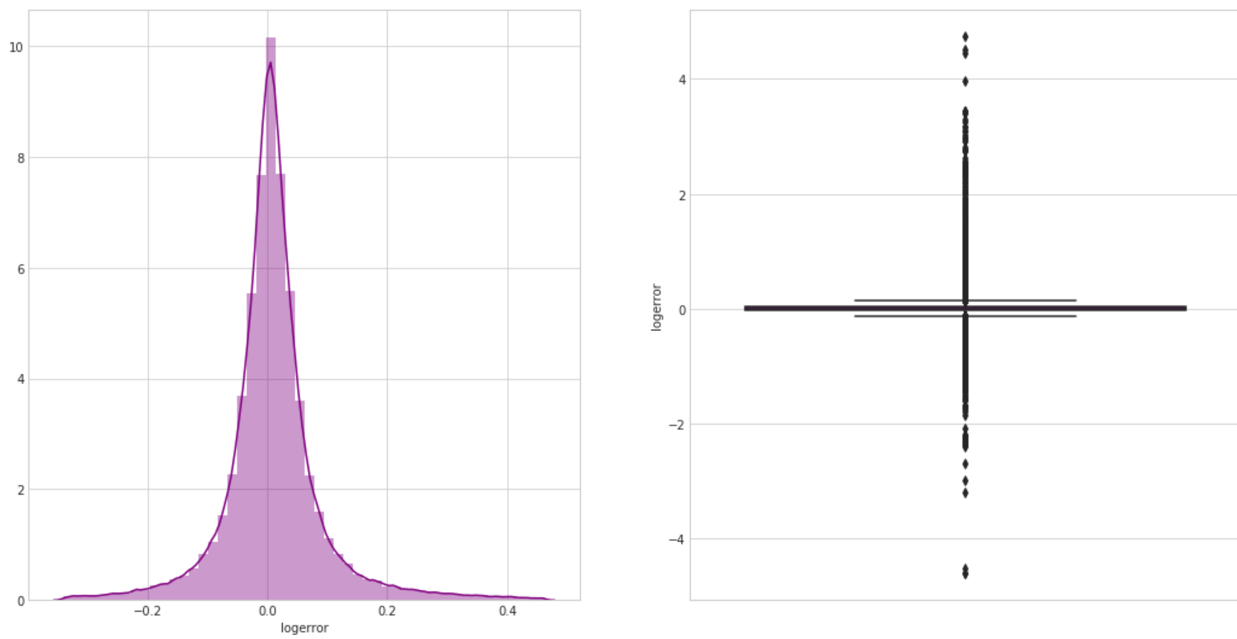
Total Nimber of NaNs in each column
storytypeid
basementsqft
yardbuildingsqft26
fireplaceflag
architecturalstyletypeid
typeconstructiontypeid
finishedsquarefeet13
buildingclasstypeid
decktypeid
finishedsquarefeet6
poolsizesum
pooltypeid2
pooltypeid10
taxdelinquencyflag
taxdelinquencyyear
hashottuborspa
yardbuildingsqft17
finishedsquarefeet15
finishedsquarefeet50
finishedfloor1squarefeet
threequarterbathnbr
fireplacecnt
pooltypeid7
poolcnt
numberofstories
airconditioningtypeid
garagetotalsqft
garagecarcnt
regionidneighborhood
heatingorsystemtypeid
buildingqualitytypeid
unitcnt
propertyzoningdesc
lotsizesquarefeet
finishedsquarefeet12
calculatedbathnbr
fullbathcnt
censustractandblock
landtaxvaluedollarcnt
regionidcity
yearbuilt
calculatedfinishedsquarefeet
structuretaxvaluedollarcnt
taxvaluedollarcnt
taxamount
regionidzip
propertycountylandusecode
roomcnt
bathroomcnt
bedroomcnt
assessmentyear
latitude
longitude
regionidcounty
rawcensustractandblock
propertylandusetypeid
fips
parcelid
0
500000
1000000
1500000
2000000
2500000
3000000
Number of NaNs

Plot # 2: logerror

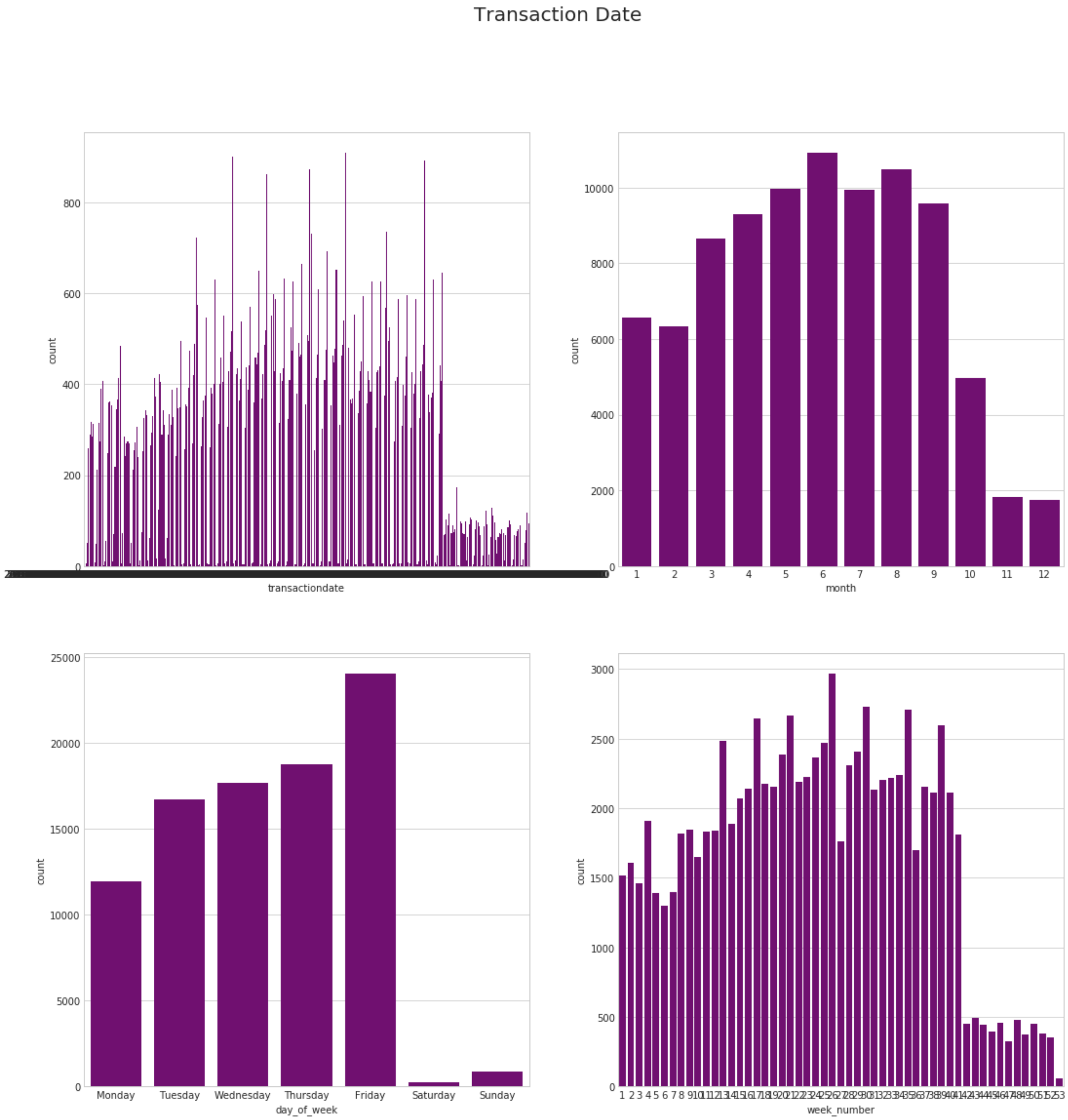
```
Checking logerror
parcelid airconditioningtypeid architecturalstyletypeid  basementsqft  \
0  17073783                   NaN                       NaN           NaN
1  17088994                   NaN                       NaN           NaN
2  17100444                   NaN                       NaN           NaN
3  17102429                   NaN                       NaN           NaN
4  17109604                   NaN                       NaN           NaN

   bathroomcnt  bedroomcnt buildingclasstypeid buildingqualitytypeid  \
0          2.5         3.0                 NaN                   NaN
1          1.0         2.0                 NaN                   NaN
2          2.0         3.0                 NaN                   NaN
3          1.5         2.0                 NaN                   NaN
4          2.5         4.0                 NaN                   NaN

   calculatedbathnbr decktypeid     ...       landtaxvaluedollarcnt  \
0                2.5        NaN     ...                     76724.0
1                1.0        NaN     ...                     95870.0
2                2.0        NaN     ...                     14234.0
3                1.5        NaN     ...                     17305.0
4                2.5        NaN     ...                    277000.0

   taxamount  taxdelinquencyflag  taxdelinquencyyear  censustractandblock  \
0    2015.06                 NaN                 NaN       61110022003007
1    2581.30                 NaN                 NaN       61110015031002
2     591.64                 NaN                 NaN       61110007011007
3     682.78                 NaN                 NaN       61110008002013
4    5886.92                 NaN                 NaN       61110014021007

   logerror  transactiondate month  day_of_week  week_number
0    0.0953       2016-01-27     1    Wednesday            4
1    0.0198       2016-03-30     3    Wednesday           13
2    0.0060       2016-05-27     5       Friday           21
3   -0.0566       2016-06-07     6      Tuesday           23
4    0.0573       2016-08-08     8       Monday           32

[5 rows x 63 columns]
```

- Boxplot
- distplot

logerror



Plot # 3: scrutinizing transaction date



Plot # 4: logerror vs variable

- barplot
- regplot
- There are similar graphs for various variables