COUPON PREDICTION

A Course Project report submitted

in partial fulfillment of requirement for the award of degree

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE & ENGINEERING

by

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CERTIFICATE

This is to certify that this project entitled **"COUPON PURCHASE PREDICTION"** is the bonafied work carried out by **T.Vishal Mary,G.Ashmitha** as a Course Project for the partial fulfillment to award the degree **BACHELOR OF TECHNOLOGY** in **COMPUTER SCIENCE & ENGINEERING** during the academic year 2022-2023 under our guidance and Supervision.

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ACKNOWLEDGEMENT

We express our thanks to Course co-coordinator **Mr. S. Naresh Kumar, Asst. Prof.** for guiding us from the beginning through the end of the Course Project. We express our gratitude to Head of the department CS&AI, **Dr. M. Sheshikala , Associate Professor** for encouragement, support and insightful suggestions. We truly value their consistent feedback on our progress, which was always constructive and encouraging and ultimately drove us to the right direction.

We wish to take this opportunity to express our sincere gratitude and deep sense of respect to our beloved Dean, School of Computer Science and Artificial Intelligence, **C. V. Guru Rao**, for his continuous support and guidance to complete this project in the institute.

Finally, we express our thanks to all the teaching and non-teaching staff of the department for their suggestions and timely support.

ABSTRACT

Our project is based on user data analysis which is used to predict what coupon a user will get based on his previous purchases and transactions from the site. Issuing discount shopping coupons and barter purchase is a popular way to promote sales in E-commerce environments. In order to improve the coupon usage ratio, it is important to predict the probability in which a user will get a coupon. To treat the coupon redemption probability prediction problem as a binary classification problem, we use machine learning methods to analyze users' coupon usage behavior and coupon purchase prediction.

Coupon prediction refers to the process of using data analytics and machine learning techniques to forecast the likelihood of a customer getting a particular coupon or offer. This practice is essential for businesses in the retail and e-commerce industries, as it allows them to optimize their marketing strategies by targeting customers who are most likely to use coupons and offers. By analyzing customer data such as past purchase and transactions, and other relevant factors, businesses can predict which customers are more likely to get coupon promotions and tailor their marketing efforts accordingly. Predictive models can also help businesses optimize the timing and distribution of coupons and offers to maximize their effectiveness. The benefits of coupon prediction include improved targeting, increased redemption rates, and a better return on investment for marketing efforts. Overall, coupon prediction is a valuable tool for businesses looking to optimize their marketing strategies and improve customer engagement.

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1.INTRODUCTION

1.1 OVERVIEW

A coupon prediction project involves applying data analytics and machine learning techniques to develop a predictive model for coupon prediction to the customers. The project typically involves collecting and analyzing customer data, such as past purchase, previous transcations and other relevant factors that may influence coupon usage. The data is then used to train a machine learning model that can predict which customers are most likely given a coupon and which coupons are likely to be redeemed. The benefits of a coupon prediction project include increased targeting, higher redemption rates, and improved return on investment for marketing efforts. A successful coupon prediction project can help businesses to optimize their marketing strategies and improve customer engagement, leading to increased sales and customer loyalty.

1.2 PROBLEM STATEMENT

Many businesses in the retail and e-commerce industries struggle to optimize their coupon and offer distribution strategies due to a lack of data-driven insights. They often rely on a trial-and-error approach to distribute coupons and offers, which can result in low redemption rates and wasted marketing resources. To address this challenge, we aim to develop a predictive model that can identify which customers are most likely to respond to coupon promotions and which coupons are likely to be redeemed. By using customer data and machine learning algorithms to predict coupon usage, we aim to improve the targeting and effectiveness of our coupon distribution strategy and increase customer engagement and sales.

1.3 EXISTING SYSTEM

Customer segmentation is one of the existing model it is the process of dividing customers into groups based on common characteristics such as demographics, behaviour, preferences, and needs. A customer segmentation model is a statistical tool used to identify meaningful segments of customers that have similar characteristics, behaviours, or needs. It uses statistical methods to cluster customers into distinct groups based on the segmentation criteria. Each group should be as homogenous as possible with respect to the criteria being used to segment them and as different as possible from other groups.

1.4 PROPOSED SYSTEM

Here we want to predict the coupon to the customer based his/her transaction history and depending upon their item purchases the customer gets the coupon discount . This is a machine learning algorithm to predict which coupons will be most effective for different types of customers based on their purchase history and other factors. This involves looking at past coupon usage data to identify patterns and trends that can be used to make predictions about future purchases.

1.5 DEFINE OBJECTIVES

The main objectives of coupon prediction are to:

- Increase coupon redemption rates: By predicting which customers are most likely to get a coupon, we can target their promotions more effectively and increase the redemption rates of their coupons.
- Improve customer satisfaction: By offering customers coupons that are more relevant to their needs and preferences, we can improve customer satisfaction and increase customer loyalty.
- Increase sales: Coupon prediction can help us to optimize promotions to maximize sales and revenue.
- Reduce marketing costs: By targeting coupons more effectively, retailers can reduce marketing costs by avoiding the distribution of coupons to customers who are unlikely to use them.
- Optimize inventory management: By predicting which products are most likely to be purchased in order to predict coupon, retailers can optimize their inventory management and ensure that they have enough stock on hand to meet demand.

Overall, coupon prediction can help retailers improve the effectiveness of their coupon campaigns, reduce costs, and gain a better understanding of their customers' behaviour and preferences.

1.6 OVERALL ARCHITECTURE

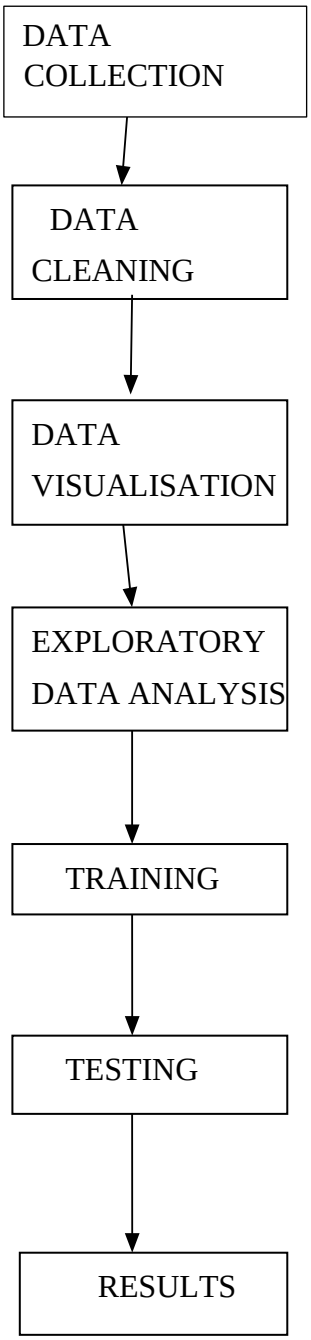


Fig.1.6.1

2.0 LITERATURE SURVEY

Coupon prediction refers to the process of using data analytics and machine learning algorithms to forecast which customers are likely to use coupons and when. This can help businesses optimize their couponing strategies, target the right customers with the right coupons, and increase their ROI. Here is a literature survey on coupon prediction.

It proposes a coupon redemption forecasting model based on machine learning algorithms such as random forest, gradient boosting, and deep learning neural networks. The people who had survey o this have demonstrate that their model out performs traditional forecasting methods such as ARIMA and exponential smoothing which presents a predictive model for coupon redemption in retailing based on logistic regression and decision trees.

The person who was going with the survey use data from a real-world retail store to validate their model and show that it achieves a high accuracy rate proposes a coupon recommendation system based on collaborative filtering, a popular recommendation algorithm and demonstrate that their system can effectively recommend coupons to users based on their past transactions and purchases

It also presents a coupon usage prediction model based on machine learning algorithms such as logistic regression and random forest which uses data from a large e-commerce website to demonstrate the effectiveness of their model in predicting coupon usage. compares various machine learning algorithms for coupon redemption prediction, including logistic regression, decision trees, and support vector machines. The person use data from a real-world retail store to evaluate the performance of these algorithms and identify the most effective ones.

The proposed approach is in two phases: obtaining trends of purchasing, and estimating likelihood of purchasing. Buying trend gives marketing clue to web marketers while purchasing probability gives real-time web marketing chance by estimating an unknown consumer's likelihood of purchasing. These methodologies may be important for real-time web marketing that likes shortcuts, Brand advice and best customer reward because unknown consumers are involved in the target marketing and the buying navigation pattern is created.

Besides that, we are looking for some very significant factors / features that can directly influence the habits of consumers using coupons. We also found the "oldest consumer influence." We also found some intelligent features that have no impact and eliminate them.

Overall, these above information demonstrate the potential of machine learning and data analytics for coupon prediction, and provide insights into the best practices and techniques for building accurate and effective couponing strategies.

Li et al. (2018) proposed a data mining approach to predict coupon redemption in e-commerce. The study used a dataset containing coupon usage and user behavior data from a Chinese e-commerce platform. The dataset was preprocessed, and feature selection was performed to select the most relevant features for the prediction task.

The authors used four classification algorithms, namely logistic regression, decision tree, random forest, and support vector machine (SVM), to predict coupon redemption. The performance of each algorithm was evaluated using metrics such as accuracy, precision, recall, F1-score, and area under the receiver operating characteristic curve (AUC-ROC).

The results showed that SVM outperformed the other three algorithms, achieving an accuracy of 76.18% and an AUC-ROC of 0.792. The authors also performed a sensitivity analysis to evaluate the impact of different feature subsets on the prediction performance. The results showed that the inclusion of user behavior data significantly improved the prediction performance.

The study contributes to the field of coupon prediction by proposing a data mining approach that can effectively predict coupon redemption in e-commerce. The approach is based on a combination of feature selection and classification algorithms, and the results show that it can achieve high prediction accuracy. The study also highlights the importance of including user behavior data in the prediction task.

3.0 DATA PREPROCESIING

```
[ ]  coupon.shape
```

```
(150, 7)
```

```
[ ]  coupon.size
```

```
1050
```

```
coupon.info
```

```
<bound method DataFrame.info of      Gender            Item1        Item2
0      Male  Computer Games          Toys  Educational Products  436274.446700
1    Female       Cosmetics  Womens Wear              Kids Wear    5323.510000
2    Female       Cosmetics  Womens Wear                  Candy   48980.998330
3      Male  Computer Games    Gym Shoes                    Tie    3697.783333
4      Male           Heels  Womens Wear              Kids Wear  289181.848300
..      ...             ...          ...                    ...           ...
145  Female         Handbag       Movies                    Tie   47223.323000
146    Male  Computer Games          Toys  Educational Products   70553.563330
147    Male       Cosmetics  Womens Wear                  Candy   56510.570000
148  Female  Computer Games  Womens Wear  Educational Products    6659.136226
149    Male           Heels          Toys  Educational Products   23826.807830

              Coupon  coupon_discount
0      Kids Apparel       117.276864
1    Womens Apparel        70.885046
2    Womens Apparel       342.826195
3      Mens Apparel        88.694903
4    Womens Apparel       200.991719
..             ...              ...
145  Womens Apparel        76.259010
146    Kids Apparel       109.160070
147  Womens Apparel       103.032016
148    Kids Apparel        57.905532
149  Womens Apparel        53.048012

[150 rows x 7 columns]>
```

```
[ ]  coupon.index
```

```
RangeIndex(start=0, stop=150, step=1)
```

```
[ ]  coupon.columns
```

```
Index(['Gender', 'Item1', 'Item2', 'Item3', 'transactions', 'Coupon',
       'coupon_discount'],
      dtype='object')
```

```
[ ]  coupon.dtypes
```

```
Gender              object
Item1               object
Item2               object
Item3               object
transactions       float64
Coupon              object
coupon_discount    float64
dtype: object
```

```
[ ]  coupon.count()
```

```
Gender             150
Item1              150
Item2              150
Item3              150
transactions       150
Coupon             150
coupon_discount    150
dtype: int64
```

3.1 DATASET DESCRIPTION

This dataset contains information related to Retail/E-commerce sales and the type of rewards selected by the customers. The dataset consist of only 150 records.

The 7 main attributes of our dataset are GENDER , ITEM1, ITEM2, ITEM3, TRANSACTIONS, COUPON, COUPON DISCOUNT.

.GENDER: The Gender of the customer to predict the coupon regarding their uses with help of Gender.

- Categorical variable. It denotes the customer's gender.

2.ITEMS: It is the group of the items.

- Computer Games
- Toys
- Educational Products
- Cosmetics
- Womens Wear
- Kids Wear
- Handbag
- Movies
- Board Games
- Mens Wear
- Candy
- Gym Shoes
- Tie
- Heels

3.COUPONS: These are the coupons assigned or predicted to the customers and the following are they

- Kids Apparel
- Womens Apparel
- Mens Apparel

4.PREVIOUS TRANSACTIONS:

5.COUPON DISCOUNT

3.2 DATA CLEANING

Data Cleaning is a process of removing null values and inaccurate values.

In this particular dataset we have checked for null and irrevalant values by importing the dataset.

If the null values are found it can be removed by isnull().

This can be implemented as follows:

```
coupon.isna()
```

	Gender	Item1	Item2	Item3	transactions	coupon	coupon_discount
0	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...
145	False	False	False	False	False	False	False
146	False	False	False	False	False	False	False
147	False	False	False	False	False	False	False
148	False	False	False	False	False	False	False
149	False	False	False	False	False	False	False

150 rows × 7 columns

```
[ ]  coupon.isna().sum()
```

```
Gender             0
Item1              0
Item2              0
Item3              0
transactions       0
coupon             0
coupon_discount    0
dtype: int64
```

```
[ ]  coupon.isna().any()
```

```
Gender             False
Item1              False
Item2              False
Item3              False
transactions       False
coupon             False
coupon_discount    False
dtype: bool
```

```
[ ]  coupon.isna().all()
```

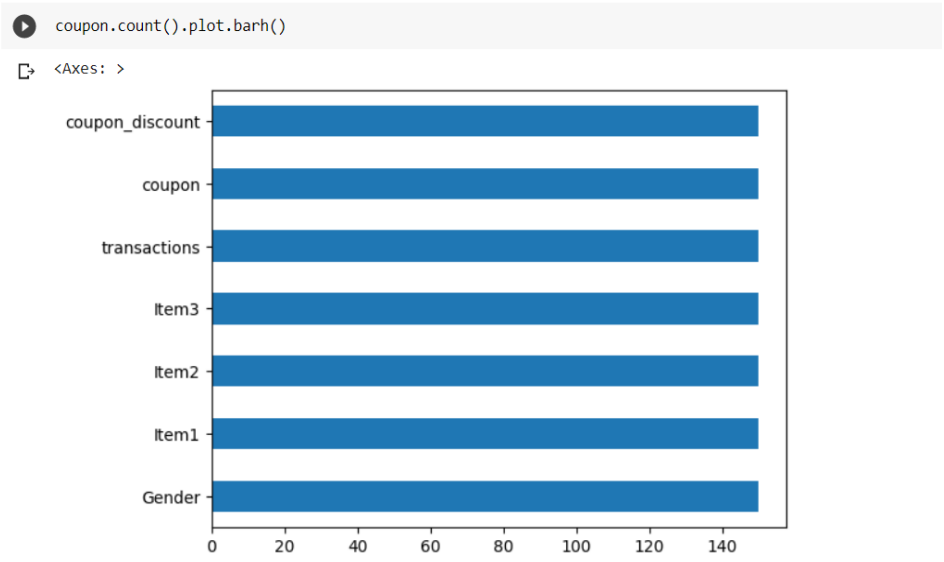
```
Gender             False
Item1              False
Item2              False
Item3              False
transactions       False
coupon             False
coupon_discount    False
dtype: bool
```

3.3 DATA AUGMENTATION

Data augmentation is a technique used in machine learning to increase the size and diversity of a training dataset by creating new training examples from existing ones. This can be particularly useful in coupon prediction tasks, where having a larger and more diverse training set can lead to better performance of the predictive model. Overall, data augmentation can be a powerful tool in coupon prediction tasks, allowing the model to learn from a larger and more diverse set of training examples and improving its ability to generalize to new and unseen data.

3.4 DATA VISUALISATION

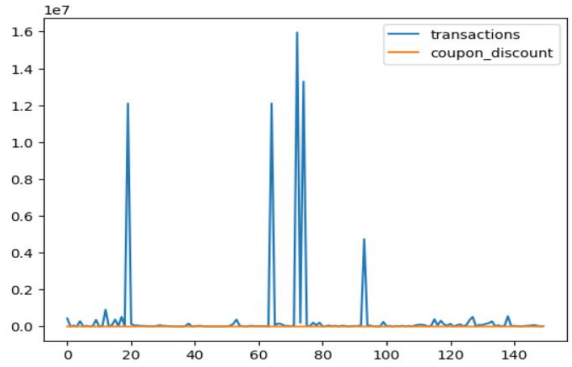
Data visualization is the portrayal of data in charts, graphs, maps and other visual formats to help you identify trends and relationships in your data



Horizontal Bar Graph of the Dataset

```
coupon.plot.line()
```

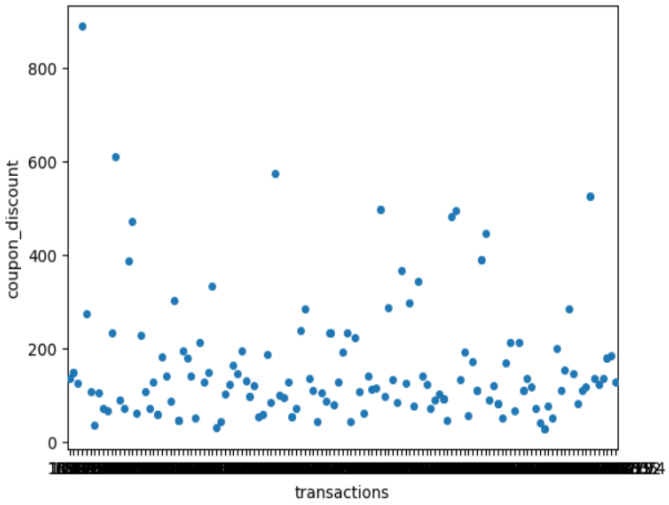
```
<Axes: >
```



Line Graph between transactions and coupon discount

```
sns.stripplot(x=coupon.transactions,y=coupon.coupon_discount,data=coupon)
```

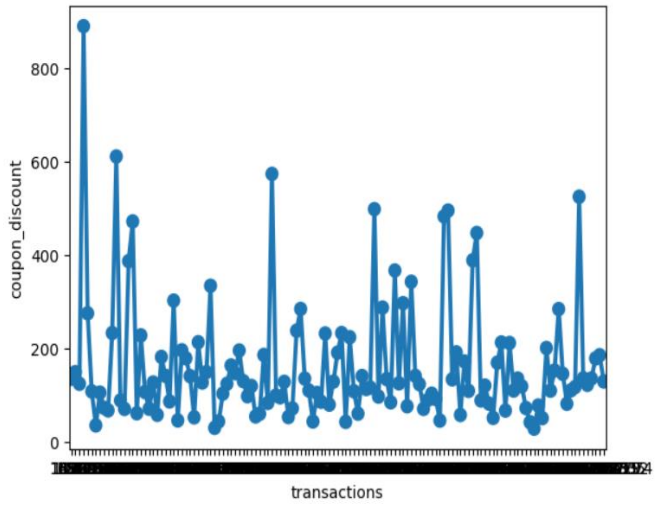
```
<Axes: xlabel='transactions', ylabel='coupon_discount'>
```



Stripplot between transactions and coupon discount

```
sns.pointplot(x='transactions',y='coupon_discount',data=coupon)
```

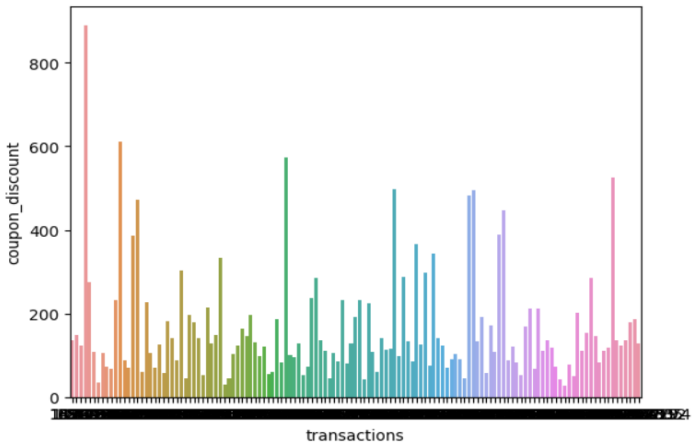
```
<Axes: xlabel='transactions', ylabel='coupon_discount'>
```



Pointplot between transactions and coupon discount

```
sns.barplot(x='transactions',y='coupon_discount',data=coupon)
```

```
<Axes: xlabel='transactions', ylabel='coupon_discount'>
```



Barplot between transactions and coupon discount

4.0 METHODOLOGY

4.1 PROCEDURE

To predict the coupon for a particular customer , we have collected the data about the transactions ,purchases and items that undertaken by the customers .We have considered the independent variables as x(Transactions) and dependent variables as y(coupon discount).From this data we want to predict the coupons in future for a customer . We have used linear regression algorithm in order to solve this problem .It is defined as the relationship between one independent variable and one independent variable.

$$y = ax + b$$

where y = Targe

x= features

a = slope

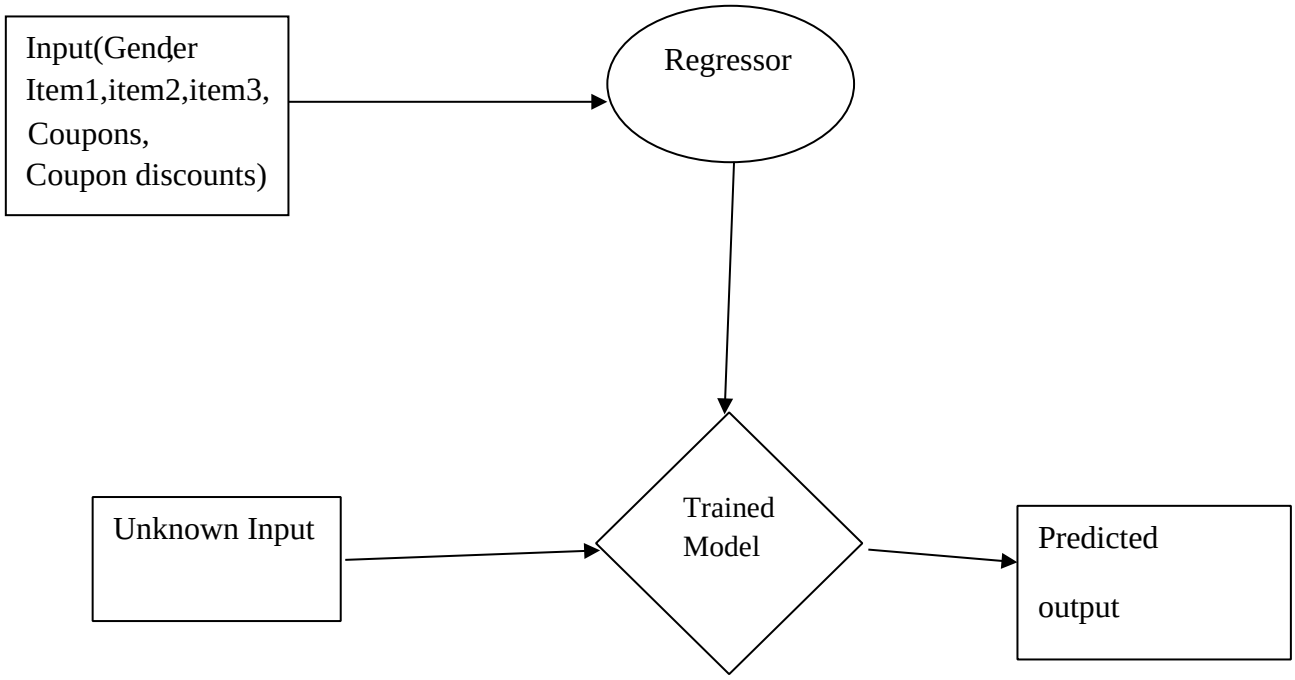
b = y-intercept constant

The slope and intercept can be calculated by:

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

4.2 Model architecture



Here the input include Transactions and which are considered as independent variables ‘x’. From this we will predict the coupon discount which is considered as a dependent variable ‘y’. Based on the transactions occurrence in the past , we will predict what coupon will occur in future , if it occurs then we will predict the discounts.

4.3 SOFTWARE DESCRIPTION

CONDA COLAB: Conda is a package manager that allows users to easily manage and install software packages and dependencies. Colab , on the other hand, is a free online platform that allows users to write and execute Python code in a Jupyter notebook-like environment. Conda-Colab is a combination of these two tools that allows users to run Conda commands in a Colab notebook. Conda-Colab enables users to install and manage software packages in a virtual environment within Colab, which helps to ensure compatibility and avoids conflicts with other installed packages. It also provides a seamless integration with Colab's GPU and TPU capabilities, making it easy to set up and run machine learning experiments.Overall, Conda-Colab is a useful tool for data scientists and machine learning practitioners who want to quickly set up and manage their environment within Colab.

Libraries used in project are as follows:

NUMPY- Numpy is a very popular python library for large multi-dimensional array and matrix processing, with the help of a large collection of high-level mathematical functions. It is very useful for fundamental scientific computations in Machine Learning.

PANDAS-Pandas is a Software Libarary in Computer Programming and it is written for the Python Programming Language its work to do data analysis and manipulation.

SEABORN- Seaborn is a Python data visualization library based on the Matplotlib library. It provides a high-level interface for drawing attractive and informative statistical graphs.

MATPLOTLIB- Matplotlib is a cross-platform, data visualization and graphical plotting library for Python and its numerical extension NumPy. As such, it offers a viable open source alternative to MATLAB. Developers can also use matplotlib's APIs to embed plots in GUI applications.

SKLEARN- Simple and efficient tools for predictive data analysis . Accessible to everybody, and reusable in various context.

METRICS-Metrics are used to monitor and measure the performance of a model (during training and testing), and don't need to be differentiable.

5. RESULTS AND DISCUSSION

```
[ ]  y = coupon['coupon_discount']
     X = coupon[['transactions']]
```

```
x
```

	transactions
0	436274.446700
1	5323.510000
2	48980.998330
3	3697.783333
4	289181.848300
...	...
145	47223.323000
146	70553.563330
147	56510.570000
148	6659.136226
149	23826.807830

150 rows × 1 columns

```
y
```

```
0      117.276864
1       70.885046
2      342.826195
3       88.694903
4      200.991719
          ...
145     76.259010
146    109.160070
147    103.032016
148     57.905532
149     53.048012
Name: coupon_discount, Length: 150, dtype: float64
```

```
[ ]  from sklearn.model_selection import train_test_split
```

```
[ ]  X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25)
```

```
[ ] from sklearn.metrics import mean_squared_error
    acc = mean_squared_error(y_test,y_predict)
    print("Mean Square Error : ",acc)
    wts = regressor.coef_
    incpt = regressor.intercept_
    print("Slope :",wts,"\nIntercept ",incpt)
```

```
Mean Square Error :  19554.45459775169
Slope : [-2.55172129e-07]
Intercept  158.14091228970713
```

6.CONCLUSION AND FUTURE SCOPE

Conclusion: In conclusion, coupon prediction is an important problem for businesses that offer coupons as a marketing tool. The goal of coupon prediction is to forecast the probability of coupon based on various predictors .

Linear regression is a commonly used method for coupon prediction, as it can model the linear relationship between coupon and the predictors. However, other regression models such as logistic regression, decision trees, or random forests may also be used depending on the nature of the problem and the available data.

Overall, accurate coupon prediction can help businesses optimize their coupon campaigns, improve customer engagement, and increase sales. By leveraging the power of data analytics and machine learning, businesses can gain valuable insights into customer.

Future Scope: The future scope for coupon prediction is promising, as advancements in data analytics and machine learning are enabling businesses to gain deeper insights into customer behaviour and preferences.

Personalization,Real-time prediction,Integration with loyalty programs,Multi-channel prediction,Integration with supply chain are some potential areas of development for coupon prediction

7.REFERENCES

https://www.kaggle.com/

https://www.kaggle.com/datasets/vysakhvms/coupons