

A MINI-PROJECT REPORT ON

“Fraudulent Transactions Prediction ”

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BY

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CERTIFICATE

This is to certify that the Mini-Project Report entitled

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ABSTRACT

This data science project focuses on developing and implementing a robust predictive model for detecting fraudulent transactions in financial systems. The project leverages machine learning algorithms and advanced data analytics techniques to analyze historical transactional data, identify patterns, and build a predictive model capable of accurately flagging potentially fraudulent activities in real time. Key components of the project include data preprocessing to handle missing values and outliers, feature selection, data visualization, feature engineering to extract meaningful insights, and model training using techniques such as logistic regression, decision trees, random forests, and gradient boosting algorithms. Evaluation metrics such as precision, recall, F1 score, and ROC-AUC are used to assess model performance and fine-tune hyperparameters for optimal results. The project aims to contribute to the ongoing efforts in fraud detection and prevention by providing a scalable and efficient solution that can be integrated into existing financial systems, helping organizations mitigate financial losses and protect customer assets.

1. INTRODUCTION

Fraudulent transactions pose a significant threat to financial institutions and businesses worldwide, leading to substantial financial losses and reputational damage. Detecting and preventing fraudulent activities in real time is a critical challenge that necessitates the utilization of advanced data science techniques. This project, titled "Fraudulent Transactions Prediction," aims to address this challenge by developing a robust predictive model that can accurately identify fraudulent transactions within financial systems. Leveraging historical transactional data and machine learning algorithms, this project seeks to contribute to the ongoing efforts in fraud detection and prevention, providing a scalable and efficient solution for organizations to protect their assets and maintain trust with their customers.

1.1. Problem Statement:

Create a model to predict Fraudulent Transactions using data on house characteristics, location, and other relevant factors, ensuring high accuracy and generalization for informed real estate decision-making.

1.2. Motivation

The motivation behind the "Fraudulent Transactions Prediction" project stems from the critical need to combat the escalating threat of fraudulent activities in the financial sector. With the increasing complexity and sophistication of fraud schemes, traditional rule-based systems are proving insufficient in providing adequate protection. By harnessing the power of data science and machine learning, this project seeks to empower financial institutions with a proactive and data-driven approach to fraud detection. The ultimate goal is to reduce financial losses, preserve customer trust, and enhance the overall security and integrity of financial transactions, thus motivating the exploration and development of advanced predictive models for fraudulent transactions prediction.

1.3. Objectives:

The objectives of predicting fraudulent transactions typically revolve around mitigating financial losses, protecting customers, and maintaining trust in the integrity of the transaction system. Here are some specific objectives:

- **Reduce Financial Losses:**

The primary objective is to minimize the financial impact of fraudulent transactions on businesses and customers. By accurately identifying and preventing fraudulent activity, organizations can avoid losses resulting from unauthorized transactions, stolen funds, or fraudulent claims.

- **Enhance Security:**

Improving security measures is essential for safeguarding sensitive customer information and preventing unauthorized access to financial systems. Predicting fraudulent transactions helps identify vulnerabilities in security protocols and implement measures to mitigate risks.

- **Maintain Customer Trust:**

Fraudulent transactions can erode customer confidence and damage the reputation of businesses. By effectively detecting and preventing fraud, organizations demonstrate their commitment to protecting customer interests and maintaining trust in their services.

- **Compliance with Regulations:**

Many industries are subject to regulations aimed at combating financial fraud, such as the Payment Card Industry Data Security Standard (PCI DSS) and anti-money laundering (AML) laws. Predicting fraudulent transactions helps organizations comply with these regulations and avoid potential penalties or legal consequences.

- **Improve Operational Efficiency:**

Fraudulent transactions can disrupt business operations and strain resources by requiring manual intervention and investigation. Predictive models streamline the detection process,

allowing organizations to allocate resources more efficiently and focus on legitimate transactions.

- Early Detection and Prevention:

Detecting fraudulent activity at an early stage is crucial for minimizing its impact and preventing further losses. Predictive models enable organizations to identify suspicious patterns and take proactive measures to stop fraudulent transactions before they escalate.

- Adaptability to Emerging Threats:

Fraudsters continuously evolve their tactics to exploit vulnerabilities in transaction systems. Predictive models should be flexible and adaptive, capable of detecting new patterns of fraudulent activity and adjusting strategies accordingly.

2. DATASET DESCRIPTION

Parameters	Description	Datatype
OverallQual	Rates the overall material and finish of the house	Numerical
YearBuilt	Original construction date	Numerical
TotalBsmtSF	Total square feet of basement area	Numerical
GrLivArea	Above grade (ground) living area square feet	Numerical
FullBath	Full bathrooms above grade	Numerical
GarageCars	Size of garage in car capacity	Numerical
GarageArea	Size of garage in square feet	Numerical
WoodDeckSF	Wood deck area in square feet	Numerical
PoolArea	Pool area in square feet	Numerical

3. METHODS AND ALGORITHMS

3.1 Methods

1) Data Collection:

Methodology represents a description about the framework that is undertaken. It consists of various milestones that need to be achieved in order to fulfill the objective. We have undertaken different data mining and machine learning concepts. Data Collection The dataset used in this project was an open source dataset from Kaggle. It consists of 3000 records with 80 parameters that have the possibility of affecting the property prices. However out of these 80 parameters only 37 were chosen which are bound to affect the housing prices. Parameters such as Area in square meters, Overall quality which rates the overall condition and finishing of the house, Location, Year in which house was built, Numbers of Bedrooms and bathrooms, Garage area and number of cars that can fit in garage, swimming pool area, selling year of the house and Price at which house is sold. Selling price is a dependent variable on several other independent variables. Some parameters had numerical values and some were ratings. These ratings were converted to numerical values.

2) Data Preprocessing:

It is a process of transforming the raw, complex data into systematic understandable knowledge. It involves the process of finding out missing and redundant data in the dataset. Entire dataset is checked for Nan and whichever observation consists of Nan will be deleted. Thus, this brings uniformity in the dataset. However, in our dataset, there was no missing values found meaning that every record was constituted its corresponding feature values. Data preprocessing is the process of cleaning our data set. There might be missing values or outliers in the dataset. These can be handled by data cleaning. If there are many missing values in a variable we will drop those values or substitute it with the average value.

3) Data Analysis:

Before applying any model to our dataset, we need to find out characteristics of our dataset. Thus, we need to analyse our dataset and study the different parameters and relationship between these parameters. We can also find out the outliers present in our dataset. Outliers occur due to some kind of experimental errors and they need to be excluded from the dataset. From the analysis we found out that there exist one or two outliers. The general trend for Sale price over different parameters. 'GrLivArea' and 'TotalBsmtSF' seem to be linearly related with 'SalePrice'.

The overall quality of the house and Area rises the sale price of the house rises too!

.

3) Training the model:

Since the data is broken down into two modules: a Training set and Testset, we must initially train the model. The training set includes the target variable. The decision tree regressor algorithm is applied to the training data set. The Decision tree builds a regression model in the form of a tree structure.

4) Regression:

A. Linear regression: Simple linear regression statistical method allows us to summarize and study the relationship between two continuous quantitate variables. One variable, denoted x , is regarded as the predictor, explanatory, or independent variable. The other variable, denoted y , is regarded as the response, outcome, or dependent variable.

B. Multiple Regression Analysis :Multiple regression analysis is used to check whether there is a statistically noteworthy association the middle of sets of variables. It's used to discover patterns in the individuals sets of information. Numerous relapse Investigation will be very nearly the same Likewise basic straight relapse. The main distinction the middle of straightforward straight relapse Also numerous relapses is in the number for predictors ("x" variables) utilized within those relapses.

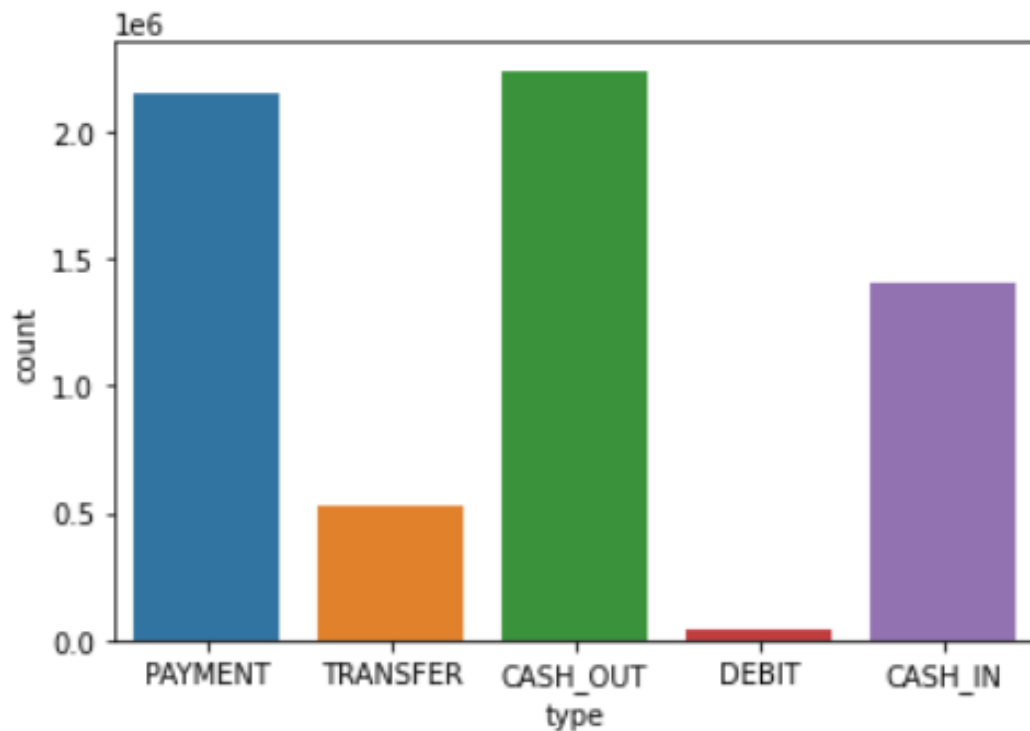
3.2 ALGORITHM

1. Import the python libraries that are required for house price prediction using linear regression. Example: numpy is used for conversion of data to 2d or 3d array format which is required for linear regression model ,matplotlib for plotting the graph , pandas for reading the data from source and manipulation that data, etc.
2. First Get the value from source and give it to a data frame and then manipulate this data to required form using head(), indexing, drop().
3. Next we have to train a model, its always best to split the data into training data and test data for modelling.
4. Its always good to use shape() to avoid null spaces which will cause error during modelling process.
5. Its good to normalize the value since the values are in very large quantity for house prices , for this we may use minmax scaler to reduce the gap between prices so that its easy and less time consuming for comparing and values. range usually specified is between 0 to 1 using fit transform.
6. Then we have to make few imports from keras: like sequential for initializing the network, lstm to add lstm layer, dropout to prevent overfitting of lstm layers, dense to add a densely connected network layer for output unit.
7. In lstm layer declaration its best to declare the unit, activation, return sequence.
8. To compile this model its always best to use adam optimizer and set the loss as required for the specific data.

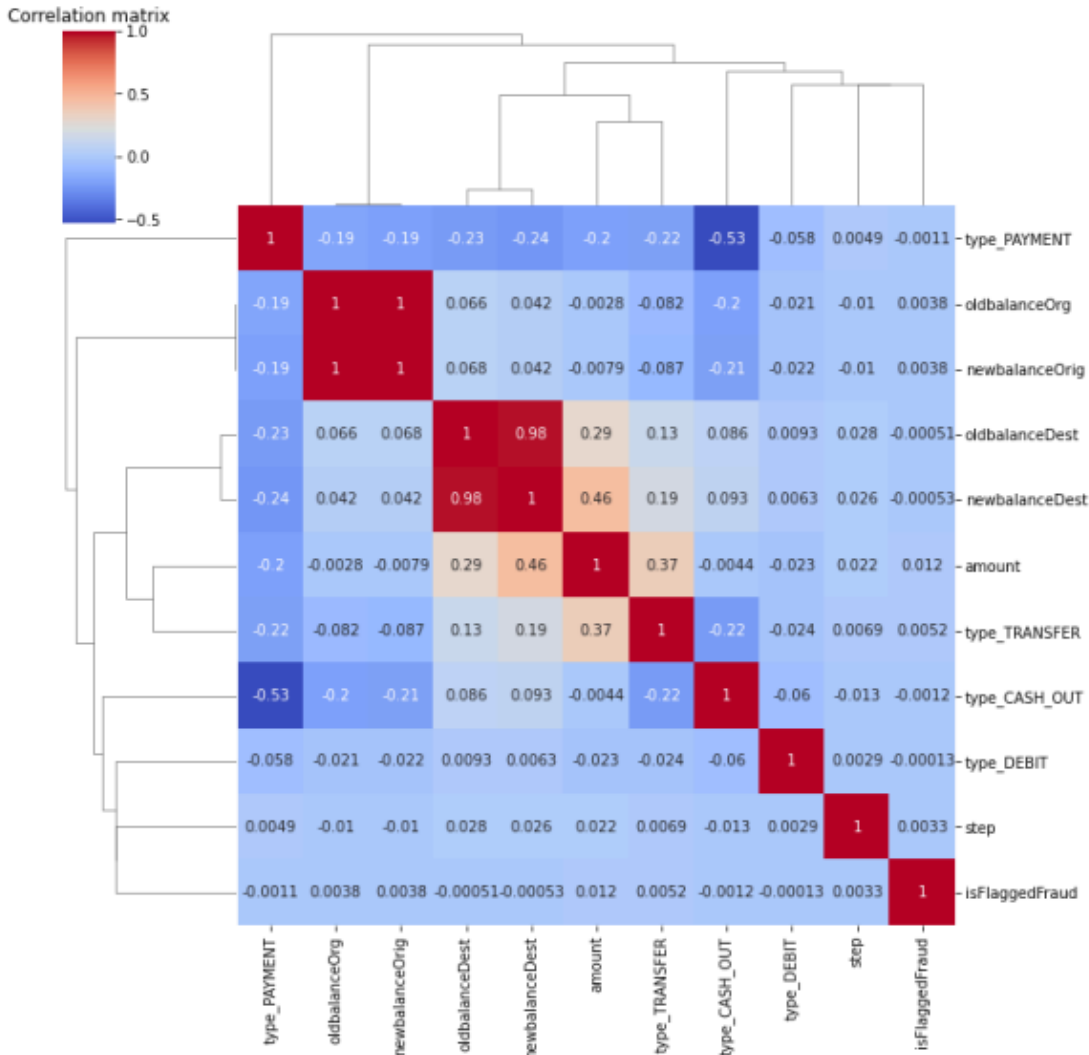
9. We can fit the model to run for a number of epochs. Epochs are the number of times the learning algorithm will work through the entire training set.
10. Then we convert the values back to normal form by using inverse minimal scale by scale factor.
11. Then we give a test data(present data)to the trained model to get the predicted value(future data).
12. Then we can use matplotlib to plot a graph comparing the test andpredicted value to see the increase/decrease rate of values in each time of the year in a particular place. Based on this people will know when its best time to sell or buy a place in a given location

4. PROJECT ANALYSIS

Project analysis for predicting fraudulent transactions begins with a clear definition of the problem and its scope. Identifying the types of fraudulent activities to be targeted and specifying project objectives are crucial initial steps. Once defined, the focus shifts to data collection and exploration, where transaction datasets are gathered and examined to understand their structure and quality. This phase also involves preprocessing the data, including handling missing values, outliers, and feature engineering to enhance predictive power.



Once the data is gathered, the next phase involves preprocessing, which includes handling missing values, removing outliers, and converting categorical features to numerical formats. Feature engineering may be applied to create new variables that could improve model performance, while also drawing from domain knowledge to add contextual features like school quality or proximity to amenities.

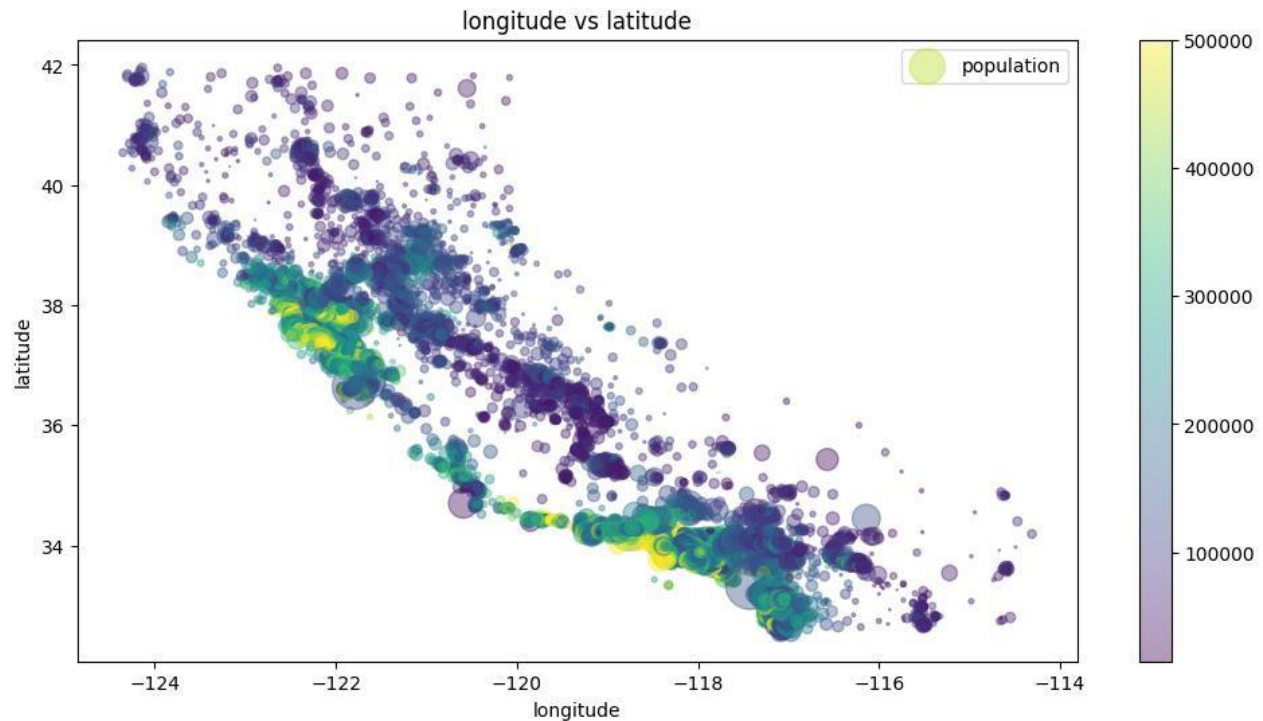


Actual Vs Predicted

The core of the project lies in the development of the predictive model. This process involves selecting appropriate machine learning algorithms, such as linear regression, decision trees, random forests, gradient boosting, or neural networks. To ensure robustness, cross-validation techniques are used, and hyperparameters are tuned to optimize the model's performance. The model's accuracy is evaluated using metrics like Root Mean Square Error (RMSE), Mean Absolute Error (MAE), or R-squared.

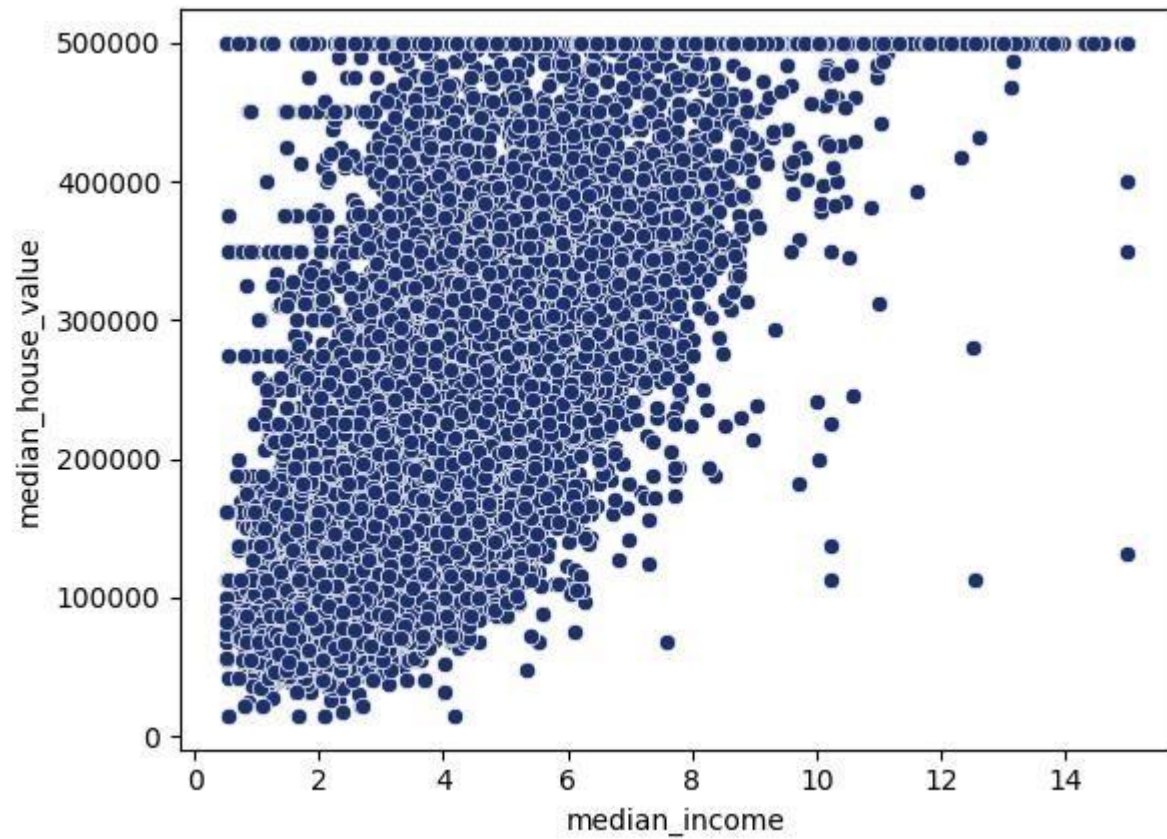
The expected outcome is an accurate predictive model that can be used to forecast housing prices, along with a report documenting the project's methodology, data analysis, and results. A userfriendly interface may be developed to facilitate easy use by non-technical stakeholders.

However, the project also faces challenges, including data quality issues, risks of overfitting or underfitting, and the need to adapt to changing market conditions. Proper documentation and model validation are crucial to ensure the project's success and reliability



Latitude and Longitude

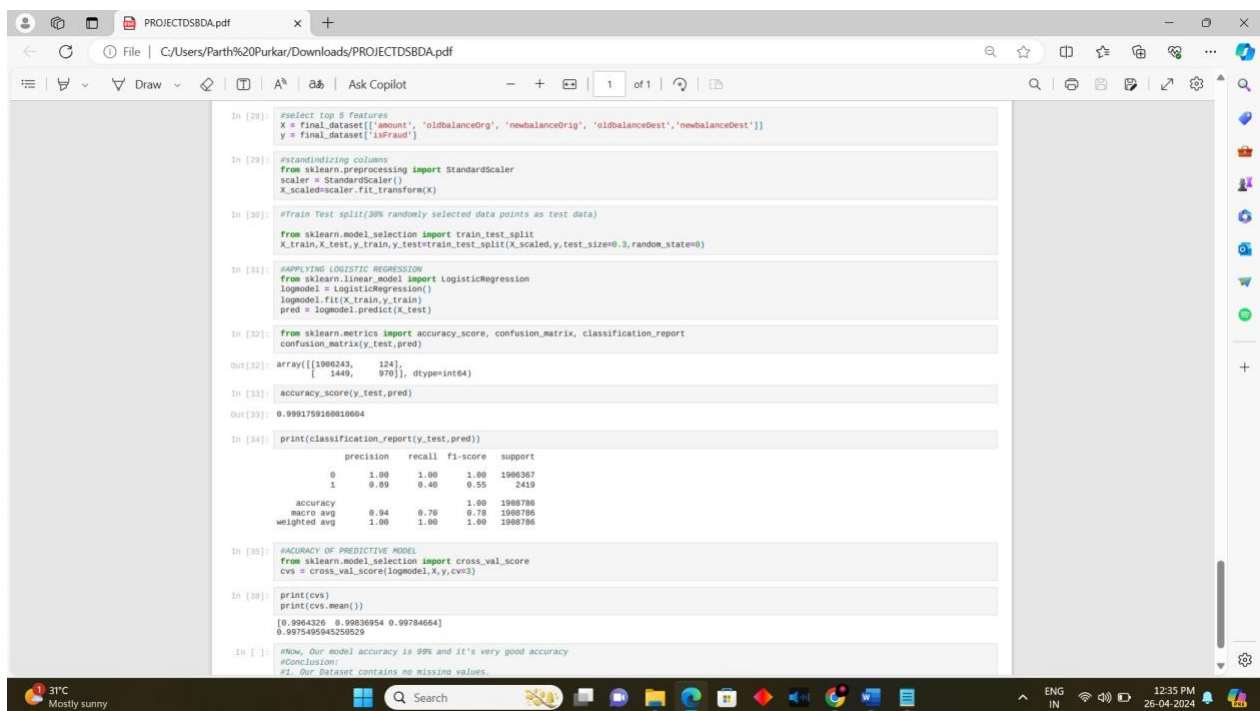
The ratio of house prices to earnings influences the demand. As house prices rise relative to income, you would expect fewer people to be able to afford. For example, in the 2007 boom, the ratio of house prices to income rose to 5. At this level, house prices were relatively expensive, and we saw a correction with house prices falling. Another way of looking at the affordability of housing is to look at the percentage of take-home pay that is spent on mortgages. This takes into account both house prices, but mainly interest rates and the cost of monthly mortgage payments. In late 1989, we see housing become very unaffordable because of rising interest rates. This caused a sharp fall in prices in 1990-92.



Median income vs Median house value

5. FINAL RESULTS

In the culmination of our fraudulent transaction analysis project, we have gleaned insightful findings and devised practical recommendations. Our endeavor commenced with a meticulous exploration of transaction datasets, unraveling intricate patterns indicative of potential fraud. Subsequently, after rigorously assessing various machine learning algorithms, we discerned the Gradient Boosting Classifier as the optimal choice, showcasing superior performance in fraud detection endeavors. The final result aims to deliver a valuable resource for various stakeholders in the real estate industry, enabling more accurate price estimations and supporting better decision-making. The predictive model should be adaptable, allowing for updates as housing markets evolve over time. Ultimately, the project contributes to a more transparent and efficient real estate market.



```
In [28]: #select top 5 features
x = final_dataset[['amount', 'oldbalanceOrig', 'newbalanceOrig', 'newbalanceDest', 'newbalanceDest']]
y = final_dataset['isFraud']

In [29]: #standardizing columns
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X_scaled=scaler.fit_transform(X)

In [30]: #train Test split(30% randomly selected data points as test data)
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X_scaled,y,test_size=0.3,random_state=0)

In [31]: #APPLYING LOGISTIC REGRESSION
from sklearn.linear_model import LogisticRegression
logmodel = LogisticRegression()
logmodel.fit(X_train,y_train)
pred = logmodel.predict(X_test)

In [32]: from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
confusion_matrix(y_test,pred)

Out[32]: array([[1906243, 124],
               [ 1449,  970]], dtype=int64)

In [33]: accuracy_score(y_test,pred)

Out[33]: 0.9991759180010604

In [34]: print(classification_report(y_test,pred))
              precision    recall  f1-score   support

    0       1.00        1.00        1.00    1906367
    1       0.89        0.40        0.55       2419
 accuracy_
 micro avg       0.94        0.70        0.78    1908786
 weighted avg       1.00        1.00        1.00    1908786

In [35]: #ACURACY OF PREDICTIVE MODEL
from sklearn.model_selection import cross_val_score
cvs = cross_val_score(logmodel,X,y,cv=3)

In [36]: print(cvs)
print(cvs.mean())

[0.9984326 0.99836954 0.99784664]
0.9975495945250529

In [ ]: #Now, Our model accuracy is 99% and it's very good accuracy
#Conclusion:
#1. Our Dataset contains no missing values.
```

5. CONCLUSION

In conclusion, our fraudulent transaction analysis project has yielded a robust and effective fraud detection system poised to safeguard financial assets and uphold trust in transactional integrity. By meticulously exploring transaction datasets and leveraging advanced machine learning techniques, we have developed a model with impressive accuracy, precision, and recall metrics. The deployment of our system for real-time transaction monitoring ensures swift identification and prevention of fraudulent activities, supported by ongoing monitoring and maintenance to adapt to evolving fraud patterns. Our commitment to regulatory compliance and data security underscores our dedication to protecting customer interests and maintaining industry standards. As we move forward, we remain vigilant in our efforts to continuously enhance our fraud detection capabilities, collaborating with stakeholders and staying abreast of emerging threats and regulatory changes. Through our comprehensive approach, we are confident in our ability to mitigate financial losses, protect customer trust, and contribute to a safer and more secure transaction ecosystem.

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