INTERNSHIP REPORT

A Report Submitted to

Jawaharlal Nehru Technological University Kakinada, Kakinada

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

B. PAVAN KALYAN

(20KN1A4407)

S. SRI VARSHA

(20KN1A4454)

P. SIVA NAGA RAJU

(20KN1A4434)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

NRI INSTITUTE OF TECHNOLOGY

Autonomous

(Approved by AICTE, Permanently Affiliated to JNTUK, Kakinada)

Accredited by NBA (CSE, ECE & EEE), Accredited by NAAC with ‘A’ Grade

ISO 9001: 2015 Certified Institution

Pothavarappadu (V), (Via) Nunna, Agiripalli (M), Krishna Dist., PIN: 521212, A.P, India.

2020-2021

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CERTIFICATE

This is to certify that the “**Internship report”** submitted by **B. PAVAN KALYAN (Regd. No.:20KN1A4407),** S. SUMA SRI VARSHA **(Regd. No.:20KN1A4454), P. SIVA NAGA RAJU (Regd. No.:20KN1A4434)** is work done by her and submitted during YEARS academic year, in partial fulfillment of the requirements for the award of the degree of **BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE AND ENGINEERING,** at **BLACK BUCK, LOCATION.**

Kathyayani

INTERNSHIP COORDIANTOR

(R. KATHYAYANI)

Head of the Department

(Dr. D. SUNEETHA)

EXTERNAL EXAMINER

CERTIFICATE OF INTERNSHIP

ACKNOWLEDGEMENT

I take this opportunity to thank all who have rendered their full support to my work. The pleasure, the achievement, the glory, the satisfaction, the reward, the appreciation and the construction of my project cannot be expressed with a few words for their valuable suggestions.

I am expressing my heartfelt thanks to **Head of the Department, Dr. D. SUNEETHA** garu for her continuous guidance for completion of my Project work.

I am extending our sincere thanks to **Dean of the Department, Dr. K. V. SAMBASIVA RAO** for his continuous guidance and support to complete my project successfully.

I am thankful to the **Principal, Dr. C. NAGA BHASKAR** Garu for his encouragement tocomplete the Project work.

I am extending my sincere and honest thanks to the **Chairman, Dr. R. VENKATA RAO Garu & Secretary, Sri K. Sridhar** Garu for their continuous support in completing the Project work.

Finally, I thank the Administrative Officer, Staff Members, Faculty of Department of CSE, NRI Institute of Technology and my friends, directly or indirectly helped us in the completion of this project.

B. PAVAN KALYAN
20KN1A4407
S. SUMA SRI VARSHA
20KN1A4454
P. SIVA NAGA RAJU
20KN1A4434

ABSTRACT

Supermarkets are expanding in most populated cities, and market competition is fierce. Future sales forecasting is an essential component of any business. Accurate forecasting of future sales assists businesses in developing and improving business strategies, as well as gaining proper market knowledge. Companies can use standard sales projections to analyze historical scenarios and then apply client purchases. Inferences are used prior to budgeting to detect shortfalls and weaknesses, as well as to develop a good strategy for the following year. A thorough understanding of previous opportunities enables one to plan for future market demands and increase one's chances of success. The dataset is one of the historical sales of a supermarket company that was recorded in three different branches over a three-month period. Predictive data analytics methods are easy to apply with this dataset.

In this project we used various Machine Learning Regression techniques to forecast the sales of the supermarkets referred above. The Machine Learning Techniques we used in this project are Linear Regression, K-nearest Neighbors, Support Vector Regression, Decision Tree Regression, Long Short-term Memory Regression etc. Even though we used various regression techniques, the main goal of this project is to find the ML model that predicts super market sales with the highest accuracy.

We followed 4 steps:

1. Data Collection
2. Data Pre-processing
3. Exploratory Data Analysis
4. Fitting the Model

Organization Information:

Blackbuck Engineers is started in 2013 with the aim of creating a great ecosystem of academia, research, industry, and individuals. Blackbucks is a premier partner to Govts International Institute of Digital Technologies, and IITs. Blackbuck delivers the TAPTAP AI Driven employability platform to transform the journey of students towards their dream goals while helping **HRs hire right students**.

Blackbuck has the largest chain of excellence in emerging tech across India.

Blackbucks runs post-graduation programs in AI, ML and Data Science

www.theblackbucks.com

Programs and opportunities:

This ground-up approach helps us deliver not only the solution to our clients but also add value to at the core Blackbuck Engineers which operates in Five specific domains namely TapTap - AI Driven, Post-Graduation Programs, Center of Excellence, Virtual Programming Labs and Happie Days - A social Networking site for the students. TapTap offer services in Campus Recruitment drives for the Employers as well as College authorities. Recruiters can Conduct Customized Online Assessments secured with Best-in-class Proctoring and Schedule the end-to-end hiring process. Under each division we further provide specific industry solutions on focused domains with cutting edge technologies. Blackbuck Engineers emphasize on building relationships with our clients by delivering projects on time and within the budget

Learning Objectives/Internship Objectives

- Internships are generally thought of to be reserved for college students looking to gain experience in a particular field. However, a wide array of people can benefit from Training Internships in order to receive real world experience and develop their skills.

- An objective for this position should emphasize the skills you already possess in the area and your interest in learning more

- Internships are utilized in a number of different career fields, including architecture, engineering, healthcare, economics, advertising and many more.

- Some internship is used to allow individuals to perform scientific research while others are specifically designed to allow people to gain first-hand experience working.

- Utilizing internships is a great way to build your resume and develop skills that can be emphasized in your resume for future jobs. When you are applying for a TrainingInternship, make sure to highlight any special skills or talents that can make you stand apart from the rest of the applicants so that you have an improved chance of landing the position.

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WEEKLY OVERVIEW OF INTERNSHIP ACTIVITIES

1st WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	13.06.2022	Monday	Introduce the Topic & the Problem Statement
	14.06.2022	Tuesday	Introduce the Topic & the Problem Statement
	15.06.2022	Wednesday	Introduce the Topic & the Problem Statement
	16.06.2022	Thursday	Introduce the Topic & the Problem Statement
	17.06.2022	Friday	Introduce the Topic & the Problem Statement

2nd WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	20.06.2022	Monday	Abstract Building
	21.06.2022	Tuesday	Abstract Building
	22.06.2022	Wednesday	Abstract Building
	23.06.2022	Thursday	Abstract Building
	24.06.2022	Friday	Abstract Submission

3rd WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	27.06.2022	Monday	Abstract Submission
	28.06.2022	Tuesday	Abstract Submission
	29.06.2022	Wednesday	Explain your Approach to Solving Problem
	30.06.2022	Thursday	Explain your Approach to Solving Problem
	01.07.2022	Friday	Explain your Approach to Solving Problem

4th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	04.07.2022	Monday	Explain your Approach to Solving Problem
	05.07.2022	Tuesday	Explain Structure of Project
	06.07.2022	Wednesday	Explain Structure of Project
	07.07.2022	Thursday	Explain Structure of Project
	08.07.2022	Friday	Explain Structure of Project

5th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	11.07.2022	Monday	Data Preprocessing
	12.07.2022	Tuesday	Data Preprocessing
	13.07.2022	Wednesday	Data Preprocessing
	14.07.2022	Thursday	Data Preprocessing
	15.07.2022	Friday	Data Preprocessing

6th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	18.07.2022	Monday	Perform Analysis
	19.07.2022	Tuesday	Perform Analysis
	20.07.2022	Wednesday	Perform Analysis
	21.07.2022	Thursday	Perform Analysis
	22.07.2022	Friday	Perform Analysis

7th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	25.07.2022	Monday	PPT Preparation
	26.07.2022	Tuesday	PPT Preparation
	27.07.2022	Wednesday	PPT Preparation
	28.07.2022	Thursday	PPT Preparation
	29.07.2022	Friday	PPT Preparation

8th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	01.08.2022	Monday	PPT Submission
	02.08.2022	Tuesday	PPT Submission
	03.08.2022	Wednesday	Mid Review
	04.08.2022	Thursday	Mid Review
	05.08.2022	Friday	Mid Review

9th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	08.08.2022	Monday	Mid Review
	10.08.2022	Tuesday	Mid Review
	11.08.2022	Wednesday	Building & Applying Algorithm
	12.08.2022	Thursday	Building & Applying Algorithm

10th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	16.08.2022	Tuesday	Building & Applying Algorithm
	17.08.2022	Wednesday	Building & Applying Algorithm
	19.08.2022	Friday	Building & Applying Algorithm

11th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	22.08.2022	Monday	Concluding Project
	23.08.2022	Tuesday	Concluding Project
	24.08.2022	Wednesday	Concluding Project
	25.08.2022	Thursday	Concluding Project
	26.08.2022	Friday	Concluding Project

12th WEEK	DATE	DAY	NAME OF THE TOPIC/MODULE COMPLETED
	29.08.2022	Monday	Final Review
	30.08.2022	Tuesday	Final Review
	01.09.2022	Wednesday	Final Review
	02.09.2022	Thursday	Final Review
	05.09.2022	Friday	Final Review

CHAPTER – 1

INTRODUCTION

1.INTRODUCTION

- **CONTEXT:**

The growth of supermarkets in most populated cities are increasing and market competitions are also high. The dataset is one of the historical sales of supermarket company which has recorded in 3 different branches for 3 months data. Predictive data analytics methods are easy to apply with this dataset.

- **ATTRIBUTE INFORMATON:**

Invoice id: computer generated sales slip invoice identification number

Branch: Branch of supercentre (3 branches are available identified by A, B, C).

Customer type: Type of customers, recorded by the members for customers using member card and normal for without member card.

City: Location of supercentres.

Gender: Gender type of customer.

Production Line: General item categorization in groups.

Unit price: Price of each product in $.

Quantity: Number of products purchased by customer.

Tax: 5% tax fee for customer buying.

Total: Total price including tax.

Date: Date of purchase (Record available from January 2019 to March 2019)

Time: Purchase time (10am to 9pm)

Payment: Payment used by customer for purchase

COGS: Cost of goods sold

Gross margin percentage: Gross margin percentage.

Rating: customer satisfaction rating on their overall shopping experience (1 -10)

1.1 CLASSIFICATION OF TECHNIQUES:

1. Linear regression
2. Lassocv Regression
3. Random Forest Regression
4. Decision Tree Regression
5. Long Short-Term Memory Regression
6. Ridge Regression
7. Support Vector Regression
8. K Nearest Neighbor Regression

CHAPTER – 2

MOTIVATION

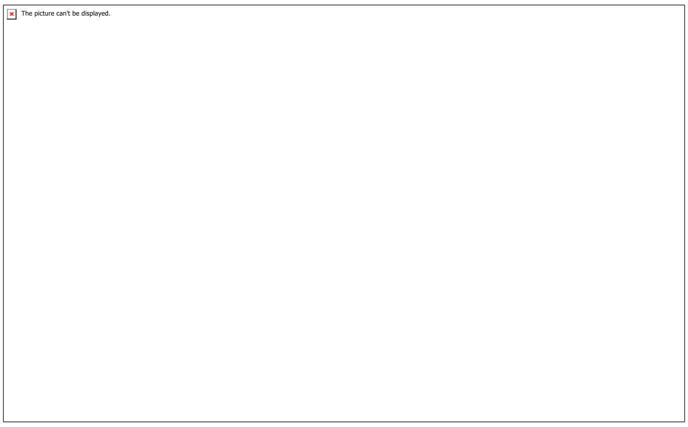
2. MOTIVATION

The success of a supermarket can be gauged by its sales. The growth of retail store & supermarket sales is directly proportional to the customer experience as **sales are linked to consumer satisfaction**. The higher the consumer satisfaction, the better your sales performance will be.

Inventory is an important asset sitting on the shelves of the supermarket. It plays an instrumental role in the fate of the store.

Strong desire, the most important element in sales, will provide the incentive to make the changes even when it is difficult or uncomfortable." Commitment is having a plan to achieve that goal. "Commitment is a measure of whether you will do whatever it takes to achieve success in sales.

By using this project whoever wants to improve their supermarket's business they use these insights. By using this information supermarket owners can improve their business.



CHAPTER – 3

SYSTEM ANALYSIS

3.SYSTEM ANALYSIS

2.1 EXISTING SYSTEM:

The existing system is very paper based in small as well as medium supermarkets. Even though the paper work and manpower requirement is less, the existing system is not very economical for these markets. Relevant and irrelevant information are entered and stored in the same place, which is very clumsy and untidy process.

In case of big supermarkets, the existing system is computerized to some extent, but it is not fully automated to cover all the aspects of the supermarket. The data entry, storing, and retrieval procedure is very inefficient. Further, there are chances of data misplacement and wrong data entry. The system is still very insecure and inflexible to adapt to user requirements.

2.2 PROPOSED SYSTEM:

The proposed supermarket management system aims at full automation of big, medium, and mini supermarkets by making the system reliable, fast, user-friendly, and informative. It reduces paperwork, manpower requirement, and increases the productivity of the supermarket. Using this application, one can add, modify, update, save, delete, and print details. There’s also a search feature to find products available in the supermarket.

CHAPTER – 4

SOFTWARE REQUIREMENTS

4.SOFTWARE REQUIREMENTS

System configurations

The software requirement specification can produce at the culmination of the analysis task. The function and performance allocated to software as part of system engineering are refined by established a complete information description, a detailed functional description, a representation of system behavior, and indication of performance and design constrain, appropriate validate criteria, and other information pertinent to requirements.

Software Requirements:

- Operating system : Windows 10 Ultimate.
- Coding Language : Python
- Platform : Visual Studio Code.
- Data Base : Kaggle Database.

Hardware Requirement:

- System : Core i5 2.4 GHz.
- Hard Disk : 1TB.
- Ram : 8GB.

CHAPTER – 5

LITERATURE REVIEW

5.LITERATURE REVIEW

Python is a high-level, interpreted, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation.

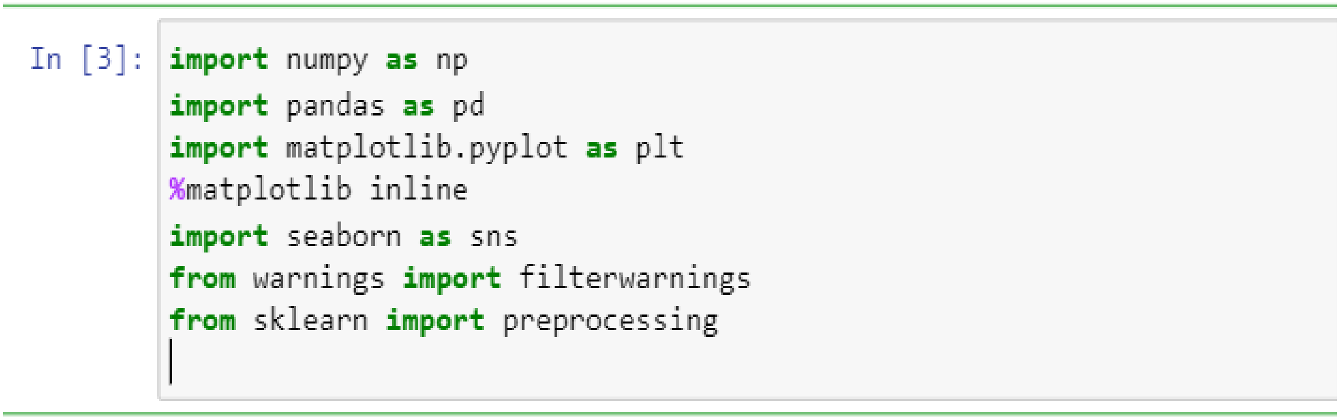
Python is dynamically-typed and garbage-collected. It supports multiple

Programming including structured (particularly procedural), object- oriented and functional programming. It is often described as a "batteries included" language due to its comprehensive standard library.

JUPYTER NOTBOOK: The Jupyter Notebook is an open-source web application that you can use to create and share documents that contain live code, equations, visualizations, and text. Jupyter Notebook is maintained by the people at Project Jupyter.

If so, then you can use a handy tool that comes with Python called pip to install Jupyter Notebook like this:

```
$ pip install jupyter
```



```
In [3]: import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        %matplotlib inline
        import seaborn as sns
        from warnings import filterwarnings
        from sklearn import preprocessing
```

CHAPTER – 6

KEYWORDS & DEFINITIONS

6.KEYWORDS and DEFINITION

PIP	pip is the standard package manager for Python. It allows you to install and manage additional packages that are not part of the Python standard library.
from	The from keyword is used to import only a specified section from a module.
Import	import imports the whole library. from import imports a specific member or members of the library.
Import*	It just means that you import all (methods, variables, ...) in a way so you don't need to prefixthem when using them
NumPy	NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.
Updater	The update() method inserts the specified items to the dictionary. The specified items can be a dictionary, or an iterable object with key value pairs.
Pandas	pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series.
Matplotlib	Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython,
Machine Learning	Machine Learning is a subfield of Artificial Intelligence, which is broadly defined as the capability of a machine to imitate intelligent human behaviour.

Regression	Regression is a technique for investigating relationship between dependent variable or outcome and independent features or variables.
Dataset	A collection of related sets of information that is composed of separate elements but can be manipulated as a unit by a computer.
Algorithm	A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

CHAPTER – 7

METHODOLOGIES

7.METHODOLOGIES

We follow a structured methodology for our projects which starts from designing the solution to the implementation phase. Well planned Project reduces the time to deliver the project and any additional ad-hoc costs to our clients, hence we dedicate majority of our time understanding our client’s business and gather requirements. This ground up approach helps us deliver not only the solution to our clients but also add value to your investments.

Data Preprocessing:

Data preprocessing 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.

It involves the following steps:

1. Data collection
2. Importing Libraries
3. Importing Dataset
4. Finding missing data
5. Encoding Categorical values
6. Exploratory Data Analysis
7. Splitting Dataset into train-test data
8. Fitting the model
9. Model Evaluation

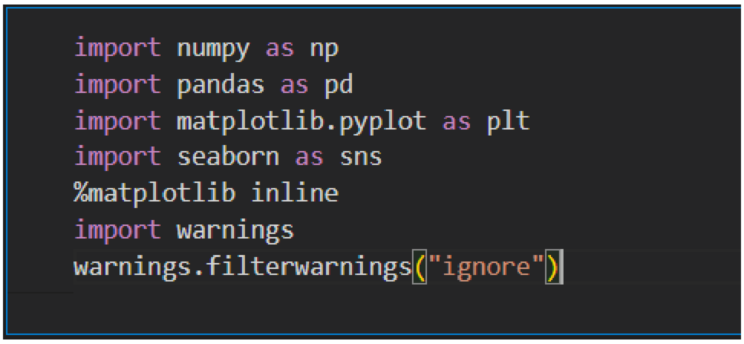
Data Collection:

Data collection is an essential part of exploratory data analysis. It refers to the process of finding and loading data into our system. Good, reliable data can be found on various public sites or bought from private organizations. Some reliable sites for data collection are Kaggle, GitHub, Machine Learning Repository, etc.

The data depicted below represents the supermarket sales dataset that is available on Kaggle. It contains information on supermarket and its sales.

Importing Libraries:

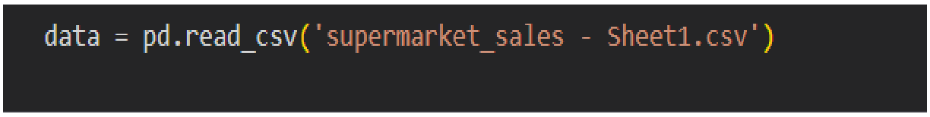
To import the required libraries, we use the following code:



```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
import warnings
warnings.filterwarnings("ignore")
```

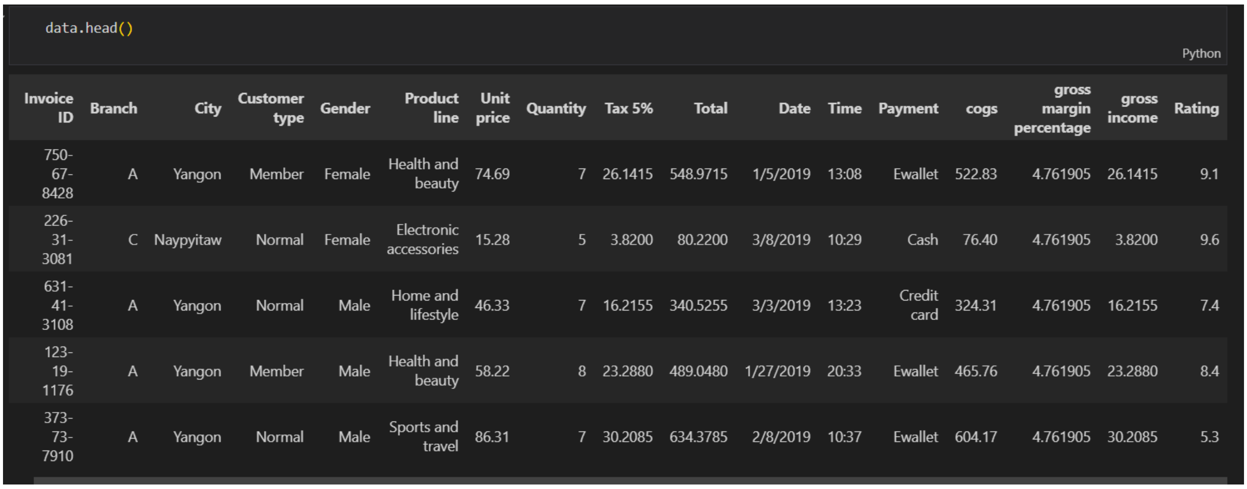
Importing Dataset:

To import the dataset, use the following code:



```
data = pd.read_csv('supermarket_sales - Sheet1.csv')
```

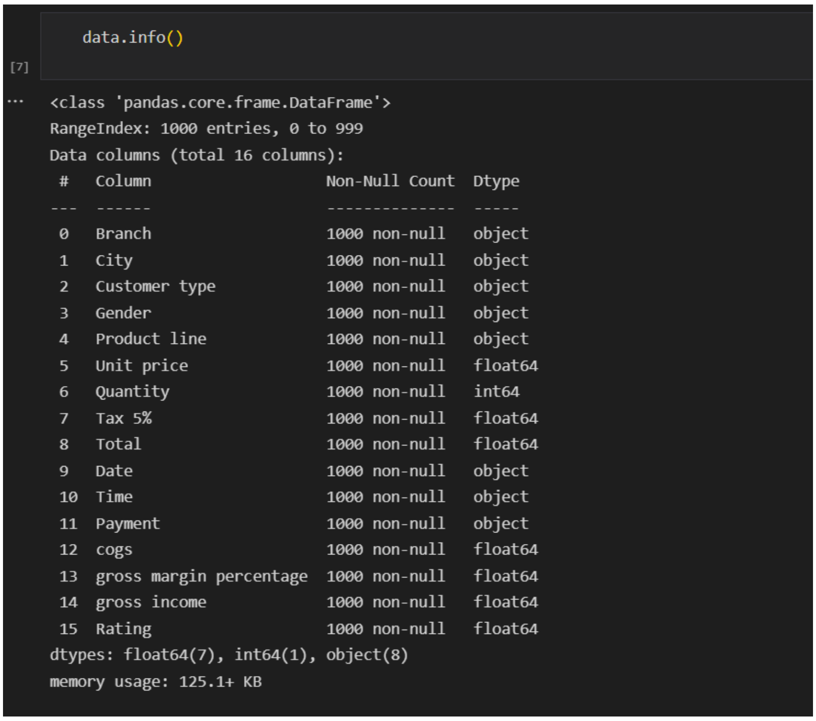
To get a brief look into our Dataset we used the following code:



```
data.head()
```

Invoice ID	Branch	City	Customer type	Gender	Product line	Unit price	Quantity	Tax 5%	Total	Date	Time	Payment	cogs	gross margin percentage	gross income	Rating
750-67-8428	A	Yangon	Member	Female	Health and beauty	74.69	7	26.1415	548.9715	1/5/2019	13:08	Ewallet	522.83	4.761905	26.1415	9.1
226-31-3081	C	Naypyitaw	Normal	Female	Electronic accessories	15.28	5	3.8200	80.2200	3/8/2019	10:29	Cash	76.40	4.761905	3.8200	9.6
631-41-3108	A	Yangon	Normal	Male	Home and lifestyle	46.33	7	16.2155	340.5255	3/3/2019	13:23	Credit card	324.31	4.761905	16.2155	7.4
123-19-1176	A	Yangon	Member	Male	Health and beauty	58.22	8	23.2880	489.0480	1/27/2019	20:33	Ewallet	465.76	4.761905	23.2880	8.4
373-73-7910	A	Yangon	Normal	Male	Sports and travel	86.31	7	30.2085	634.3785	2/8/2019	10:37	Ewallet	604.17	4.761905	30.2085	5.3

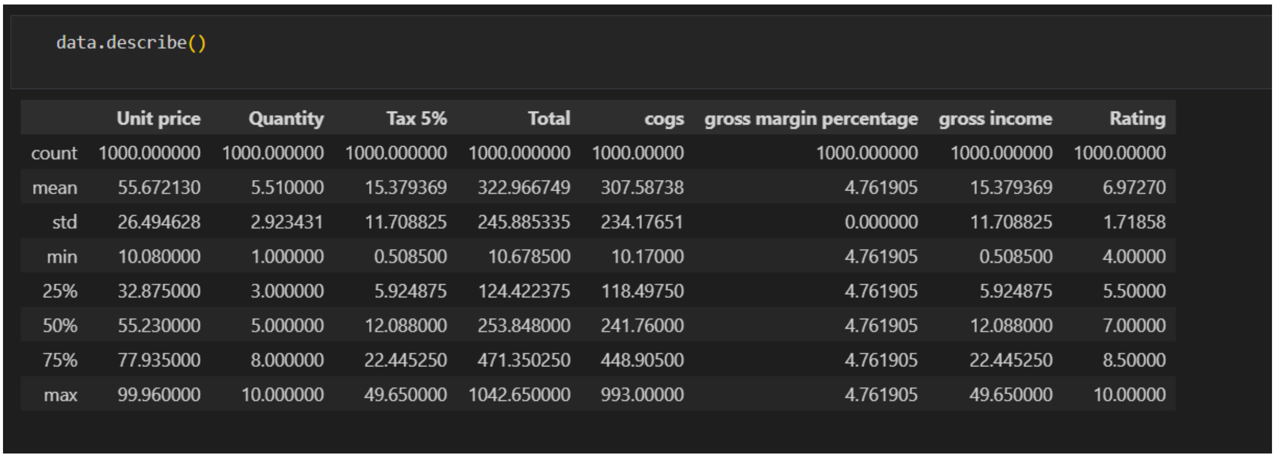
Information about the dataset can be obtained by using the below code:



```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 16 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   Branch                   1000 non-null   object 
 1   City                     1000 non-null   object 
 2   Customer type            1000 non-null   object 
 3   Gender                   1000 non-null   object 
 4   Product line             1000 non-null   object 
 5   Unit price               1000 non-null   float64
 6   Quantity                 1000 non-null   int64  
 7   Tax 5%                   1000 non-null   float64
 8   Total                    1000 non-null   float64
 9   Date                     1000 non-null   object 
 10  Time                     1000 non-null   object 
 11  Payment                  1000 non-null   object 
 12  cogs                     1000 non-null   float64
 13  gross margin percentage  1000 non-null   float64
 14  gross income             1000 non-null   float64
 15  Rating                   1000 non-null   float64
dtypes: float64(7), int64(1), object(8)
memory usage: 125.1+ KB
```

Python provides us description about Dataset as follows:



```
data.describe()
```

	Unit price	Quantity	Tax 5%	Total	cogs	gross margin percentage	gross income	Rating
count	1000.000000	1000.000000	1000.000000	1000.000000	1000.00000	1000.000000	1000.000000	1000.00000
mean	55.672130	5.510000	15.379369	322.966749	307.58738	4.761905	15.379369	6.97270
std	26.494628	2.923431	11.708825	245.885335	234.17651	0.000000	11.708825	1.71858
min	10.080000	1.000000	0.508500	10.678500	10.17000	4.761905	0.508500	4.00000
25%	32.875000	3.000000	5.924875	124.422375	118.49750	4.761905	5.924875	5.50000
50%	55.230000	5.000000	12.088000	253.848000	241.76000	4.761905	12.088000	7.00000
75%	77.935000	8.000000	22.445250	471.350250	448.90500	4.761905	22.445250	8.50000
max	99.960000	10.000000	49.650000	1042.650000	993.00000	4.761905	49.650000	10.00000

Since the supermarket sales dataset doesn't have any null values but categorical data, we convert them into numerical values by using "Pandas" library.

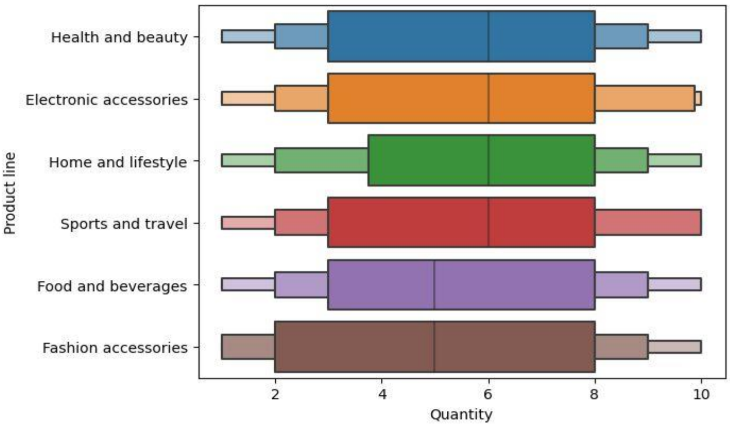
Exploratory Data Analysis:

The visualization techniques that are used in this project are

1. Box Plot
2. Bar Plot
3. Heat Map
4. Line Plot

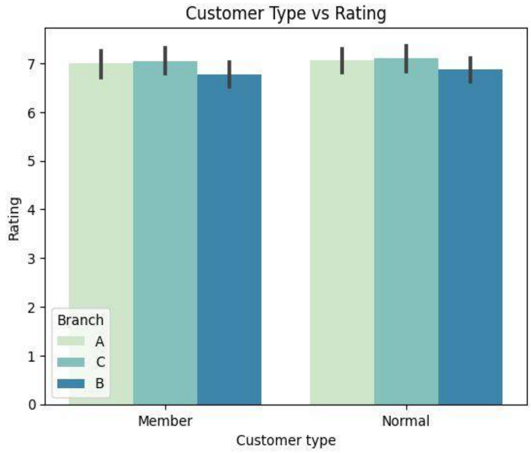
1. Box Plot:

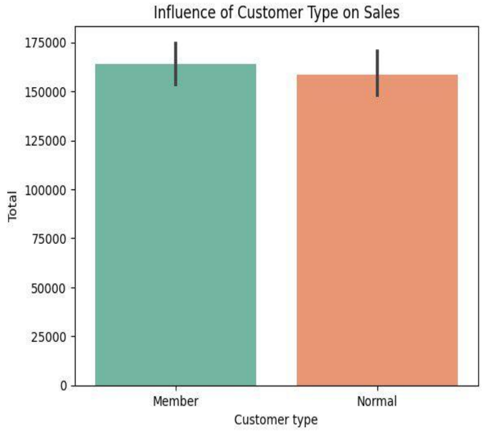
Boxplot is a method for graphically demonstrating the locality, spread and skewness groups of numerical data through their quartiles. In addition to the box on a box plot, there can be lines (which are called *whiskers*) extending from the box indicating variability outside the upper and lower quartiles, thus, the plot is also termed as the **box-and-whisker plot** and the **box-and-whisker diagram**. Outliers that differ significantly from the rest of the dataset may be plotted as individual points beyond the whiskers on the box-plot. Box plots are non-parametric: they display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution (though Tukey's boxplot assumes symmetry for the whiskers and normality for their length.



2. Bar Plot:

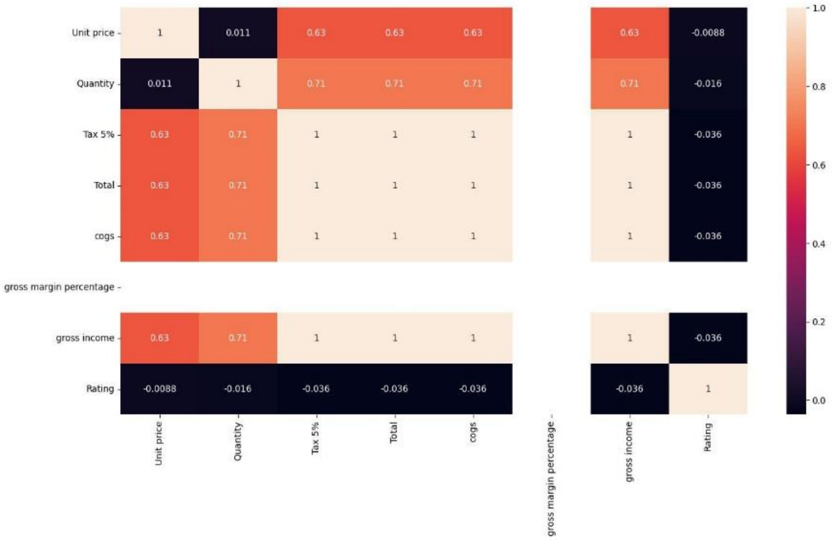
A bar plot or bar chart is a graph that represents the category of data with rectangular bars with lengths and heights that is proportional to the values which they represent. The bar plots can be plotted horizontally or vertically. A bar chart describes the comparisons between the discrete categories. One of the axis of the plot represents the specific categories being compared, while the other axis represents the measured values corresponding to those categories.





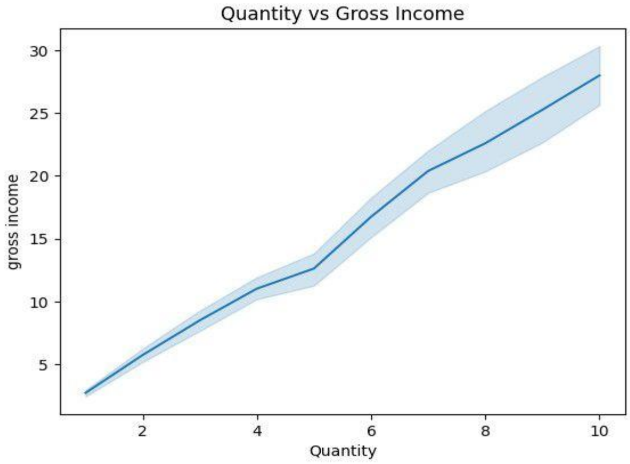
3. Heat Map:

A **heat map** (or **heatmap**) is a data visualization technique that shows magnitude of a phenomenon as color in two dimensions. The variation in color may be by hue or intensity, giving obvious visual cues to the reader about how the phenomenon is clustered or varies over space. There are two fundamentally different categories of heat maps: the cluster heat map and the spatial heat map. In a cluster heat map, magnitudes are laid out into a matrix of fixed cell size whose rows and columns are discrete phenomena and categories, and the sorting of rows and columns is intentional and somewhat arbitrary, with the goal of suggesting clusters or portraying them as discovered via statistical analysis.



4. Line Plot:

A **line chart** or **line graph** or **curve chart** is a type of chart which displays information as a series of data points called 'markers' connected by straight line segments. It is a basic type of chart common in many fields. It is similar to a scatter plot except that the measurement points are ordered (typically by their x-axis value) and joined with straight line segments. A line chart is often used to visualize a trend in data over intervals of time – a time series – thus the line is often drawn chronologically. In these cases, they are known as run charts.



Splitting Dataset into Train-Test data:

The train-test split is used to estimate the performance of machine learning algorithms that are applicable
for prediction-based Algorithms/Applications. This method is a fast and easy procedure to perform such that we can compare our own machine learning model results to machine results. By default, the Test set is split into 30 % of actual data and the training set is split into 70% of the actual data. Scikit-learn alias "**sklearn**" is the most useful and robust library for machine learning in Python. The **scikit-learn library** provides us with the "model_selection" module in which we have the splitter function "train_test_split()."

Model Fitting:

In this project we used most of the Regression Algorithms like

1. Linear Regression
2. Ridge Regression
3. LassoCV Regression
4. Decision Tree Regression
5. Random Forest Regression
6. OLS Regression
7. LSTM Regression

1.Linear Regression:

In statistics, linear regression is a linear approach for modelling the relationship between a scalar response and one or more explanatory variables (also known as dependent and independent variables). The case of one explanatory variable is called *simple linear regression*; for more than one, the process is called **multiple** linear regression. This term is distinct from multivariate linear regression, where multiple correlated dependent variables are predicted, rather than a single scalar variable.

In linear regression, the relationships are modelled using linear predictor functions whose unknown model parameters are estimated from the data. Such models are called linear models. Most commonly, the conditional mean of the response given the values of the explanatory variables (or predictors) is assumed to be an affine function of those values; less commonly, the conditional median or some other quantile is used. Like all forms of regression analysis, linear regression focuses on the conditional probability distribution of the response given the values of the predictors, rather than on the joint probability distribution of all of these variables, which is the domain of multivariate analysis.

Linear regression was the first type of regression analysis to be studied rigorously, and to be used extensively in practical applications. This is because models which depend linearly on their unknown parameters are easier to fit than models which are non-linearly related to their parameters and because the statistical properties of the resulting estimators are easier to determine.

Given a data set $\{y_i,\, x_{i1}, \ldots, x_{ip}\}_{i=1}^{n}$ of *n* statistical units, a linear regression model assumes that the relationship between the dependent variable *y* and the *p*-vector of regressors **x** is linear. This relationship is modeled through a *disturbance term* or *error variable ε* — an unobserved random variable that adds "noise" to the linear relationship between the dependent variable and regressors. Thus, the model takes the form

$$y_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip} + \varepsilon_i = \mathbf{x}_i^{\mathsf{T}} \boldsymbol{\beta} + \varepsilon_i, \qquad i = 1, \ldots, n,$$

2. Ridge Regression:

Ridge regression is a method of estimating the coefficients of multiple-regression models in scenarios where the independent variables are highly correlated. It has been used in many fields including econometrics, chemistry, and engineering. Also known as Tikhonov regularization, named for Andrey Tikhonov, it is a method of regularization of ill-posed problems. it is particularly useful to mitigate the problem of multicollinearity in linear regression, which commonly occurs in models with large numbers of parameters. In general, the method provides improved efficiency in parameter estimation problems in exchange for a tolerable amount of bias (see bias–variance trade-off).

3. LassoCV Regression:

Lasso regression is a regularization technique. It is used over regression methods for a more accurate prediction. This model uses shrinkage. Shrinkage is where data values are shrunk towards a central point as the mean. The lasso procedure encourages simple, sparse models (i.e., models with fewer parameters). This particular type of regression is well-suited for models showing high levels of multicollinearity or when you want to automate certain parts of model selection, like variable selection/parameter elimination. Lasso Regression uses L1 regularization technique. It is used when we have more features because it automatically performs feature selection. The word “LASSO” stands for **L**east **A**bsolute **S**hrinkage and **S**election **O**perator.

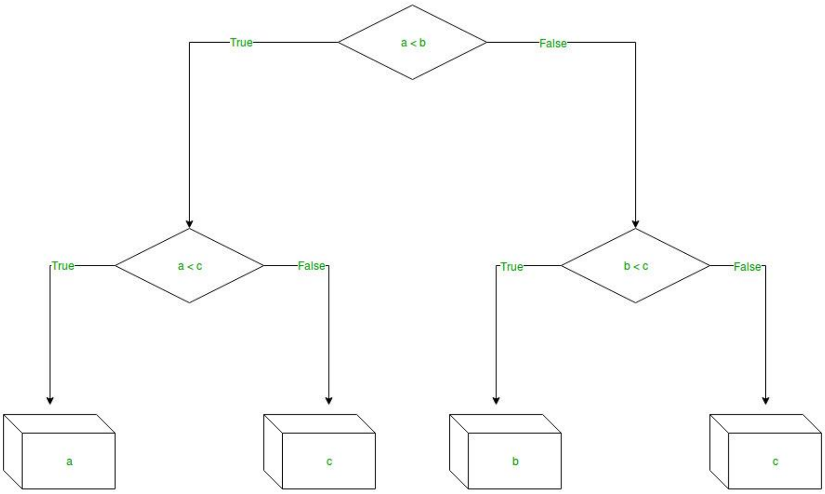
5. Decision Tree Regression:

Decision Tree is a decision-making tool that uses a flowchart-like tree structure or is a model of decisions and all of their possible results, including outcomes, input costs, and utility.
Decision-tree algorithm falls under the category of supervised learning algorithms. It works for both continuous as well as categorical output variables.

The branches/edges represent the result of the node and the nodes have either:

1. Conditions [Decision Nodes]
2. Result [End Nodes]

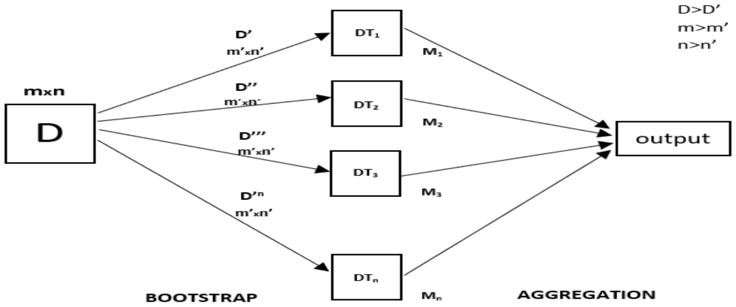
The branches/edges represent the truth/falsity of the statement and take makes a decision based on that in the example below which shows a decision tree that evaluates the smallest of three numbers:



Decision tree regression observes features of an object and trains a model in the structure of a tree to predict data in the future to produce meaningful continuous output. Continuous output means that the output/result is not discrete, i.e., it is not represented just by a discrete, known set of numbers or values.

5. Random Forest:

Every decision tree has high variance, but when we combine all of them together in parallel then the resultant variance is low as each decision tree gets perfectly trained on that particular sample data, and hence the output doesn't depend on one decision tree but on multiple decision trees. In the case of a classification problem, the final output is taken by using the majority voting classifier. In the case of a



regression problem, the final output is the mean of all the outputs. This part is called **Aggregation**. Random Forest is an ensemble technique capable of performing both regression and classification tasks with the use of multiple decision trees and a technique called Bootstrap and Aggregation, commonly known as **bagging**. The basic idea behind this is to combine multiple decision trees in determining the final output rather than relying on individual decision trees. Random Forest has multiple decision trees as base learning models.

6.Ordinary Least Squares Regression:

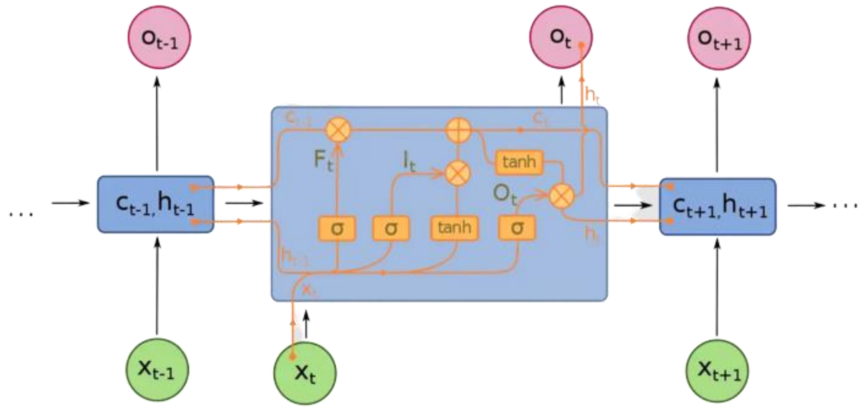
In statistics, ordinary least squares (OLS) is a type of linear least squares method for choosing the unknown parameters in a linear regression model (with fixed level-one effects of a linear function of a set of explanatory variables) by the principle of least squares: minimizing the sum of the squares of the differences between the observed dependent variable (values of the variable being observed) in the input dataset and the output of the (linear) function of the independent variable.

Geometrically, this is seen as the sum of the squared distances, parallel to the axis of the dependent variable, between each data point in the set and the corresponding point on the regression surface—the smaller the differences, the better the model fits the data. The resulting estimator can be expressed by a simple formula, especially in the case of a simple linear regression, in which there is a single regressor on the right side of the regression equation.

The OLS estimator is consistent for the level-one fixed effects when the regressors are exogenous and forms perfect collinearity (rank condition), consistent for the variance estimate of the residuals when regressors have finite fourth moments and—by the Gauss–Markov theorem—optimal in the class of linear unbiased estimators when the errors are homoscedastic and serially uncorrelated. Under these conditions, the method of OLS provides minimum-variance mean-unbiased estimation when the errors have finite variances. Under the additional assumption that the errors are normally distributed with zero mean, OLS is the maximum likelihood estimator that outperforms any non-linear unbiased estimator.

7. LSTM Regression:

Long Short-Term Memory (LSTM) networks are a type of Recurrent Neural Network that can learn order dependence. The output of the previous step is used as input in the current step in RNN. Hochreiter & Schmidhuber created the LSTM. It addressed the issue of RNN long-term dependency, in which the RNN is unable to predict words stored in long-term memory but can make more accurate predictions based on current data. RNN does not provide an efficient performance as the gap length rises. The LSTM may keep information for a long time by default. It is used for time-series data processing, prediction, and classification.



LSTM has feedback connections, unlike conventional feed-forward neural networks. It can handle not only single data points (like photos) but also complete data streams (such as speech or video). LSTM can be used for tasks like unsegmented, linked handwriting recognition, or speech recognition.

Model Evaluation:

The evaluation metrics that are used in this project are:

1. Mean Absolute Error
2. Mean Squared Error
3. Root Mean Squared Error

1.Mean Absolute Error:

In statistics, mean absolute error (MAE) is a measure of errors between paired observations expressing the same phenomenon. Examples of *Y* versus *X* include comparisons of predicted versus observed, subsequent time versus initial time, and one technique of measurement versus an alternative technique of measurement. MAE is calculated as the sum of absolute errors divided by the sample size

$$\mathrm{MAE} = \frac{\sum_{i=1}^{n} |y_i - x_i|}{n}$$

2.Mean Squared Error:

In statistics, the mean squared error (MSE) or mean squared deviation (MSD) of an estimator (of a procedure for estimating an unobserved quantity) measures the average of the squares of the errors—that is, the average squared difference between the estimated values and the actual value. MSE is a risk function, corresponding to the expected value of the squared error loss. The fact that MSE is almost always strictly positive (and not zero) is because of randomness or because the estimator does not account for information that could produce a more accurate estimate. In machine learning, specifically empirical risk minimization, MSE may refer to the *empirical* risk (the average loss on an observed data set), as an estimate of the true MSE (the true risk: the average loss on the actual population distribution).

$$\mathrm{MSE} = \frac{1}{n} \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$$

3.Root Mean Squared Error:

The root-mean-square deviation (RMSD) or root-mean-square error (RMSE) is a frequently used measure of the differences between values (sample or population values) predicted by a model or an estimator and the values observed. The RMSD represents the square root of the second sample moment of the differences between predicted values and observed values or the quadratic mean of these differences.
These deviations are called *residuals* when the calculations are performed over the data sample that was used for estimation and are called *errors* (or prediction errors) when computed out-of-sample. The RMSD serves to aggregate the magnitudes of the errors in predictions for various data points into a single measure of predictive power. RMSD is a measure of accuracy, to compare forecasting errors of different models for a particular dataset and not between datasets, as it is scale-dependent.

$$\mathrm{RMSD} = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \hat{x}_i)^2}{N}}$$

CHAPTER – 8

CODING

8.CODING

Code to import Regression Techniques:

from sklearn.ensemble import RandomForestRegressor

from sklearn.linear_model import LinearRegression

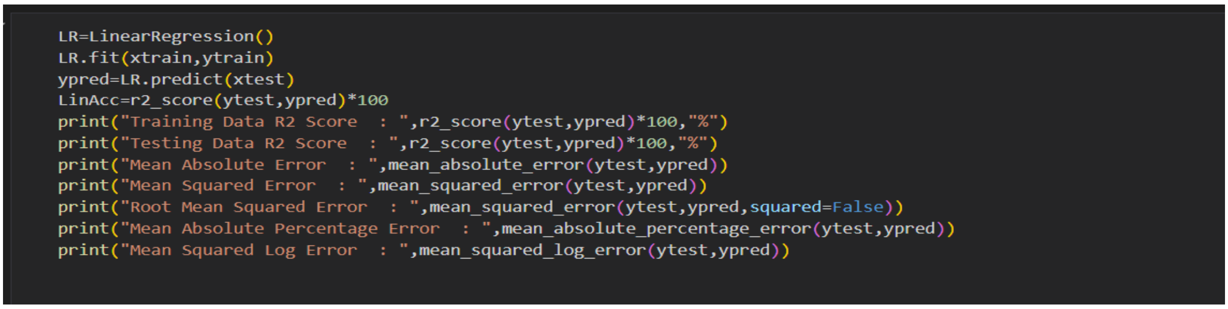
from sklearn.neighbors import KNeighborsRegressor

from sklearn.tree import DecisionTreeRegressor

from sklearn.svm import SVR

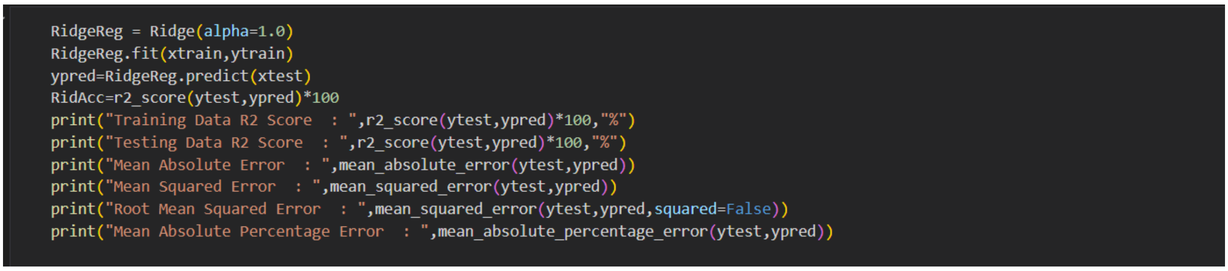
from sklearn.metrics import r2_score, mean_absolute_error, mean_squared_error

Implementing Linear Regression:



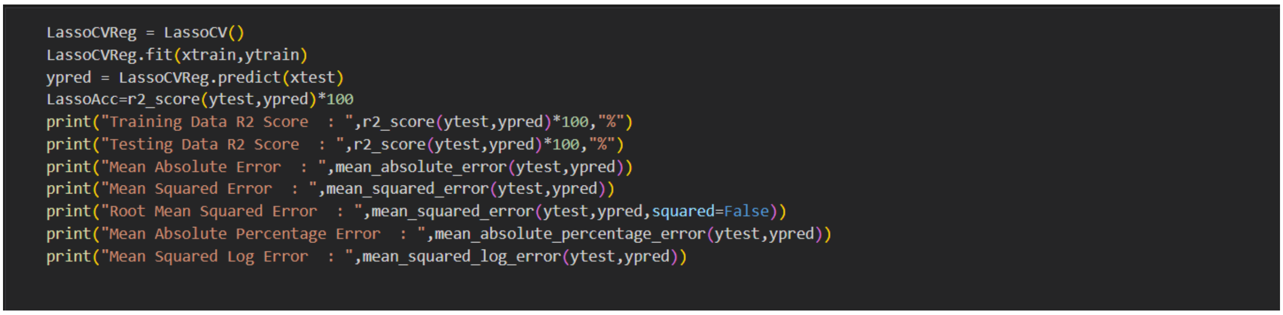
```
LR=LinearRegression()
LR.fit(xtrain,ytrain)
ypred=LR.predict(xtest)
LinAcc=r2_score(ytest,ypred)*100
print("Training Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Testing Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Mean Absolute Error  : ",mean_absolute_error(ytest,ypred))
print("Mean Squared Error  : ",mean_squared_error(ytest,ypred))
print("Root Mean Squared Error  : ",mean_squared_error(ytest,ypred,squared=False))
print("Mean Absolute Percentage Error  : ",mean_absolute_percentage_error(ytest,ypred))
print("Mean Squared Log Error  : ",mean_squared_log_error(ytest,ypred))
```

Implementing Ridge Regression:



```
RidgeReg = Ridge(alpha=1.0)
RidgeReg.fit(xtrain,ytrain)
ypred=RidgeReg.predict(xtest)
RidAcc=r2_score(ytest,ypred)*100
print("Training Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Testing Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Mean Absolute Error  : ",mean_absolute_error(ytest,ypred))
print("Mean Squared Error  : ",mean_squared_error(ytest,ypred))
print("Root Mean Squared Error  : ",mean_squared_error(ytest,ypred,squared=False))
print("Mean Absolute Percentage Error  : ",mean_absolute_percentage_error(ytest,ypred))
```

Implementing LassoCV Regression:



```
LassoCVReg = LassoCV()
LassoCVReg.fit(xtrain,ytrain)
ypred = LassoCVReg.predict(xtest)
LassoAcc=r2_score(ytest,ypred)*100
print("Training Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Testing Data R2 Score  : ",r2_score(ytest,ypred)*100,"%")
print("Mean Absolute Error  : ",mean_absolute_error(ytest,ypred))
print("Mean Squared Error  : ",mean_squared_error(ytest,ypred))
print("Root Mean Squared Error  : ",mean_squared_error(ytest,ypred,squared=False))
print("Mean Absolute Percentage Error  : ",mean_absolute_percentage_error(ytest,ypred))
print("Mean Squared Log Error  : ",mean_squared_log_error(ytest,ypred))
```

In addition to the above Regression Algorithms, we included some other techniques like Decision Tree Regression, Random Forest, LSTM Regression, OLS Regression, K-Nearest Neighbors.

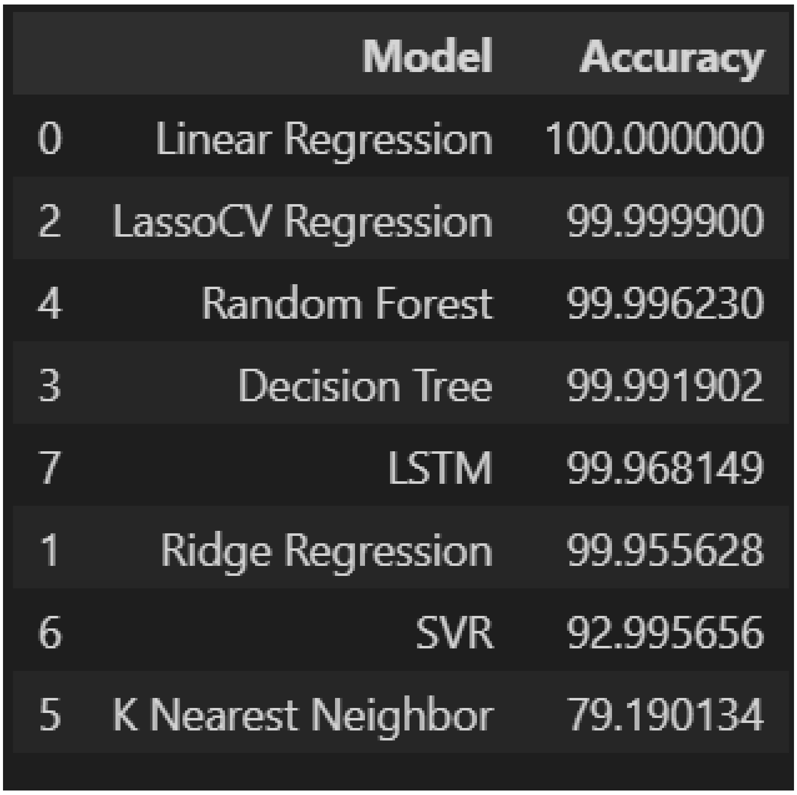
CHAPTER – 9

RESULTS

9.RESULTS

Out if all the Machine Learning Algorithms we have executed, Linear Regression Model has the highest Accuracy & K-Nearest Neighbor has the Lowest Accuracy.

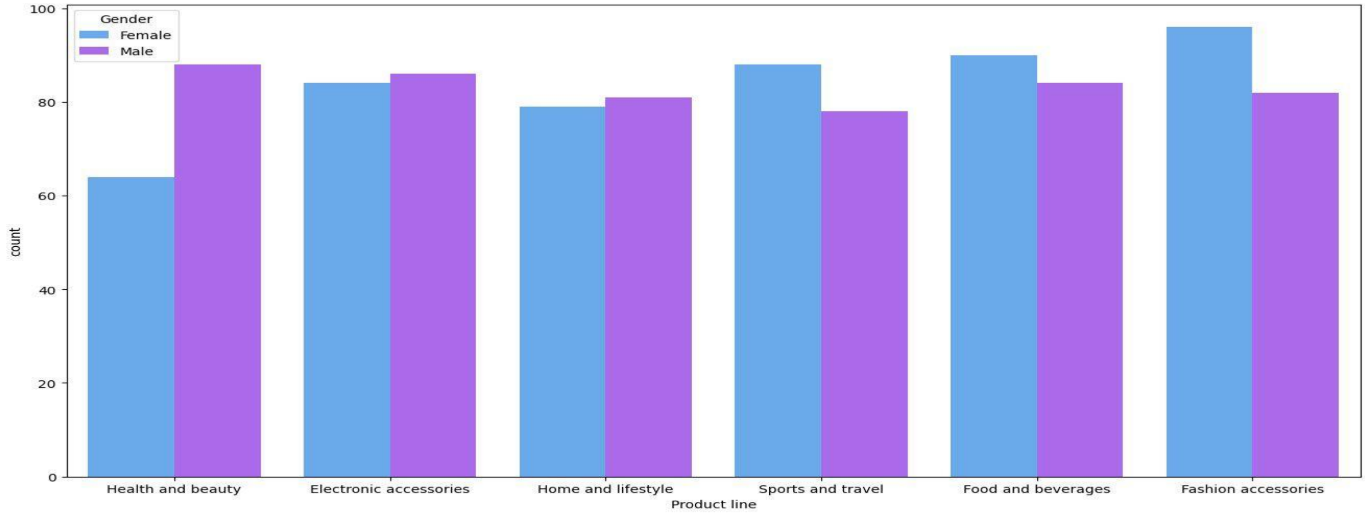
The Accuracies of all the Machine Learning Algorithms are as follows:

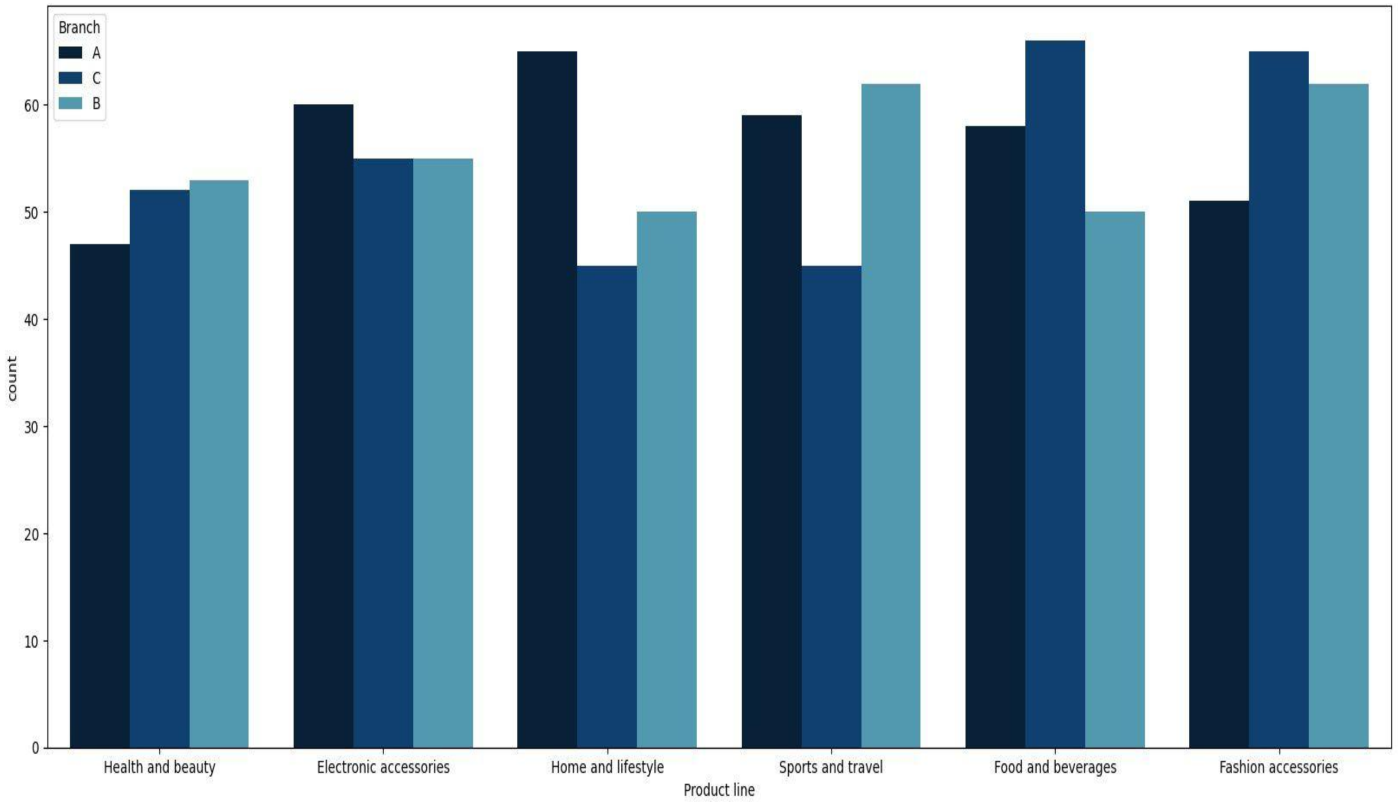


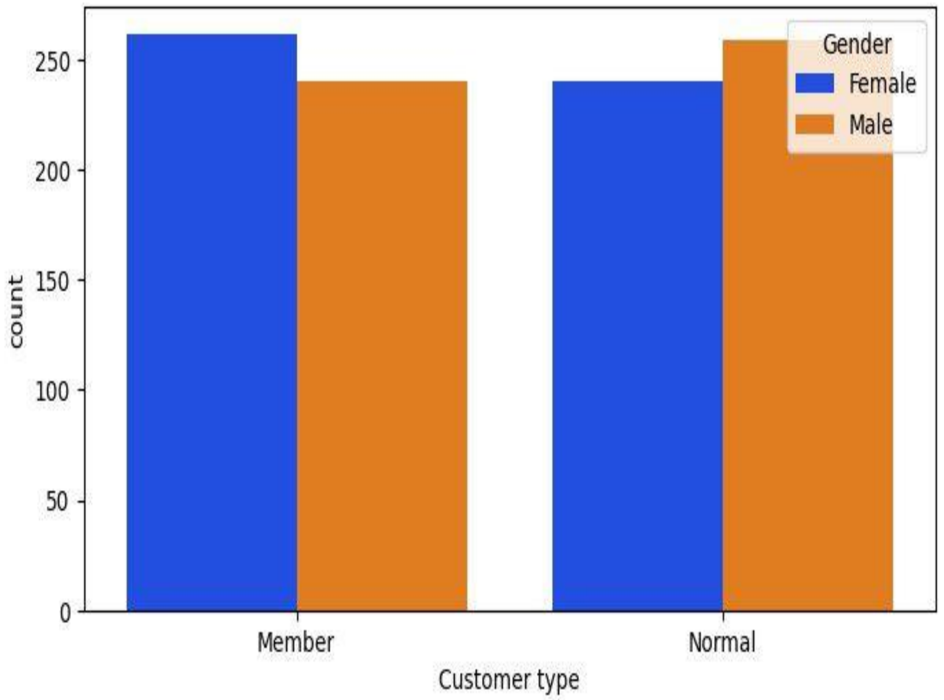
	Model	Accuracy
0	Linear Regression	100.000000
2	LassoCV Regression	99.999900
4	Random Forest	99.996230
3	Decision Tree	99.991902
7	LSTM	99.968149
1	Ridge Regression	99.955628
6	SVR	92.995656
5	K Nearest Neighbor	79.190134

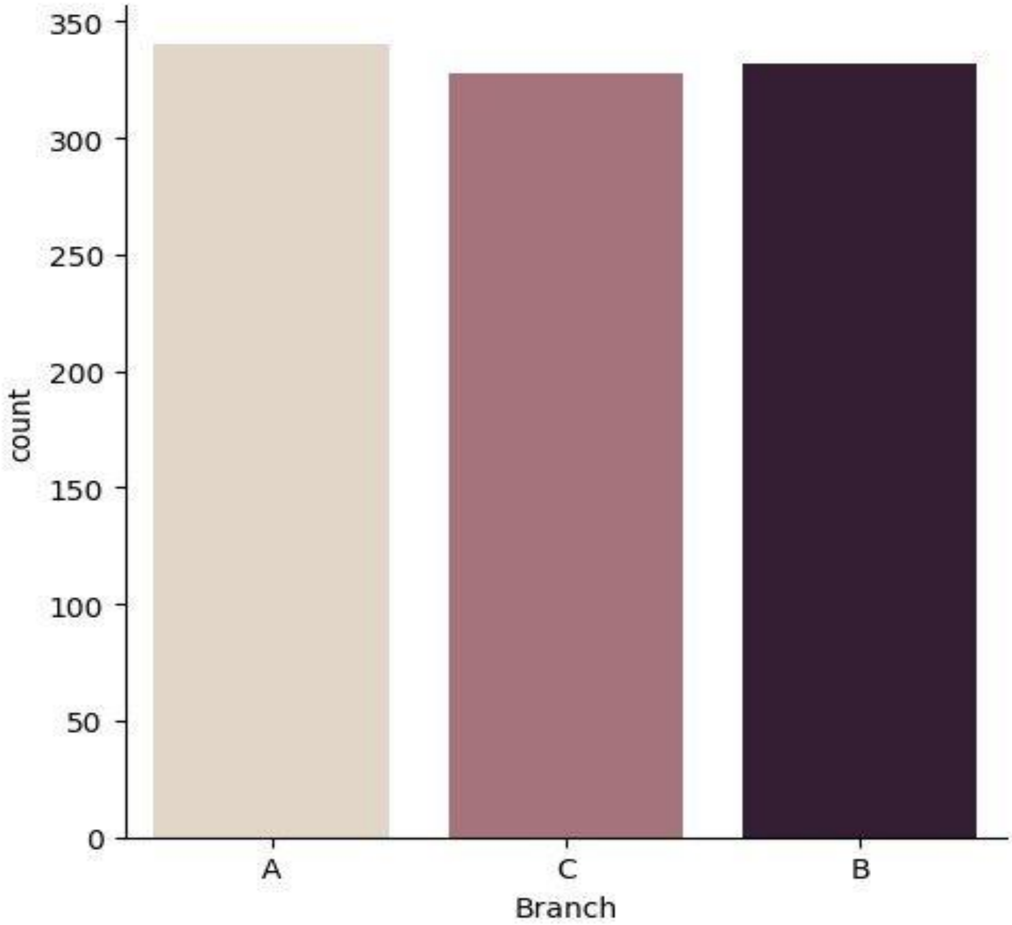
So, by taking all the accuracies into note, we selected Linear Regression algorithm as the ideal Machine Learning Regression Algorithm for prediction of future sales of Supermarkets.

Insights:




Branch
A
C
B
count
0
10
20
30
40
50
60
Health and beauty
Electronic accessories
Home and lifestyle
Sports and travel
Food and beverages
Fashion accessories
Product line


Gender
Female
Male
count
0
50
100
150
200
250
Member
Normal
Customer type


350
300
250
200
150
100
50
0
count
A
C
B
Branch

CHAPTER – 10

CHALLENGES FACED

10.CHALLENGES FACED

- When we first collected our dataset from Kaggle database we found that there are no null values in it. But it had Categorical data which has to be converted into numerical values. So, in order to covert categorical data into numerical values we used “pd.get_dummies()” function.

- This technique creates a separate column for each categorical value. Although it might be quite useful, it creates insanely large number of variables or columns.

- If a certain column contains large number of categories, the “pd.get_dummies()” function will create the columns that are equal to the number of categories thereby increasing the size of the dataset.

- The computation time of the program will directly depend on the size of the data that is used in it. If the dataset size is huge then the time complexity of the program will increase thereby making the program less efficient.

- The substitution of the “pd.get_dummies()” is to use Label Encoder to encode the categorical data. This technique will not create any additional columns and thereby not effecting the size of the dataset.

CHAPTER – 11

CONCLUSION

11.CONCLUSION

The project as a whole describes the scope and viability of the agriculture industry and mainly of the financial, technical and its market potential. The project guarantee sufficient fund to repay the loan and also give a good return on capital investment. When analyzing the social- economic impact, this project is able to generate an employment of 5 and above. It will cater the demand of Agriculture and thus helps the other business entities to increase the production and service which provide service and support to this industry. Thus, more cyclic employment and livelihood generation. So, in all ways, we can conclude the project is technically and socially viable and commercially sound too.

When we take a close look at the Debt Service Coverage Ratio (DSCR), the avg: DSCR is 4.07 : 1, which is at a higher proposition and proposes a stable venture The Profit and Loss shows a steady growth in profit throughout the year and the firm has a higher Current Ratio (average) of 10.48, this shows the current assets and current liabilities are managed & balanced well.

This project helps supermarket owners who wants develop their business. We have plotted many Visualizations from the supermarket sales dataset. From those visualizations we have to select useful insights and make use of them in order to increase sales in the future. We have applied most of the Regression models and from those models, Linear Regression Model gives predictions with the highest accuracy.

CHAPTER – 12

FUTURE SCOPE

12.FUTURE SCOPE:

- It reduces the time and manpower required for management and maintenance of different tasks.
- It reduces the paper work in existing system; hence it is economical and efficient.
- With this system, customers get quality of service; customers can even give feedback which can be stored in the database.
- As the entire system is fully computerized, records of daily and monthly purchases and sales can be recorded and analyzed.
- This system is very secure, user-friendly, and reliable.

CHAPTER – 13

REFERENCES & APPENDIX

13.REFERENCES

- Kaggle.com
- GeeksforGeeks
- Tutorials Point
- Wikipedia
- Javatpoint
- Analytics Vidya
- Towards Data science
- John Paul Muller and Luca Massaron, “Deep Learning for Dummies”

APPENDIX

Resources for Model Building, Data Analysis and Data Visualization:

1. Python
2. Jupyter Notebook
3. Visual Studio Code 2022
4. Anaconda