A Literature Review on House Price Prediction based on Fuzzy Logic

Harsha Mulchandani[a*], Jagruti Vaswani[b], Rahul Vaghela[c], Dr. Rajan Patel[d]

[a*,b] *M.E. Student, Gandhinagar Institute of Technology, Moti Bhoyan, Gandhinagar, India*
[c] *Assistant Professor, Gandhinagar Institute of Technology, Moti Bhoyan, Gandhinagar, India*
[d] *Professor, Gandhinagar Institute of Technology, Moti Bhoyan, Gandhinagar, India*

Abstract
The house price prediction systems have proved to be the best ways for a client to help in buying a house based on their likes and dislikes. The main objective of the House Price Prediction is to give a range of properties to the client's requirements things like surroundings, technology, and amenities. A few of these systems are based on Soft Computing Techniques like Fuzzy Logic, Fuzzy inference system, and Neuro-Fuzzy inference system. The fuzzy logic technique has been taken into the considerations for the prediction system as it represents uncertainty, and it can be viewed as an extension of multivalued logic.

Keywords: Fuzzy Logic, House Price Prediction, Real Estate Prediction, Fuzzy Inference system, Soft Computing, Neuro-Fuzzy Inference system

1. Introduction

A home is a basic necessity for everyone living in the world, and humans want it to be a perfect place for their kids to grow, to spend their lifetime in peace at the place they wish to have all the wonderful amenities. The demand for house is increasing gradually depending upon the population. And, as we talk about buying a House not all human beings want to buy/ own a lavish home. But they surely need a house with their desired amenities in the chosen surroundings.
The problem here is to predict the House Prices based on an individual like and dislikes. And here comes Fuzzy Logic comes for the rescue. As we all are aware of how does a Human think, and Raheel Farooq quotes "The biggest challenge for human mind is human mind" and this explains that we cannot think in one way so to understand our variety of thinking, Fuzzy Logic is by far the best way possible for House Price Prediction.

2. Theory Background

Soft computing is a commendable system that helps in resolving complex real-life problems by providing a range of possible outcomes. The House Price prediction system using Soft Computing algorithms will give the buyer a fair price of the property. So, they cannot be cheated and not end up paying extra to the builders/brokers. More importantly, soft computing works on uncertainty, imprecision, approximation but also provides a precise solution based on real-life problems.
Fuzzy Logic can be defined as a method resembling human behaviour and giving intermediate values rather than giving the output in 0 or 1 or YES or NO.
In the real world many times we encounter a situation when we can't determine whether the state is true or false, their fuzzy logic provides very valuable flexibility for reasoning.

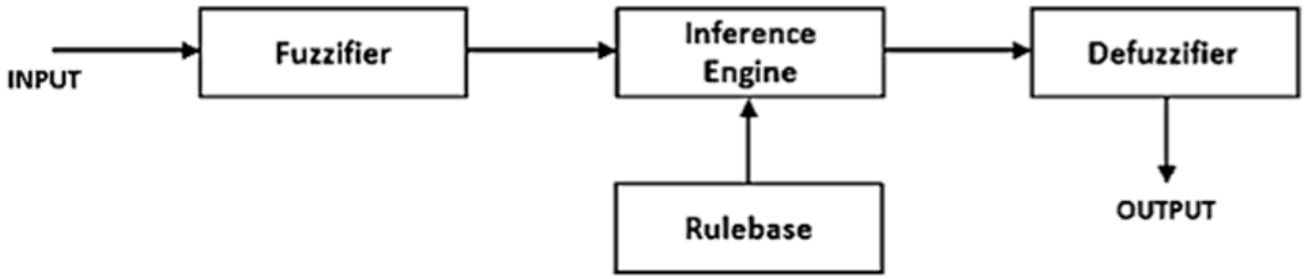

Fig. 1. Fuzzy Inference System

* Harsha Mulchandani
Email address: 200120702012@git.org.in

House Price Prediction is an approach to predict the house pricing for the easiness of people, to find their own house based on their wishes. Whether, it is a Bungalow, Flat, Tenement or just a cottage, people would be able to get options to select from. In House Price Prediction, soft computing will be helping the client to see a variety of houses/ properties depending upon its desires and amenities required.

3. Literature Review

House price prediction is a vast topic, which is implemented through a variety of Computer Science Methods. Like Machine Learning, Linear Regression, Decision Tree, Deep Learning, Fuzzy Logic, ANFIS (Adaptive-Neuro Fuzzy Inference System), and Linear performance pricing.

In proposed model of Machine Learning, the dataset is divided into two parts: Training and Testing. 80% of data is used for training purpose and 20% used for testing purpose. The training set include target variable. The model is trained by using various machine learning algorithms, out of which Random forest regressions predict better results. For implementing the Algorithms, they have used Python Libraries NumPy and Pandas. [1]

In another paper based on Machine Learning has used the multivariate linear regression model to perform the prediction. Also, it is compared with other Machine Learning models like Lasso, LassoCV, Ridge, RidgeCV and decision tree regressor. Multivariate linear regression and LassoCV performs the best with 84.5% accuracy. [6]

In Deep Learning Model study, the authors have developed a mode based on using Heterogeneous Data Analysis Along with Joint Self-Attention Mechanism. The Heterogeneous Data is to supplement house information, and it also assigns the weights automatically depending different features or samples. [2]

House price prediction using polynomial regression with Particle Swarm Optimization the authors have Washington DC house price prediction using polynomial regression and particle swarm optimization methods. They have also improved particle swarm optimization method with two methods. One is changing the topological structure of particle relations and the second improvement is the introduction of new particle control mechanisms. [3]

The present study uses data of sales transactions and the valuation of real estate properties from Pune city. For modeling the prediction process, the data is converted into the format of variables and the corresponding outcome in terms of the value of the property. The results are presented by using the performance matrices such as MAPE and R2, where Mean Absolute Percentage Error (MAPE) is most commonly used to forecast the error of any model. [4]

Real Property Value Prediction Capability Using Fuzzy Logic and ANFIS study uses data of sales transactions and the valuation of real estate properties from Pune city. For modeling the prediction process, the data is converted into the format of variables and the corresponding outcome in terms of the value of the property. The results are presented by using the performance matrices such as MAPE and R2, where Mean Absolute Percentage Error (MAPE) is most commonly used to forecast the error of any model. [5]

Determining the best price with linear performance pricing and checking with fuzzy logic paper aims to compare and verify findings with the LPP method and Fuzzy Logic results. This article explained linear performance pricing (LPP), backed up its accuracy with fuzzy logic, and showed how it can be used to efficiently provide the focus needed to achieve cost reduction. Besides, although it is widely used in the automotive industry in the USA and Europe, there is little discussion in the literature about its support with LPP and fuzzy logic. [7]

ANFIS approach is first time applicable to the real estate property assessment. This study has shown that ANFIS can yield results that are comparable to those obtained using the traditional regression approach. The main contribution of this study is clear demonstration that ANFIS is a viable approach in real estate value assessment and is worthy of further exploration. [8]

In [9] the authors have aimed to developed four different methods in order to estimate the real market price of 380 properties owned by Midtown Realty Group in Miami, Florida. the FIS models that also explain satisfactorily nonlinear relationships of the variables with the dependent variable; however, the problem we have in these models is that they must be well defined number of inputs and the relationships they have with each other, that is, the rules that explain the fuzzy inference model.

In [10] paper a study has been shown to compare different methods like ANN, FL, and FLSR for house price prediction. The major focus was on FL and FLSR, and on Fuzzy Regression. Fuzzy Regression Model was explained through a graph of predicted and actual values. Also, a Result comparison is also done with MAE (Mean Absolute Error), which shows considerable reduction is achieved in FIS and FLSR where the error rate drops by more than 25000 compared to the MAE of ANN model.

5. Observation

This survey paper presents an overview of recent updates on House Price Prediction with these different methods: Fuzzy Logic, Machine Learning, Deep Learning, Polynomial Regression with Particle Swarm Optimization, ANFIS and Adaptive Neuro-Fuzzy inference system. From a few Machine Learning methods Random forests gives better result. In the Polynomial Regression with Particle Swarm optimization method, the methods have been imporvised in two ways. One is changing the topological structure of particle relations and the second improvement is the introduction of new particle control mechanisms. The studies based on Fuzzy logic compared with LPP, used with ANFIS Neuro fuzzy inference system shows that Fuzzy Logic can be a viable solution for House Price Prediction and to provide a variety of houses on the demands of the clients.

6. Conclusion

With this literature survey, we have come to know that there is a scope of improvement in the field of House Prediction in the fields like ANFIS, LPP, Machine Learning. Mainly, in ANFIS a larger dataset can be given to the machine to perform the predictions and get the accurate outputs.

References

1. Anand G. Rawool , Dattatray V. Rogye , Sainath G. Rane , Dr. Vinayk A, House Price Prediction Using Machine Learning, 2021.
2. PEI-YING WANG1, CHIAO-TING CHEN 2, JAIN-WUN SU1, TING-YUN WANG1, AND SZU-HAO HUANG 3, (MEMBER, IEEE), Deep Learning Model for House Price Prediction Using Heterogeneous Data Analysis Along with Joint Self-Attention Mechanism, 2021.
3. Chenhao Zhou, House price prediction using polynomial regression with Particle Swarm Optimization, 2021.
4. Ankita Kamire , Nitin Chaphalkar , Sayali Sandbhor, Real Property Value Prediction Capability Using Fuzzy Logic and ANFIS, 2021.
5. Anirudh Kaushal, Achyut Shankar, House Price Prediction Using Machine Learning, 2021.
6. Gamze Tanak Coskun , Ayten Yılmaz Yalçıner, Determining the best price with linear performance pricing and checking with fuzzy logic, 2021.
7. Jian Guan, Jozef Zurada, and Alan S. Levitan, An Adaptive Neuro-Fuzzy inference system-based approach to Real Estate Property Assessment, 2020.
8. Andrzej Biłozor and Maurizo d'Amato, Residential market ratings using fuzzy logic decision-making procedures, 2019
9. Felipe Alonso Arias Arbelaez and Francisco Ivan Zuluaga Daz , Estimation of Real Estate Asset Pricing Models, 2016.
10. Abdul G. Sarip and Muhammad Burhan Hafez, Fuzzy Logic Application for House Price Prediction, 2015.