

First Stop for First-time home buyers

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Background:

First time new buyers in this generation have some of the questions same as previous generations that what budget they should have to get their dream home, These buyers also have some very unique problems like what bidding price will help them get the first home they make an offer on or what will be the all-in monthly cost they would incur after buying home of their dreams. Our project aims at solving all of these problems. We would achieve this by first building a regression model to predict house prices. We are using King County housing dataset for the year 2014-2015 with prices for about 21k houses. As a part of the regression model, we would first try to find all the features which are strongly correlated with the house prices. Once we have identified the most relevant features, we would give the user the capability to enter values for those features and get the prediction they are looking for. For this purpose, we aim to build a web UI tool. This tool would be most helpful to first-time home buyers to set up expectations, plan budgets and make an informed decision on expenses before they even go through the exansted house-hunting process given current real-estate market status.

Goals:

- Given data for King County houses, build a model to find features most relevant to determine house price.
- Given a set of features, use the model to determine predicted house price.
- Given the house features and median listed price, determine the listed price for each house.
- Given the listed price for a house and the sold price, should be able to determine the right bidding price range.
- Given the listed price for a house, should be able to find exact monthly expenses incurred by the buyer.


Users:

We are mainly targeting millennials, those between the ages of 18 and 34 and most of whom are first-time home buyers. As per this [report](#) (Zillow group's consumer trend report), 50% of the buyers are below 36 years of age and 47 percent are first-time buyers. Our web app will be especially useful for setting up budget expectations for these users. Another small section of customers who are simply looking for a basic estimation on house listing price based on house features either buying or selling may find our web app useful as well.


Although millennial home buyers share many concerns and preferences with their grandparents' generation, for example, both generations inclined to consider townhouses at higher rate than single family house compared to those ages 35-49. However, there are a few unique characters of millennials home buyers that caught our attention and inspired our designing of our web app:

1. Millennial home buyers wait longer to buy a first home than previous generations. They are very tech savvy and rely on tremendous amount of research online before contacting an agent.
2. Millennial home buyers undertake far more social home searches,, seeking input from friends, relatives and neighbors 58 percent of the time. They also scrutinize more and read more interviews online about real estate agents.
3. The current real estate market is distinct from before, millennials are entering a market with record-low inventory and high price appreciation, many millennials don't end up getting the first home they make an offer on. An understanding on bidding strategy becomes more important for these home buyers.

Primary persona:

	<p>Rachel</p> <p>AGE: 30 OCCUPATION: Software Engineer at a big tech company located in Seattle EDUCATION: Bachelor's degree</p>
<p>GOALS</p>	<p>First Time home buyer, looking for a moderate size single family house for her and her husband with possibilities of increasing family size in the following a few years.</p>
<p>TECH ABILITY</p>	<p>Somewhat tech savvy, heavy user and contributor to social media</p>
<p>DOMAIN</p>	<p>Have been house hunting for 6 months now. Zillow and redfin user.</p>

Secondary persona:

	<p>John</p> <p>AGE: 34 OCCUPATION: Executive at a Seattle startup EDUCATION: Master's degree</p>
<p>GOALS</p>	<p>Already owned a condo, looking to sell the condo and buy a new</p>

	single family house. The house market is quite different from the time when he bought the condo 8 years ago. Wants to find a tool to help him set expectations on prices
TECH ABILITY	Somewhat tech savvy, heavy user and contributor to social media
DOMAIN	Zillow and redfin user, but find looking at houses one by one takes too much time. Wanted to have a concept on selling and buying prices to help him plan budget for the next two years.

Use Cases:

1. Rachel wants to buy a home in a specific neighborhood with particular features. She wants to know the price range given her requirements.
2. Rachel has seen 10 properties and likes 3 of them. Given the features and listed price for each house, she wants to know the right bidding amount for each house.
3. John wants to sell his home. Given his house features, he wants to calculate the right listed price.
4. Ana has zeroed in on a house after months of house hunting. Given the price of house, she wants to know the exact monthly expenses she will incur.

How will users interact with the system and how will the system respond:

Use Case# 1

Prospective buyer desires to determine a price range for a home with a selection of features

The actors in the use case are a prospective buyer, the machine learning engine, and a user interface. The machine learning engine shall have the ability to accept, through the interface, user-entered parameters to include the following:

- Number of bedrooms
- Number of bathrooms
- Home square feet
- Lot square feet
- Waterfront yes/no
- View yes/no
- Condition score
- Grade score
- Above ground square feet
- Basement square feet
- Year built
- Year renovated

- Zip code
- School district

Upon initiation, the user interface shall present to the prospective buyer a collection of appropriate and intuitive data-entry widgets, arranged in a logical format. These may include text entry, pull-down widgets, radio buttons, etc. When satisfied with the input, the prospective buyer shall submit her input to the user interface with a pushbutton, or similar finalization widget. The user interface shall submit the input parameters to the machine learning engine, which shall use a best-available model to determine an appropriate price range for the input parameters. These shall be returned, and displayed to the prospective buyer via the user interface.

Fig. 1 screenshot for use case 1

Use Case #2

Prospective buyer desires to determine an appropriate bidding range for homes for which she has interest

The actors in the use case are a prospective buyer, the machine learning engine, and a user interface. The machine learning engine shall have the ability to accept, through the interface, modified values for all property characteristics as desired in use case (1) for one or more homes. The machine learning engine shall also have the ability to accept the (optional) current list price for each home of interest.

Upon initiation, the user interface shall present to the prospective buyer a collection of appropriate and intuitive data-entry widgets, arranged in a logical format. These may include text entry, pull-down widgets, radio buttons, etc. When satisfied with the input, the prospective buyer shall submit her input to the user interface with a pushbutton, or similar finalization widget. The user interface shall submit the input parameters to the machine learning engine, which shall

use a best-available model to determine an appropriate bidding range for each property of interest using the given property features and – if available – list price. The appropriate bidding range shall be returned, and displayed to the prospective buyer via the user interface.

Fig. 2 screenshot for use case 2

User case #3

Prospective seller desires to determine an appropriate listing price for a home with a selection of features

Very similar to user case #1, the actors in the use case are a prospective seller, the machine learning engine, and a user interface. The machine learning engine shall have the ability to accept, through the interface, user-entered parameters similar to that in case #1.

Note that the some of the arbitrary inputs including condition score, grade score may affect the result of listing price. If the user is not certain of an appropriate score, she may always try a few different scores and consider the returned results as a whole.

The response will be similar to that in use case #1.

First Stop for Home Buyers
Housing Price Prediction
Bidding Price Range
Listing Price Range
Monthly Expenses

Home Type
☒ Single Family
☐ Condo
☐ Apartment

Number of bedrooms
☒ One
☒ Two
☒ Three
☒ Four
☒ Five Plus

Number of bathrooms
☒ One
☒ Two
☒ Three
☒ Four
☒ Five Plus

Waterfront
☒ Yes
☒ No

View
☒ Yes
☒ No

Lot square feet

Year built

Lot square feet

Home square feet

Zip code

School district

Listing Price Range:
Summary of the house:
Expected difference between the final sold price and recommended listing price:

Fig. 3 screenshot for use case 3

Use Case#4

Prospective buyer desires to determine exact monthly expenses she will incur on the house of her choice. Upon initiation (On selecting the tab for 'My Monthly Expenses'), the user interface will present to the prospective seller a collection of appropriate and intuitive data-entry widgets, arranged in a logical format. These may include text entry, pull-down widgets, radio buttons, etc. The user will enter her inputs (which is the listed price or house features) and submit to the user interface with a pushbutton (or similar finalization widget). The user interface will submit the input parameters to the machine learning engine, which will use a mathematical model to determine the monthly expenses for the user. These will be returned, and displayed to the user via the user interface.

First Stop for Home Buyers
Housing Price Prediction
Bidding Price Range
Listing Price Range
Monthly Expenses

Home Type
☒ Single Family
☐ Condo
☐ Apartment

Number of bedrooms
☒ One
☒ Two
☒ Three
☒ Four
☒ Five Plus

Number of bathrooms
☒ One
☒ Two
☒ Three
☒ Four
☒ Five Plus

Waterfront
☒ Yes
☒ No

View
☒ Yes
☒ No

Lot square feet

Year built

Lot square feet

Home square feet

Zip code

School district

Monthly Expenses:
Mortgage:
Tax:
Utilities:
HOA:

Fig. 4 screenshot for use case 4