

Prediction of Property Price and Possibility Prediction Using Machine Learning

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ABSTRACT

Nowadays the use of prediction methods is used in most of the area. The rising demand for prediction has made it more popular and a helpful tool. Thus most of us are go for prediction most of the time. But there are some cons in it, most of us don't think about the part which was going to happen after the prediction. The prediction is to find the approximate result but we are also able to use the predicted result for further use. The more we use the predicted value, our outcome will attain high usability in future aspects. People are becoming more curious about property value and their predictions. Among those, the real estate value is a very curious one because it is one of the fixed assets. Real estate deals with the land which is the most essential one for all. The land and housing property will be directly related to the country's economy and its growth and fall. The economic growth will be predicted by considering real estate as one of its features for prediction. The home is the one where we all live in and hence it is a mandatory one for all the people who live on earth. For a child, the place where it lives and how its surroundings will make the child grow with good qualities. The environment and surroundings are also important features to take in mind to predict its value. But most of us will only take the building and its physical materials for consideration but the real up and down of the price values depend on those extra surrounding environments which are placed nearby. The main role of the idea is not only to predict the price but also to find some of the possibilities after the prediction has been done successfully. Thus the prediction will not be the end of the idea, it also becomes the beginning of a new one.

Index Terms – Property prediction, Find the possibilities of new insights, Machine Learning methods.

Introduction

Real estate is a thriving and appealing investment sector not only in our country but throughout the world. It is one of the wealth measures for the country and also for a person. It is an important problem for all the stakeholders like house buyers, house owners, agents, real estate brokers, investors. The price of the property will keep on increasing unevenly. Thus, the price value will depend on certain features and criteria like the area of the property [sq. ft], the number of rooms and balconies, and even more. The location where the property has been situated plays a vital role in prediction.

Some additional features are also able to decide the price value of the property like the availability of the basic needs and people review. These features will change over time and it is not a constant one. The above features are changing property which predicts to make a variable output through time and surroundings.

Thus the prediction will become more accurate when we have all these data in a correct format and most probably true values. The main role in prediction is data collection and data cleaning. It will help us to have the true data values and also be able to change the unnecessary data into either useful data or true data. So the prediction of the price will depend on multiple features. These all features contribute their property to predict the single output called price. The Property prediction factors will depend upon some of the nearby features which are shown in figure 1.



Figure 1: Property prediction factors

Data Description

In our research, we have used a large amount of data which are more essential for the contribution of the price prediction. The features which have been used in our projects are the area of the property, no. of bathrooms, no. of bedrooms, balcony, and area type. We have used more than 10000 rows of data which consist of around 8 feature columns that are going to take part in the price prediction. The initial data we collected may or may not consists of false data and null values. Hence, the first and foremost process is to clean the data for better understanding. When the data is cleaned well it will help us to predict the value with high accuracy. Data cleaning can be one of the time-consuming processes but it will lead the remaining process safely and efficiently. Thus every feature has its priority and contribution in prediction. The high priority feature has more impact on the output whereas the less priority feature will not have that much impact on the output of the prediction than the high priority feature. After cleaning of data, the prediction process will take place. The importance of the features is based on the proposal we implemented which was shown in figure 2. The extra data which is gathered for finding further insights and possibilities also wants to be cleaned. But these data are time-series data, they keep on changing to time. Hence these data are managed frequently to make the process more elegant.

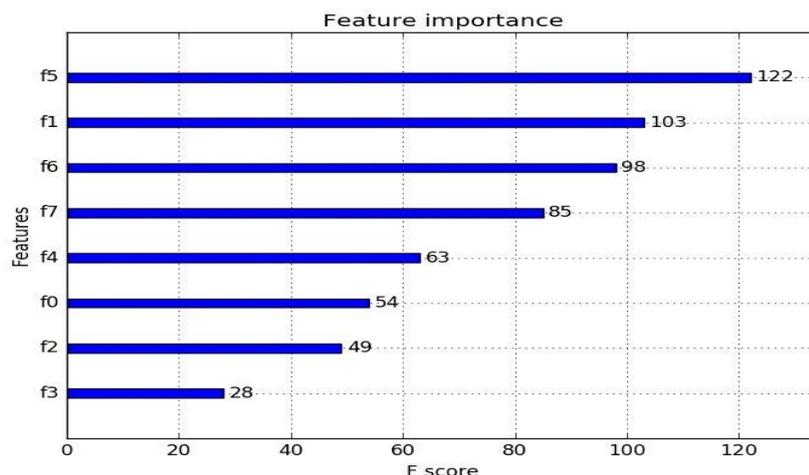


Figure 2: Feature importance

Related Work

Many works are related to our implementation. Figure 3 shows the relationship between supply and demand. But the main part of our implementation is to make use of the predicted results in a much efficient way. The results are dependent on some independent features. The predicted output can also be varied by some other related data. Thus in our implementation, the price of a house or residential area can be predicted by using machine learning concepts whereas those predicted values are not accurate. They can also be able to change over time by some additional features like the surroundings and current issues. Many algorithms, such as Linear Regression, Random Forest, Gradient Boosting, and others, are used to forecast home prices.



Figure 3:Supply andDemand

This paper [2] uses the Hybrid Regression approach to forecast home prices by focusing on the innovative feature to find the best feature and its association with the sales price. To increase precision, Feature Engineering enhanced the data's normality and linearity. For better results in their scheme, they combined several algorithms. They demonstrated that working with the Ames housing dataset was easy and that using hybrid algorithms (64 percent and 36 percent, respectively) yielded better results in terms of home price than using only one of them.

This paper [5] was proposed by a group of students who believe that combining linear and boosted algorithms with neural networks would improve prediction accuracy. Here a various features data, which are very essential for prediction is used. Initially, it was not cleaned but after they have been cleaned the data well for better performance. They have used some of the regression algorithms in this implementation. The dataset was run through the algorithms of the neural network will take all the results of those algorithms as feedback to it. It will analyze the information and present the results. Thus the Boosted Regression with a neural network is to improve accurateness.

This paper [8] proposal is about the optimization method and regression analysis for a better outcome of the model to have a highly predictable value as an outcome. The NJOP price is predicted using Hedonic pricing by implementing regression techniques based on features like NJOP building price, land area, land price. For the selection of effect variables, a stochastic optimization technique (PSO) is used. It showed a minimum predicted error of RMSE 14.186 as the result.

This paper [11] was implemented for predicting an unstable value, with some of the Machine Learning algorithm techniques which makes it better in performance. There are several in-between steps like Data Cleaning, Data Analysis, and Data Evaluation. At last, the output result was stored in a CSV file for better understanding. In this implementation, the higher accuracy was achieved by Decision Tree of 84% approx., they also used a classification algorithm for trying the regression problem was also done successfully. They have collected the dataset from an open-source (Kaggle). Thus 37 features are taken from the dataset consisting of 80 features, which were affecting the price of the home property.

This paper [14] proposed by Limsombunchai, Christopher Gan, and Minsoo Lee and their implementation empirically compares the prediction of two regression algorithms. They have been tested a specific number of home information. The previous findings were supported by hedonic price modeling. The hedonic price model does not outperform the neural network even if it has an R^2 value higher than 75%. Because of incomplete nearby feature data and a smaller number of data, the price forecast varies due to irregularities between home features and price. The limitation in this model is the predicted price is the estimated price but not the actual price of the home due to a lack of real data from the market. The next limitation is that it will contain only the current year's information. Then the last limitation is that the model does not consider the nearby additional features for prediction.

This paper [17] was proposed by using algorithms (ML) based on data of home features and crimes to predict the price. In today's economy, the increasing value of the property is a common topic. After the crisis in the US caused by loss of stock in before days, many factors are contributing to its role in determining the housing and property price. The agencies, finances, real estate professionals, intermediates have also become the factors for predicting the price. It outperforms the Traditional way of predicting the sales price in which the single variable will determine the price whereas in this the multiple variables of home attributes will be used to make forecasts and show it. If the property has an excellent interior and view, then its value is higher than the average value. Then the investors or buyers must make some decision based on other information, thus all of these are considered as important for the prediction of price. Thus, the buyers should take consideration of the time and quality to predict the price which is shown in figure 4.



Figure 4: Time and quality vs price

This paper [20] was proposed to model the ozone in the lower atmosphere. The prediction was dependent on the environmental pollutants and variables of meteorology. In this proposal, they have been used Principal Component Analysis along with ANN. It shows that the combination of different model predictions will increase the accuracy compares to the single model prediction. Here the variable subset was identified by the PCR variable selection technique. Then the non-linearity was fixed by using the ANN. The ANN is capable of producing a better fit than PCR but if these combined it will produce a better result. This type of modeling approach will offer great potential in other aspects of modeling.

This paper [23] was proposed to estimate the value of a house in Virginia. The residential deals are determined based on the value of OFHEO. It also assists with future price prediction. In this model, the accuracy was improved by training with 5359 townhouse data. The price of the property will depend on the crime rate of the area shown in figure 5. The model developed using algorithms like Naïve Bayesian, Ada Boost, and RIPPER to compare the accuracy for better performance. Thus in this model RIPPER algorithm outperform other algorithms. Recent research has tried using algorithms like Neural Network and SVM, but in this study, we have been finding the best algorithm by comparing the accuracy. The proposal comes with some limitations that it will be done for a specific area and hence in future if we can able to interconnect with all the regional data, then it will become very effective for future use.

This paper [26] addresses the prediction of stock movement direction and price index of stock for stock market of India. It compares with 3 algorithm methods and proceeds it in two ways. First, using technical parameters for trading data. Second, technological features can be used to predict trends. The results demonstrate the effectiveness was improved in which parameters were represented as trend deterministic data. The emphasis of this model is forecasting in the short-term, but forecasting in the long-term will be a future challenge when data is needed in real-time, such as time-based data. As a result, the effectiveness of our strategy is dependent on human actions when it comes to spending and making decisions in different domains.

Some other related works are studied comparatively and shown in table 1 with some explanations.



Figure 5: Nearby factors affecting the property price

Methodology

The methodology of using machine learning is very popular nowadays. The use of machine learning has been kept on growing in a high manner. These machine learning implementations are useful for prediction and classification. They are the baseline for artificial intelligence. The main part of artificial intelligence is to have some common sense with the right decision-making. The classification and prediction are the ones that make a model to have a sense of decision making from it. Hence, each machine learning algorithm has its high accuracy, but the accuracy is not only based on the algorithm we used. It is also based on the data we provide and how much we train the model. The more cleaned data can be able to increase the model accuracy. The life cycle of the machine learning methodology was given below in figure 6.

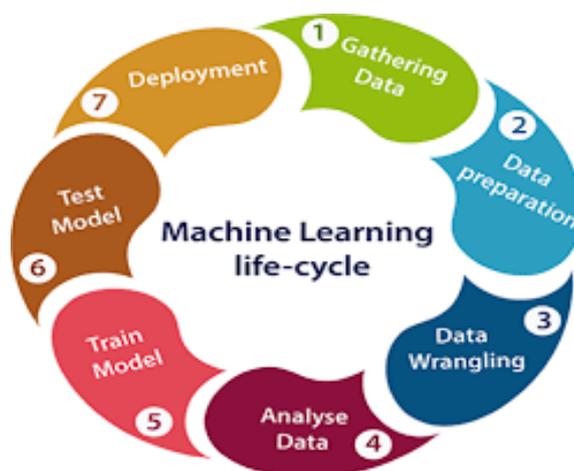


Figure 6: Life cycle of Machine Learning

Linear Regression:

It is one of the types in supervised Learning, Where we will be having both the X and Y form in which we can the Y->output for the given X as input from the dataset. Linear

Regression uses the mathematical formula $Y=mx +c$, this equation gives the best fit line going through the data points. However the data points are scattered so, it's not possible to draw the perfect line but draws a kind of best fit line. Simple linear regression and multiple linear regression are the two forms of linear regression. Simple Linear is used to forecast a value using only one independent variable, whereas Multiple Linear is used to predict a value using one or more independent variables.

Random Forest:

It is also a type of supervised learning, Random forest is also known as Random decision forests it will be flexible and reliable for some machine learning problems. It uses multiple models to obtain better performance in prediction. Random Forest has the minimum training time compared to other algorithms and even if we run with the large dataset, random forest runs efficiently. In a situation where a large amount of data can be missing, a random forest helps in maintaining accuracy. Since we know that this algorithm works on both the classification and regression kind of tasks but the experts suggests it's not suitable for regression kind of tasks. Random forest prevents the over-fitting problem by enhancing the accuracy.

Gradient Boosting:

It's also a form of supervised learning that can be applied to regression and classification problems. It's one of the types of greedy algorithms that can make the training dataset fit quickly. By reducing over-fitting generally improves the algorithm performance. It reduces the overall prediction error by relying on the best possible next model when combined with previous models. Comparing the linear regression and random forest algorithm with dataset gradient boosting gives more accuracy when compared to other algorithms. Gradient boosting has its advanced technique called Extreme Gradient Boosting (XGBoost). It has a very fast training period and can be distributed across clusters. XGBoost is capable of handling missing values in the dataset internally. Thus, figure 7 shows that the main process in machine learning is the data analysis and steps of processing the data.

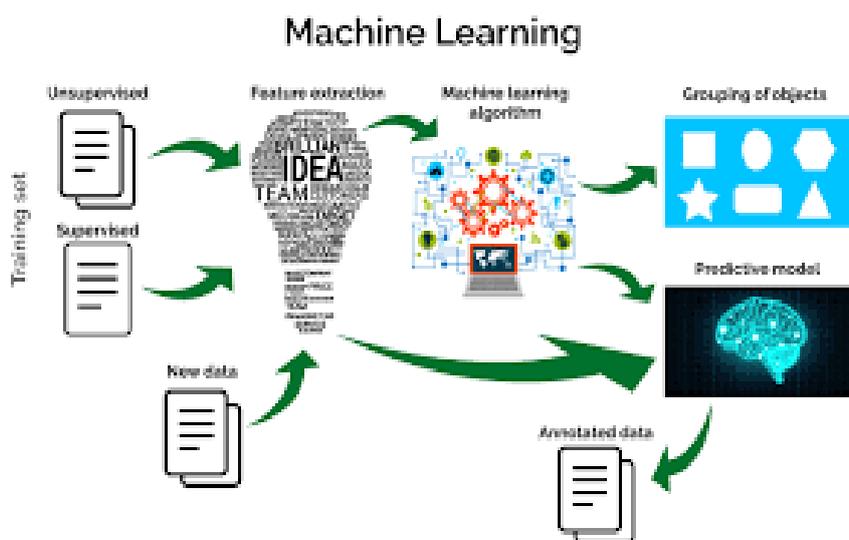


Figure 7: Analysing and processing of data

Future Challenges

Thus the implementation is not based on the accuracy of the prediction, whereas it is based on how we are going to use those predictions in a better way. Hence, In the future, there are a lot of opportunities for new challenges. The first main challenge is about data gathering for additional insights. Thus the data gathering is more time-consuming work and also a slow process. There are some of the open data for quick use but it may or may not be useful for the model which we are going to showcase. Thus data gathering is one of the most important challenges in the future. The data are kept on increasing exponentially. The data which we have collected will expire at some point. The retention of the data keeps on decreasing in the upcoming days. The other challenges are based upon the type of work we are going to use the model. The new idea of using the predicted value differs for every individual. The efficient idea will lead to an efficient and better working model in the future.



Figure 8: Price Forecasting

Table 1: Comparative study of previous findings

S.NO	Reference	Techniques	Findings
1.	[14] Limsombunchai, Christopher	Two different Regression techniques.	The price forecast varies due to irregularities between home features and price. It will contain only the current year's information.
2.	[46] James F and G D J	Hedonic Price Model	Direct proportionality between price and surroundings has been found and analyzed.
3.	[8] Adyan, Nur	Hedonic Price Model And Regression Analysis	Highly predictable value as an outcome. Minimum predicted error of RMSE.
4.	[37] Yang Yonghui	Multi-valued integrated information along with	Output chart with error relation.

		machine learning algorithms	Data cleaning is the main part of this implementation.
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Conclusion

By summarizing, Property and residential price is dependent upon the features which are all needed for the property. The final prediction of the model will be used to make new insights for upcoming scenarios. The idea of creating a useful model by using the efficient algorithm will make the implementation fall on the higher-end whereas the final predictions are used for further future uses and possibility findings will also make it extend to a higher user level. Hence, our main perspective is to make use of prediction to make a new model and make it the beginning of a new idea.

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