PREDICTING REAL ESTATE PRICES IN MONTREAL USING MACHINE LEARNING METHODS

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ABSTRACT

Machine Learning. The indispensable part of twenty-first century technology's development. Methods of ML are helpful in many fields of our daily live. We decided to utilize ML powerful methods in analyzing real estate market in Montreal. Based on collected data, we want to predict the value of real assets in one of the biggest and most popular cities in Canada.

Keywords Machine Learning · Artificial Intelligence · ML models · housing market · real estate · business · predicting · Data Science

1 Introduction

2 Data

Our dataset consists of six data frames. The core data frame is 'listings.csv', as it contains key attributes for real estates sold in Montreal. During data exploratory analysis we have discovered that some columns contain largely nulls, so we have decided to drop them. Additionally, columns with the same value for all records were also rejected as they did not provide any information. The variable we want to predict is BuyPrice, we observed that some records contained the price per foot or square meter while the rest contained the total price of the property. In addition, we have calculated that the purchase price is mostly correlated with the potential gross income, the number of bathrooms, bedrooms, and rooms.

The next data frames that were analyzed, were 'policeCoord.csv' and 'firestations.csv'. The next data frames that were analyzed were "policeCoord.csv" and "firestations.csv". These data frames only contained the coordinates of the police and fire departments. It seems useful to calculate the distance to the nearest police and fire station for each property.

Next, we examined the file "montreal_hpi.csv" which contained the house price index measures. Due to the significant correlation (greater than 0.99) between the variables, we concluded that only one column should be used from the mentioned dataframe.

In order to add socio-demographic data, we have analyzed 'sociodemo.csv'. A data frame with information about population, nearby schools, average income, etc.

The last data frame was 'extra_data.csv' which provided additional information for some properties in 'listings.csv', unfortunately this frame was contained vast majority of null values. However, some columns, such as LivingArea, found themselves truly relevant.

3 Headings: first level

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3.1 Headings: second level

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$$\xi_{ij}(t) = P(x_t = i, x_{t+1} = j | y, v, w; \theta) = \frac{\alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})}{\sum_{i=1}^N \sum_{j=1}^N \alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})} \tag{1}$$

3.1.1 Headings: third level

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4 Examples of citations, figures, tables, references

4.1 Citations

Citations use `natbib`. The documentation may be found at

> http://mirrors.ctan.org/macros/latex/contrib/natbib/natnotes.pdf

Here is an example usage of the two main commands (`citet` and `citep`): Some people thought a thing [Kour and Saabne, 2014a, Hadash et al., 2018] but other people thought something else [Kour and Saabne, 2014b]. Many people have speculated that if we knew exactly why Kour and Saabne [2014b] thought this. . .

4.2 Figures

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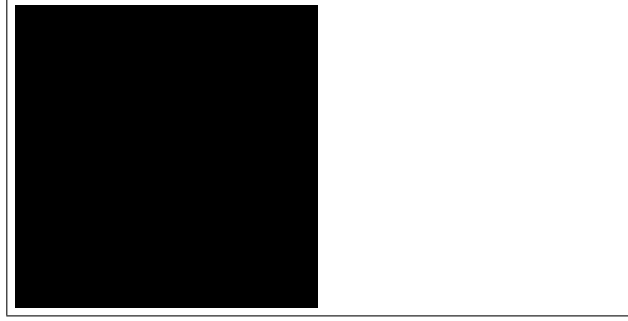
Figure 1: Sample figure caption.

Table 1: Sample table title

	Part	
Name	Description	Size (μm)
Dendrite	Input terminal	$\sim$100
Axon	Output terminal	$\sim$10
Soma	Cell body	up to 10^6

add footnotes. [1] Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetuer eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

4.3 Tables

See awesome Table 1.

The documentation for `booktabs` ('Publication quality tables in LaTeX') is available from:

https://www.ctan.org/pkg/booktabs

4.4 Lists

- Lorem ipsum dolor sit amet
- consectetur adipiscing elit.
- Aliquam dignissim blandit est, in dictum tortor gravida eget. In ac rutrum magna.

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[1]Sample of the first footnote.