A TEMPLATE FOR THE *arxiv* STYLE

A PREPRINT

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March 16, 2022

ABSTRACT

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Keywords Tree-based models · Regression · Lisbon House Prices · XAI

1 Data

Lisbon House Prices is a rater small dataset from Kaggle. It contains 250 observations, which represent estates for sale in Lisboa, which are technically described by 17 columns, hovewer some of them are unnecessary. In the end we decided to remove *Id* column which gives us no information at all and columns *Country*, *District* and *Municipality*, because all records have the same values there. Despite this columns the data set doesn't have any corrupted rekords and NULL values. Additionally we provide the description of every variable in the dataset:

- Id: is a unique identifying number assigned to each house.
- Condition: The house condition (i.e., New, Used, As New, For Refurbishment).
- PropertyType: Property type (i.e., Home, Single habitation)
- PropertySubType: Property Sub Type (i.e., Apartment, duplex, etc.)
- Bedrooms: Number of Bedrooms
- Bathrooms: Number of Bathrooms
- AreaNet: Net area of the house
- AreaGross: Gross area of the house

- Parking: Number of parking places
- Latitude: Geographical Latitude
- Longitude: Geographical Longitude
- Country: Country where the house is located
- District: District where the house is located
- Municipality: Municipality where the house is located
- Parish: Parish where the house is located
- Price Sq. M.: Price per m² in the location of the house
- Price: This is our training variable and target. It is the home price

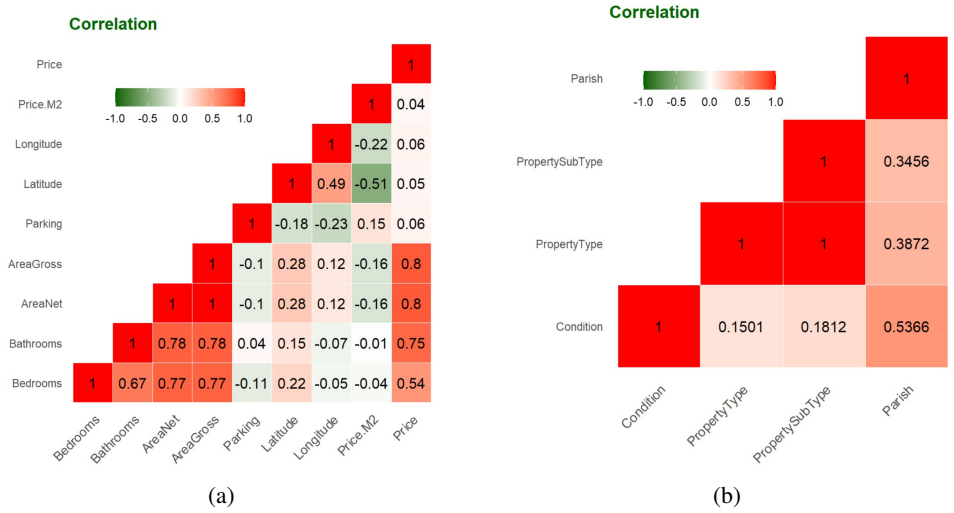
1.1 EDA

1.1.1 Dependance of numeric variables

To know more about the regression task that we are facing, we decided to conduct an Exploratory Data Analysis. We've created correlation heatmaps for numeric and categorical variables seperatly. Thanks to this method we were able to see the high dependance indexes between Bathrooms and Area Net, Bathrooms and Area Gross and most importantly, an indistinguishable differences between AreaNet and AreaGross. The latter ones give us the same information (correlation idnex equal 1), so we decided to trucate one of these columns for training process.

1.1.2 Dependance of categorical variables

Set of categorical variables is much smaller and consists of 4 variables only, hovewer, we've manage to see antoher important dependance in the data set. Creation of Cramers V Correlation Heatmap showed us a strict dependance between PropertyType and PropertySubType variables. Deeper analysis showed us that it is caused by absolute dominance of Apartment PropertySubType.

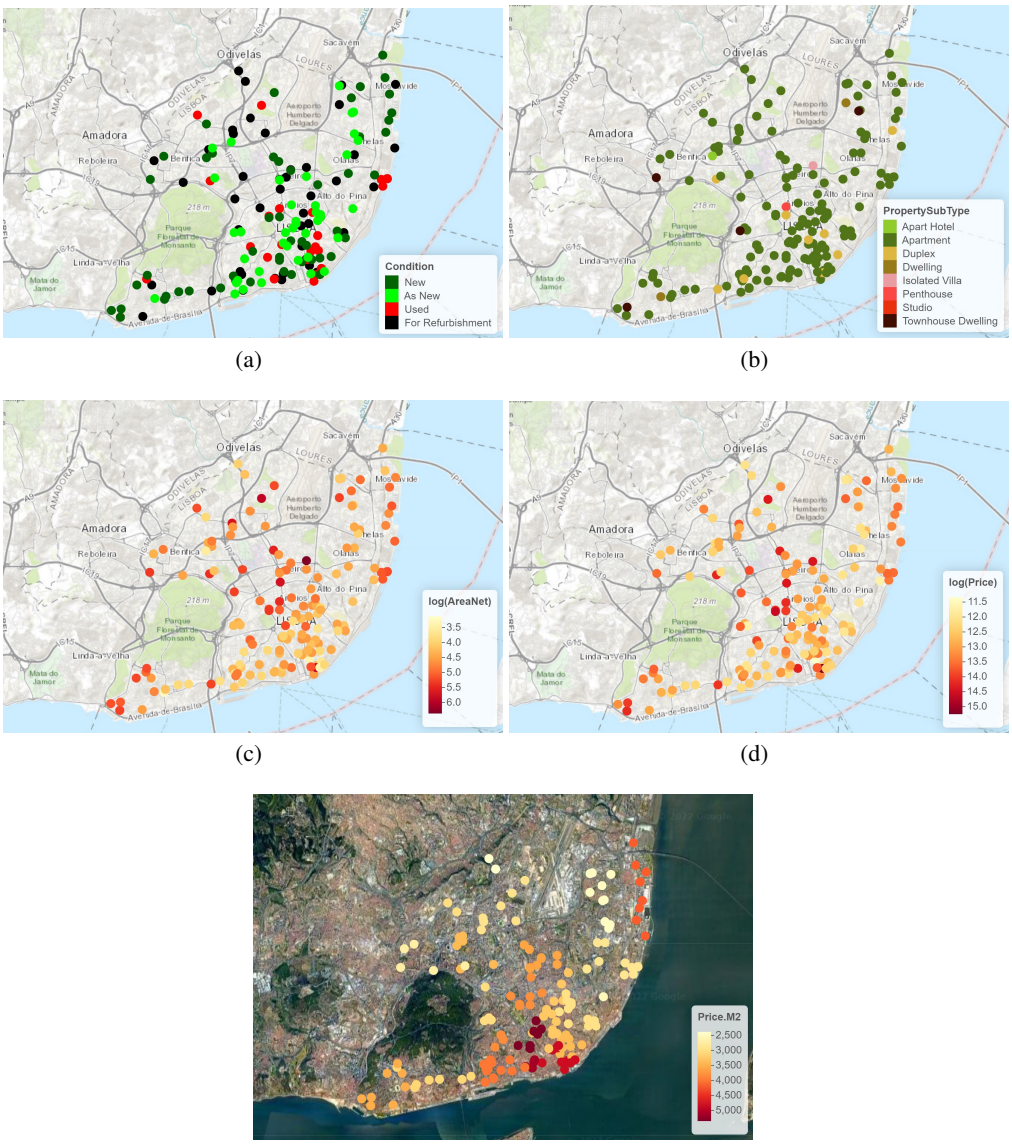


(a) (b)

Figure 1: Correlation Heatmap of: (a) numerical variables (b) categorial variables

1.1.3 Map visualization

To get more information about estate market in Lisbon, we've created maps of the estates presented in the dataset. Fist thing we saw is the forementioned Apartment dominance of the market. Moreover there is a high similarity of distribution between AreaNet and Price of the property. Apparently the most expensive properties are not located in the city center, despite the fact, that the highest prices per squared meter are obvously in the city center.



(a) (b)

(c) (d)

(e)

Figure 2: (a) Property Condition (b) Property SubType (c) Property AreaNet (d) Property Price (e) Property Price m^2

2 Introduction

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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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[1] Sample of the first footnote.

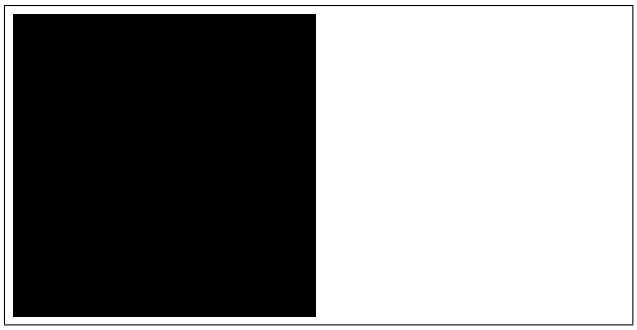

Figure 3: Sample figure caption.

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

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

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- consectetur adipiscing elit.
- Aliquam dignissim blandit est, in dictum tortor gravida eget. In ac rutrum magna.

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