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**Assessment Cover Page**

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**Declaration**

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I declare it to be my own work and that all material from third parties has been appropriately referenced.

I further confirm that this work has not previously been submitted for assessment by myself or someone else in CCT College Dublin or any other higher education institution.

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Projection of future housing relocations in Beijing

# Introduction

In this project, one of the most evident urban phenomena in the last decades in Beijing is being detected, this is the process of urban renewal of the city center, which CLOU has been managing to renovate inside the Capital Square Beijing and what they want to achieve with this is to reposition and improve the public space.

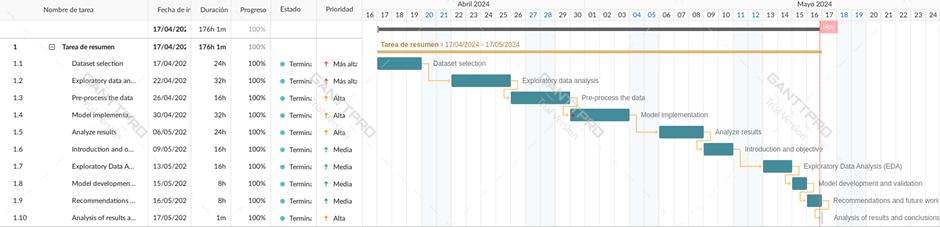
What is intended with this project is to generate a noticeable impact on the real decay and abandonment that is being observed in houses and apartments. Additionally, in these data it is observed that some houses were built since 1960. Therefore, it is intended to analyze the number of times that these houses have been remodeled to date and the variation of prices that have been obtained according to the structure of the building.

# Objective

The objective of this project is to be able to predict the price of housing based on certain specific characteristics, such as whether the owner has been in the building for more or less than 5 years, the number of people who are in each building, it is considered that with this information it can be determined which areas of the perimeter are abandoned based on the year of construction and the number of renovations that have been made since the time the house was built. To do this, the regression algorithm will be used to determine how prices vary according to the parameters mentioned above. with this information, a percentage of money for contingencies that may arise over time could be contemplated. However, for this budget to be as tight as possible, it should be taken into account that it will vary depending on the location of the place, the size of the house, the number of people living in the place and the amount of remodeling that has been done or will be done over time.

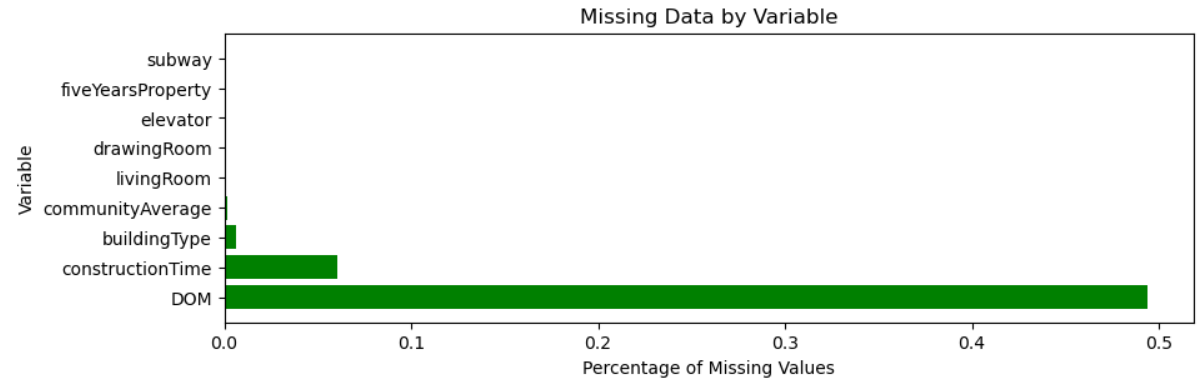
To obtain the results of the above, we have relied on the use of linear regression, root mean square error (RMSE) and coefficient of determination (R^2). Simultaneously the main objective is to predict the price of housing from certain characteristics such as house size, location, number of bedrooms among others. These models will allow me to build, evaluate and adapt the results to obtain the most accurate predictions and better understand the relationships between the characteristics of the houses and their prices.

To be able to accomplish the desired goal, we organize ourselves using the Gantt chart to have a better structure and organization to meet the project delivery deadline.



# Characterization of data

# Missing Values

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The distribution of the data in the DOM, constructionTime, buildingType and communityAverage columns in the figure above is showing us that these are the columns with the largest outliers. Based on these, we determine if the variability of the mean is noticeably higher than the median and determine if the standard deviation is high.

A table with numbers and letters

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The fact that the median value of the “Building Type” column is approximately three indicates that the dataset contains a variety of building types.

According to the “communityAverage” column, the median value is approximately 64,330.59, with a range of 20,483 to 183,109. This suggests that there is a remarkably high standard deviation. This suggests that there is a remarkably high standard deviation. This suggests that there is a remarkably high standard deviation. In addition, this table allows us to visualize that there is a remarkably high variation in house prices across communities.

Finally, we see that the median construction in the “time built” column is around 1999, with a range from 1944 to 2016. Based on the 25% percentile, this indicates that most of the properties in the data set were built after 1994, indicating that the properties were built over a considerable period of time.

The other column that also weighs heavily in our database is DOM based on the fact that our data is focused on a residential leasing platform and what we can observe here is that the average days on market is approximately 28.57 days. This tells us that the mean, property stays on the market for about a month.

We can understand the distribution of building types by determining the most prevalent building category in the dataset using the calculation mode in buildingType. Conversely, as both communityAverage and constructionTime are numerical variables, we chose the mean to assist us in obtaining the desired averages.

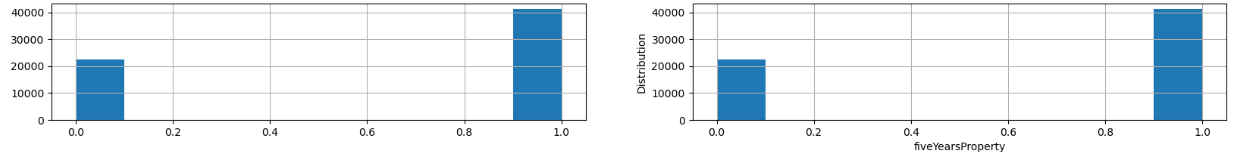
A close-up of a graph

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A diagram of a bar and a bar

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On the other hand, we chose the mode for other columns such as Property five years or Living room since it is considered that in these cases the numbers may repeat more frequently with respect to the building layout and the amount of time lived in the same location.



A graph with numbers and lines

Description automatically generated with medium confidence

It can be observed that the graphs do not show significant changes from one to the other, so we can conclude that the imputation of missing values does not alter the distributions of the variables.

# Visualising Data

**Histogram of price**

A graph of a graph of a number of blue bars

Description automatically generated with medium confidence

We can see the association between the numerical variables after cleaning our database. To illustrate how it affects the different types of variables such as construction time, renovation condition in relation to our target variable price.

A screenshot of a computer screen

Description automatically generated

The correlation graph between numerical variables shows that the variables “living room”, “drawing room”, “elevator” and “building structure” among others, are represented by yellow dots approaching the central yellow line. This suggests that these variables have a moderate correlation with each other and with the central trend line, indicating a consistent and significant relationship between them.

# Application of the model

It is noted that the choice of Linear Regression is mainly due to its ability to efficiently handle diverse and complex data sets, which is typical in the real estate sector, where variables such as location, property size and year of construction significantly influence pricing strategies.

Linear Regression

R2 score for LR on 0.2: 0.877532530096987

R2 score for LR on 0.25: 0.6676743926861246

R2 score for LR on 0.3: 0.6894598161216585

With this information provided by the linear regression model we can see that when the R² of 20% of the data is applied as the test set (R² = 0.8775), which suggests to us that with a larger training set (80%), the model can better capture the relationship between the variables.

# Hyperparameter

Based on the results of fitting a linear regression model with several training data splits and hyperparameter optimization:

The best parameters for linear regression are {'n jobs': 50}, indicating that using multiple processing núcleos improves model performance.

Second, the best R2 value obtained is 0.8708, indicating that the model approximately accounts for 87,08% of the objective variable's variability.

The third place's RMSE (relative cubic error) is 7823,33, which provides a measure of the average deviation between the predicted values and the actual values.

In addition, the intercept of the model is -7648042.55, and the coefficients associated with the characteristics indicate the magnitude and direction of the impact of each characteristic on the target variable.

### Data Sources

The database that will be worked on focuses on the information that we were recommended to take from the university website in the Strategic Thinking course. The teacher shared a dataset with different links and one of them is Kaggle. In fact, once on the page, we searched the building databases and found that this is one of the most comprehensive and has a wide variety of information.

Housing price of Beijing from 2011 to 2017, fetching from Lianjia.com

A screenshot of a website

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### Ethical Considerations

The project of future housing relocations in the city of Beijing does not have any problem associated with the data that is being taken since all the information will be taken from this page: Beijing housing price from 2011 to 2017, obtaining from Lianjia.com. as far as it has been observed its database is public and this information does not contain confidential data, nor user privacy, in terms of social impacts it would be a good tool to apply in society but it would not be a tool to generate panic in society.

# Conclusion

This project is completed, it can be concluded that the phenomenon of the curse of dimensionality was experienced in the development of the project. This fact according to Richard E. Bellman refers to a small amount of data compared to the intrinsic dimension of the data. For example: in a three-dimensional space as when we look through a telescope; We can easily visualize small particle dots in a cube. However, when we do the Hyperparameter percentages were very good with 98% but according to the data and analysis it could be observed that the data is overfitting.

This situation affects my data because I want to obtain reliable results. On the other hand, the amount of data needed would often continue to grow exponentially with dimensionality, which would make the analysis more tiring and take longer to analyze. Finally, when organizing and searching for high-dimensional data, objects would appear scattered in different ways, making common organization and search strategies difficult. In general, processes carried out in machine learning, classification and prediction models could fail due to lack of sufficient data in high-dimensional spaces.

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