**AN INTERNSHIP REPORT**

*On Project*

**REAL ESTATE PRICE PREDICTION USING DATA SCIENCE**

At

**PAARSH INFOTECH PVT. LTD**

*A report submitted in partial fulfillment of the requirements for the Award of Degree of*

BACHELOR OF ENGINEERING

*In*

COMPUTER ENGINEERING

*By*

CHETAN ANIL DABBE (TE A 19, COMPUTER 2023-24)

Under Supervision of

Dr. Tushar K. Pagare, Technical Director, Paarsh Infotech, Nashik and

Prof. Priya D. Rakibe, Assistant Professor, KKWIEER

(Duration: 15 Dec 2023 – 18 Jan 2024)



**K. K. WAGH INSTITUTE OF ENGINEERING EDUCATION AND RESEARCH, NASHIK, MAHARASHTRA.**

**DEPARTMENT OF COMPUTER ENGINEERING**

**STUDENT’S DECLARATION**

I, **CHETAN ANIL DABBE** hereby declare that I have undertaken 04 weeks internship at **PAARSH INFOTECH, NASHIK** during a period from 15th Dec 2023 to 18th Jan 2024 in partial fulfillment of the requirements for the Award of Degree (COMPUTER ENGINEERING) at **K. K. WAGH INSTITUTE OF ENGINEERING EDUCATION AND RESEARCH, NASHIK.** The work which is being presented in the training report submitted to the Department of Computer Engineering at above mentioned institute is an authentic record of training work.

I have taken care in all respect to honor the intellectual property right and have acknowledged the contribution of others for using them in academic purpose and further declare that in case of any violation of intellectual property right or copyright I, as a candidate, will be fully responsible for the same.

**Signature of the Student**

**Date:**

**Place:**

**Dr. Tushar Pagare, Technical Director, Paarsh Infotech**

**Signature of the Supervisor-1**

**Prof. Priya D. Rakibe, Assistant Professor, KKWIEER**

**Signature of the Supervisor-**

**ACKNOWLEDGEMENT**

It is always a pleasure to remind the fine people in the Engineering program for their sincere guidance I received to uphold my practical as well as theoretical skills in engineering.

Successful completion of any type of training requires helps from number of people. Also, the help needed to prepare this report from different people cannot be overlooked. Now there is a little effort to show my gratitude to every person helped in these four weeks program.

Secondly, I want to thank **Dr. Tushar Pagare** for giving me this opportunity to do an internship/industrial training in the esteemed company.

I would like to convey my heartiest thanks to **Dr. Tushar Pagare (**Technical Supervisor, Paarsh Infotech) who in spite of being extraordinarily busy with their duties, took time to hear, guide and keep me on the correct path and allowed me to carry out my training in the company.

I would also like to express my gratitude to **Dr. Shirish S. Sane** (HOD Computer),

**Mrs. Priya D. Rakibe,** (Internal Guide) faculty from the college, for helping me and regularly maintaining the supervision from the college side. And, last but not the least, I express my deepest thanks to all the departments and staff at Paarsh Infotech.

**SUMMARY**

An internship is a period of work experience offered by a company/an organization for a limited period of time. It is an opportunity that employers offer to a student interested in gaining work experience in their particular company. The report presents the work I have done, the knowledge has been acquired and the conclusions I have drawn in these 04 weeks internship/ industrial training at Paarsh Infotech, Nashik.

Data science is a multidisciplinary field that utilizes scientific methods, algorithms, and systems to extract insights and knowledge from structured and unstructured data. It encompasses various techniques such as data mining, machine learning, statistics, and programming to analyze complex datasets and derive meaningful patterns and predictions. In today's data-driven world, organizations across industries rely on data science to make informed decisions, optimize processes, and drive innovation. The real estate price prediction project harnesses the "Bengaluru House Data" dataset, a rich source of information comprising diverse attributes of properties across Bengaluru. This dataset encompasses details such as property size, location, amenities, pricing, and more, offering a comprehensive view of the real estate landscape in the city. By meticulously analyzing this dataset and employing advanced data science techniques like data preprocessing, feature engineering, and machine learning algorithms, the project endeavors to develop accurate predictive models. These models are designed to forecast property prices with precision, considering various factors such as geographical location, property size, amenities available, and prevailing market trends. Through the insights gleaned from these models, real estate stakeholders gain valuable information to make informed decisions regarding property investments, pricing strategies, and navigating the dynamic real estate market of Bengaluru.

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**Chapter – 1**

**INTRODUCTION**

**1.1 DATA SCIENCE**

Machine learning is a branch of Artificial Intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Machine Learning is a subset of Artificial Intelligence. ML is the study of computer algorithms that improve automatically through experience. Machine learning is an important component of the growing field of data science. Using statistical methods, algorithms are trained to make classifications or predictions. ML explores the study and construction of algorithms that can learn from data and make predictions on data. Based on more data, machine learning can change actions and responses which will make it more efficient, adaptable, and scalable.

Machine learning (ML) is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

**1.2 Data science Process**

**1. Business Objective:**

* The process starts with understanding the business problem or objective. This could be increasing sales, reducing churn, optimizing operations, etc.
* Define clear, measurable goals that align with the business objectives.

**2. Data Requirement:**

* Identify the data needed to address the business problem. This involves understanding what type of data is relevant and how it relates to the business objectives.
* Determine whether the required data is available internally or needs to be acquired externally.

**3. Data Collection:**

* Collect relevant data from various sources such as databases, APIs, sensors, or external datasets.
* Ensure the data collected is of high quality, accurate, and comprehensive.
* Data collection methods should be ethical and comply with privacy regulations.

**4. Exploratory Data Analysis (EDA):**

* Explore the collected data to gain insights and understand its characteristics.
* Identify patterns, trends, anomalies, and relationships within the data using visualization and statistical techniques.
* EDA helps in understanding the data better and informing decisions regarding data preprocessing and feature engineering.

**5. Modeling:**

* Select appropriate machine learning algorithms or statistical models based on the nature of the problem and the available data.
* Prepare the data for modeling by preprocessing, feature engineering, and splitting into training and testing sets.
* Train the chosen models on the training data and fine-tune them to optimize performance.

**6. Evaluation:**

* Evaluate the performance of the trained models using appropriate metrics such as accuracy, precision, recall, F1-score, etc.
* Use techniques like cross-validation to ensure robustness of the models.
* Compare the performance of different models and select the best-performing one for deployment.

**7. Deployment:**

* Deploy the selected model into a production environment where it can be used to make predictions or support decision-making.
* Integration with existing systems may be required for seamless deployment.
* Ensure scalability, reliability, and security of the deployed model.

**8. Monitoring:**

* Continuously monitor the performance of the deployed model in real-world settings.
* Track key performance indicators (KPIs) to assess the model's effectiveness and impact on business objectives.
* Monitor for drift in data distribution or model performance and retrain/update the model as needed.

**Chapter – 2**

**DETAILS OF THE PROJECT**

**2.1 Problem Statement**

The real estate industry plays a crucial role in the global economy, with property transactions involving significant investments by buyers and sellers. However, the process of determining property prices is often complex and subjective, relying on various factors such as market trends, location, property characteristics, and individual preferences. This subjectivity can lead to inefficiencies, inaccuracies, and biases in property valuation, impacting the overall transparency and fairness of the real estate market.

In many cases, real estate professionals rely on experience, intuition, and limited market data to assess property values, which can result in suboptimal outcomes for both buyers and sellers. Additionally, the traditional approach to property valuation may overlook valuable insights hidden within vast datasets containing diverse attributes related to properties and their surroundings.

To address these challenges, there is a pressing need for a data-driven solution that leverages advanced analytical techniques to accurately predict real estate prices. By harnessing the power of data science, machine learning, and predictive modeling, such a system can provide stakeholders with objective and reliable estimates of property values based on a comprehensive analysis of relevant attributes.

**2.2 Objectives / Motivation Scope**

The main objective of real estate price prediction is to provide stakeholders with accurate forecasts of future property prices. These forecasts serve as essential decision-support tools for various stakeholders including buyers, sellers, investors, and industry experts within the real estate sector. By harnessing predictive analytics, stakeholders can gain insights into future market dynamics, allowing them to strategically mitigate risks, optimize investment allocations, and devise robust financial strategies. This process involves analyzing historical data, identifying key market indicators, and employing sophisticated algorithms to extrapolate future price trajectories, thereby facilitating informed decision-making, and fostering greater efficiency and transparency in the real estate market.

Some important objectives of Real Estate Price Prediction system is as follows:

* To anticipate market trends and mitigate risks associated with property transactions.
* To optimize investment strategies by identifying properties with potential for appreciation.
* To facilitate financial planning for buyers, sellers, and investors based on predicted price trajectories.
* To enhance efficiency and transparency in the real estate market through data-driven insights.

**Chapter – 3**

**METHODOLOGICAL DETAILS**

**3.1 Dataset**

The dataset "Bengaluru\_House\_Data.csv" contains information about houses in Bengaluru, India. It includes over 13,320 records and 9 attributes.

Dataset is downloaded from here: <https://www.kaggle.com/amitabhajoy/bengaluru-house-price-data>.

**Attributes :**

* **Area type**: This is a categorical attribute that describes the type of area of the property. The possible values are "Super built-up Area", "Built-up Area", and "Plot Area".
* **Availability**: This is a categorical attribute that indicates the availability status of the property. The possible values are dates in the format "DD-MMM" (e.g., "19-Dec", "18-May", etc.), and "Ready To Move".
* **Location**: This is a categorical attribute that represents the location of the property within Bengaluru.
* **Size**: This is a numerical attribute that indicates the size of the property. For some entries, it represents the number of bedrooms (e.g., "2 BHK", "4 Bedroom"), while for others, it represents the square footage of the property (e.g., "1056", "2600").
* **Society**: This is a categorical attribute that represents the name of the housing society or complex where the property is located.
* **Total square feet**: This is a numerical attribute that represents the total square footage of the property.
* **Bath**: This is a numerical attribute that represents the number of bathrooms in the property.
* **Balcony**: This is a numerical attribute that represents the number of balconies in the property.
* **Price**: This is a numerical attribute that represents the price of the property (likely in Indian Rupees).

The dataset contains a mix of categorical and numerical attributes, with some attributes having distinct formats or units (e.g., size can be in number of bedrooms or square footage).

**3.2 Data Pre-processing**

Data pre-processing is a process of preparing the raw data and making it suitable for a machine learning model. It is the first and crucial step while creating a machine learning model. When creating a machine learning project, it is not always a case that we come across the clean and formatted data. And while doing any operation with data, it is mandatory to clean it and put in a formatted way. So for this, we use data pre-processing task.

Fig.3.2 Data Pre-processing

Here, we imported required libraries for the project, then we fetched an .csv (comma separated values) file which contains our dataset then we displayed first 5 record and last 5 using head function.

**3.3 Exploratory Data Analysis**

* **Missing variables**

Fig 3.3 (a) Missing Variables

* **Histogram**

Fig 3.3 (b) Histogram

**3.4 Feature Selection**

Here there is the use of Linear Regression. Linear regression is a statistical method used to model the relationship between a dependent variable and one or more independent variables. It aims to find the best-fitting straight line that minimizes the sum of squared residuals between the observed data points and the predicted values from the linear equation.

**Methodology:**

1. Data Collection: Gather the relevant data, including the dependent variable (y) and the independent variable(s) (x).
2. Exploratory Data Analysis: Perform exploratory data analysis to understand the data distribution, identify outliers, and check for potential violations of assumptions.
3. Model Fitting:
4. Simple Linear Regression (one independent variable): Estimate the coefficients (slope and intercept) of the linear equation using techniques like ordinary least squares.
5. Multiple Linear Regression (multiple independent variables): Use matrix algebra to estimate the coefficients of the multiple linear equation.
6. Assumptions Checking: Verify the assumptions of linear regression, such as linearity, normality of residuals, homoscedasticity (constant variance of residuals), and independence of errors.
7. Model Evaluation:
   1. Assess the model's goodness of fit using metrics like R-squared and adjusted R-squared.
   2. Evaluate the statistical significance of the coefficients using hypothesis testing (e.g., t-tests, F-tests).
   3. Analyze residual plots to identify potential violations of assumptions.
8. Model Validation: Use techniques like cross-validation or holdout data to assess the model's predictive performance on unseen data.
9. Model Interpretation: Interpret the coefficients and their practical implications in the context of the problem.
10. Model Refinement (if needed): Consider transformations of variables, removing or adding predictors, or using more advanced regression techniques if the assumptions are violated or the model performance is unsatisfactory.

**Chapter – 4**

**RESULTS**

**4.1 Linear Regression**

Linear regression is a statistical modeling technique that aims to find the best-fitting straight-line relationship between a dependent variable and one or more independent variables. It is based on the principle of least squares, which minimizes the sum of squared residuals between the observed data points and the predicted values from the linear equation. Linear regression models can be simple (with one independent variable) or multiple (with multiple independent variables). The coefficients of the linear equation are estimated using techniques like ordinary least squares, and the model's performance is evaluated using measures like R-squared and hypothesis testing. Linear regression is widely used for prediction, inference, and understanding the relationship between variables in various fields.

* Accuracy Score = 84.779%
* F1 Score = 78.578%

**4.2 LASSO (Least Absolute Shrinkage and Selection Operator)**

Lasso is a regularization technique used in linear regression models. It adds a penalty term to the cost function, which is the sum of the absolute values of the coefficients multiplied by a tuning parameter. This penalty term encourages sparse solutions, where some coefficients are shrunk to exactly zero, effectively performing feature selection. The Lasso can handle multicollinearity and help prevent overfitting by shrinking the coefficients of less important features towards zero. The strength of regularization is controlled by the tuning parameter, with larger values leading to more coefficients being shrunk to zero.

* Accuracy Score = 72,673%
* F1 Score = 71.934%

**4.3 Decision Tree**

It is a type of supervised learning algorithm that is mostly used for classification problems. A decision tree is a machine learning algorithm that builds a tree-like model of decisions and their possible consequences. It can handle both categorical and numerical data. In this algorithm, we split the population into two or more homogeneous sets. This is done based on most significant attributes/ independent variables to make as distinct groups as possible.

* Accuracy Score = 71.606%
* F1 Score = 68.145%

**4.4 Model Comparison**

|  |  |  |
| --- | --- | --- |
| Model Name | Accuracy | F1 score |
| Linear regression | 0.847796 | 0.785789 |
| LASSO | 0.726738 | 0.719346 |
| Decision tree | 0.716064 | 0.681453 |

**4.5 Suggestions / Recommendation for Improvement**

* Improve Efficiency Using Algorithms such as Linear regression, LASSO Decision trees.
* We can also improve the efficiency of the model by increasing the data size and updating the data up to time . By adding the latest data and training this data over model. We can improve the efficiency of the model by fine tuning the dataset.

**Chapter – 5**

**CONCLUSION AND FUTURE**

**SCOPE**

**5.1 Conclusion**

The real estate price prediction system represents a significant advancement in property valuation methodology. Through meticulous experimentation with a diverse range of algorithms, including Linear Regression, LASSO, and Decision Tree, the effectiveness of data-driven approaches in accurately forecasting property prices has been demonstrated. Notably, Linear Regression emerged as the most accurate model, achieving an impressive 84.779% accuracy rate, followed closely by LASSO at 72.673%, and Decision Tree at 71.606%.

This achievement is underpinned by the sophisticated framework of data science and machine learning algorithms upon which the system is built. By harnessing predictive modeling techniques, the system not only enhances the precision of property valuations but also streamlines decision-making processes for all stakeholders involved in real estate transactions, including buyers, sellers, and industry professionals.

The implications of these findings are profound, highlighting the transformative potential of data-driven approaches in revolutionizing traditional real estate valuation practices. By leveraging the power of advanced analytics, deeper insights into market dynamics, trends, and factors influencing property values can be unlocked. This, in turn, empowers stakeholders to make more informed, data-driven decisions, leading to greater efficiency, transparency, and confidence in the real estate market.

Looking ahead, a commitment to sustained innovation and optimization is essential. Continuous refinement of predictive models, integration of additional data sources, and advancements in machine learning techniques will be crucial in further enhancing the efficacy and reliability of real estate price prediction systems. Staying at the forefront of technological advancements and embracing data-driven approaches will continue to shape the future of real estate valuation, facilitating smarter, more informed decision-making processes in an ever-evolving market landscape.

**5.2 Future Scope**

The future scope of real estate price prediction through data science is expansive and promising. Building upon the success of the initial system, there are numerous avenues for evolution and expansion to further augment its capabilities, adaptability, and impact within the real estate market.

Incorporating a wider array of data sources such as real-time economic indicators, demographic shifts, urban development data, and environmental factors holds the potential to enhance the accuracy and relevance of predictions. Integration of social media and online activity data could offer valuable insights into emerging trends and preferences in real estate, enriching the predictive model.

Moreover, enhancing the system to provide real-time predictions based on dynamic market data could equip users with up-to-the-minute information, vital for making informed decisions in a volatile market environment. This would necessitate the development of robust backend infrastructure and potentially the utilization of streaming data platforms.

Future enhancements will concentrate on integrating more diverse datasets, refining user interface designs, and implementing advanced machine learning techniques to further refine accuracy and user experience. By continually refining and expanding the capabilities of the real estate price prediction system, we can drive innovation and efficiency in the real estate industry, empowering stakeholders with invaluable insights for more informed decision-making.

The proposed working model can also help in reducing treatment costs by providing Initial

diagnostics in time. The model can also serve the purpose of training tool for medical students

and will be a soft diagnostic tool available for physician and cardiologist. General physicians can

utilize this tool for initial diagnosis of cardio-patients. There are many possible improvements

that could be explored to improve the scalability and accuracy of this prediction system. As we

have developed a generalized system, in future we can use this system for the analysis of

different data sets. The performance of the health’s diagnosis can be improved significantly by

handling numerous class labels in the prediction process, and it can be another positive direction

of research. In DM warehouse, generally, the dimensionality of the heart database is high, so

identification and selection of significant attributes for better diagnosis of heart disease are very

challenging tasks for future research.

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**Chapter – 6**

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**Chapter – 7**

**INTERNSHIP DETAILS**

**6.1 Internship Certificate**

**6.2 Company Details**

* Company Name – Paarsh Infotech Private LTD.
* Location – Office no. 01 Bhakti Apartment, Near Rasoi Hotel Suchita Nagar Mumbai Naka, Nashik 422001
* Internship Mode - Online
* Background - It has been classified as non-govt company and is registered under Registrar of Companies Maharashtra India. Company provides different types of Software and Internship Programs.

**6.3 Supervisor Details**

* Name – Dr. Tushar Pagare
* Email - paarshinfotech@gmail.com
* Mobile - +919860988343

**6.4 Attendance Record**

|  |  |
| --- | --- |
| Name of student | Chetan Anil Dabbe |
| Roll No | 19 |
| Div | A |
| Name of Course | Data Science Internship |
| Date of Commencement of Internship | 15 Dec 2023 |
| Date of Completion of Training | 18 Jan 2024 |
| Organization Name | Paarsh Infotech Pvt. LTD. |

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Industry Signature:

Industry Supervisor Name: Dr. Tushar Pagare

Email ID: paarshinfotech@gmail.com