Fontys Hogescholen ICT

Project Proposal

Housing Price Prediction by Zhaklin Yanakieva

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Project definition

Background

House price forecasting is an important topic of real estate. Machine learning techniques are applied to analyze the information gathered to create models for house buyers and sellers and therefore, help them have more knowledge about the real estate they are buying/selling. The project will be conducted by analysing value ranges that are in the dataset of a website (https://www.pararius.com/apartments/eindhoven). In this project I am going to predict the price of houses and I will verify my results by the training of the models.

Project Goal

The objective of the project is to predict the prediction of the market value of houses in Eindhoven.

Project Domain

The domain of this project is determined to be: *Prediction of a real-estate price*

In order to explore this domain the following research questions were brought forward:

- On what basis does the price of a real-estate change?
- What do people look for in a real-estate?

Also the following research methods were applied:

- Literature study
- Stakeholder analysis

Domain research

Literature study

- **On what basis does the price of a house change?[1]**

  1. <u>Neighborhood comps</u> - One of the best indicators of your home's value is the sale prices of similar homes in your neighborhood that have sold recently. These comparable homes are often referred to as "comps".

  2. <u>Location</u> - Your current home may be the ideal location for you — close to your job or near your parent's house — but when appraisers determine how much value to assign based on the location of the house, they're looking at three primary indicators, according to Inman:

  - The quality of local schools
  - Employment opportunities
  - Proximity to shopping, entertainment, and recreational centers

  These factors can influence why some neighborhoods command steep prices, and others that are a few miles away don't. In addition, a location's proximity to highways, utility lines, and public transit can all impact a home's overall value. When it comes to calculating a home's value, location can be more important than even the size and condition of the house.

  3. <u>Home size and usable space </u>- When estimating your home's market value, size is an important element to consider, since a bigger home can positively impact its valuation.

  4. <u>Age and condition</u> - Many buyers will pay top-dollar for a move-in-ready home. This is why most buyers require an inspection contingency in their contract — they want to negotiate repairs to avoid any major expenses following the sale.

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[1] https://www.opendoor.com/w/blog/factors-that-influence-home-value

5. <u>Upgrades and updates</u> - Updates and upgrades can add value to your home, especially in older homes that may have outdated features. However, not all home improvement projects are created equally. The impact of a project or upgrade varies based on the market you're in, and your existing home value.

6. <u>The local market</u> - Even if your home is in excellent condition, in the best location, with premium upgrades, the number of other properties for sale in your area and the number of buyers in the market can impact your home value. If there are a lot of buyers competing for fewer homes it's a seller's market. Conversely, a market with few buyers but many homes on the market is referred to as a buyer's market.

7. <u>Economic indicators</u> - The broader economy often impacts a person's ability to buy or sell a home, so in slower economic conditions, the housing market can struggle. For example, if employment or wage growth slows, then fewer people might be able to afford a home or there may also be less opportunity to relocate for new opportunities. It's important to keep up with the current status of home sales and home price appreciation in your area, especially when you evaluate the best time to sell your house.

8. <u>Interest rates</u> - Why care about interest rates? Both short-term interest rates (like what you pay on a credit card) and long-term interest rates (like what you pay on a mortgage) influence your ability to afford a home, but in different ways. A rise in short-term interest rates may increase the interest on your savings, but it also makes short-term debt more expensive. For example, if you're spending more money paying off a credit card or short-term loan, then you will likely have less money available in your budget to afford a home.

- **What do people look for in a house?[2]**
  - What the Experts Say Women Want?

    Experts say it is recommended spending the most money in the kitchen and the bathroom, which again meant new kitchen cabinets, new

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[2] https://toughnickel.com/real-estate/What-Do-Women-Look-For-When-Buying-a-House

vanities and new flooring. Also, a clean house, no reminders of the previous tenants, an easy to clean house, "neutral" as beige colors, no repairs needed.

Stakeholders

Name	Details
Buyers	People who have the intention to buy a new property.
Sellers	People who have the intention to sell a property.
Real-estate agencies	Institutions through which people rent/purchase houses.
Tenants	People who have the intention to rent a property.

Planning

In total: 6 weeks of learning and coding

First week:

Research the domain

Data requirements

Introduction to python

Second week:

Collect data

Understand data

Prepare data

Find a way to evaluate the model (test plan)

Third week:

Research on models

Choose a few models to experiment with

Decide which models to use

Fourth week:

Research frameworks

Decide which framework fits best

Fifth week:

First steps into coding – create a model

Define and train the model

Make several iterations and keep track of the performance

Sixth week:

Beta testing, feedback and improvement

Last fixes

Ethical considerations & Impact assessment

This part of the project is discussed in the Project Impact document, which is submitted together with the Project Proposal document.

Exploratory Data Analysis

You can find the exploratory data for test analysis here or in a pdf format.

Modelling

The modelling stage will consist of training a Linear Regression and Random Forest model. The reason for choosing to train this machine learning model is based on the

explored information - the predicting label, which is a numeric value for which the models are suitable. In this case, the predicting label is the price of a real estate. The price is measured in euros since the project data is extracted from a Dutch housing website.

Evaluation

After exploring the data set and training the models, a vital part of the project is the evaluation of the models performance.

First of all, the performance of the model has to be tested with common evaluation metrics. Then, an approach, which consists of predicting a future value, to evaluate the model is accurate enough to determine the performance.

Deployment

Ideally the model will be deployed by using an API and creating a Web application. The users will have the chance to access the Web application so as to query the API, which will be open for it.

Conclusion

Taking into account what we have discussed in this document, the project seems to be successful. Given enough data and time, an ML model can be trained to make accurate enough predictions about housing properties price in order to deploy the application properly.

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