

# Greater Seattle Area Housing: Sales Price Prediction

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2017-02-27

## Summary

The goal of this project is to predict the sale price of a property by employing various predictive machine learning models in an ensemble given housing data such as the number of bedrooms/bathrooms, square footage, year built as well as other less intuitive variables as provided by the Zillow API.

## Training Data

The most important element of any data science project is the data itself. This project heavily utilizes data from Zillow, a real estate destination for the internet generation. Fortunately, Zillow provides a public API which provides a convenience to an otherwise tedious task. Below are some basic information of the data.

```
>>> df.head()
      zipid      street      city state      zip FIPSCounty
0  38447172  18314 48th Ave W  Lynnwood    WA  98037    53061
1  38448108  19011 Grannis Rd   Bothell    WA  98012    53061
2  38448131  2625 189th St SE   Bothell    WA  98012    53061
3  38449213  719  John Bailey Rd Bothell    WA  98012    53061
4  38452743  5113 212th St SW   Lynnwood    WA  98036    53061

      useCode taxAssessmentYear taxAssessment yearBuilt  ...
bedrooms \
0  SingleFamily      2015      222100      1967  ...
3
1  SingleFamily      2015      233400      1969  ...
3
2  SingleFamily      2015      486300      1999  ...
```

```

2
3 SingleFamily          2015          238800          1957      ...
3
4 SingleFamily          2015          294300          1960      ...
3

    lastSoldDate lastSoldPrice zestimate zestimateLastUpdated \
0    11/07/2016      315000      326746      12/30/2016
1    10/06/2016      353000      368478      12/30/2016
2     02/01/2016      405000      673774      12/30/2016
3     07/22/2016      360000      369992      12/30/2016
4     05/12/2016      430000      460211      12/30/2016

    zestimateValueChange zestimateValueLow zestimateValueHigh \
0                -5752           310409           343083
1                -2945           350054           386902
2                 -360           640085           707463
3                 1275           351492           388492
4                 1540           437200           483222

    zestimatePercentile    region
0                0    Lynnwood
1                0    Bothell
2                0    Bothell
3                0    Bothell
4                0    Lynnwood

[5 rows x 23 columns]

```

Printing the *shape* attribute shows that we have 2826 observations and 23 columns.

```

>>> df.shape
(2826, 23)

```

Finally, printing the *columns* attribute produces a list of all column names.

```

>>> df.columns
Index([u'zipid', u'street', u'city', u'state', u'zip', u'FIPSCounty',
       u'useCode', u'taxAssessmentYear', u'taxAssessment',
       u'yearBuilt',
       u'lotSizeSqFt', u'finishedSqFt', u'bathrooms', u'bedrooms',
       u'lastSoldDate', u'lastSoldPrice', u'zestimate',
       u'zestimateLastUpdated', u'zestimateValueChange',
       u'zestimateValueLow',
       u'zestimateValueHigh', u'zestimatePercentile', u'region'],
      dtype='object')

```

## Collection Process

Although the availability of a public API has made the data collection process simple, there are some limitations that we had to be cognizant of. Our vision was to start with a “seed” property which in turn would collect “comps” or comparables. Comps are simply other properties that have similar features to our seed property. This will provide a buyer an idea of what the value of the property should be.

The first limitation is that the full set of information that we were looking for cannot be extracted from one API endpoint. Zillow does not provide an endpoint which returns property information of comps given a seed property. What it provides instead is one endpoint that returns a list of comp property IDs (Zillow Property ID or ZPID) given a seed property address and a separate endpoint that returns property information given a ZPID. Furthermore, the comp endpoint returns a maximum of 25 comps per seed property. Thus the collection process is divided into three steps:

1. Collect comp IDs given a property address using *GetDeepSearchResults*.
2. Loop through each ZPID, collect 25 more comps for each, and append results to list of the other ZPIDs.
3. Collect property information for each ZPID collected using *GetDeepComps*.

The second limitation is that Zillow has limited the number of calls allowed per day to 1000. This poses a problem if one’s intent was to collect a significant amount of data. This limits our collection process further since we had to resort to making two calls. A simple solution was to include a sleep timer of 24 hours when a call encounters a rate limit warning. Although somewhat inconvenient, the solution achieved what we needed to accomplish.