INSPECTION AND QULAITY CONTROL IN SUPPLY CHAIN VISIBILITY

AFFILATION
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ABSTRACT: The paper mainly aims about the inspection and quality control management during supply chain using machine learning algorithm. Supply chain visibility is the method to track each and every component from suppliers and manufactures and improving the customers facilities. The current approach is to analyse the manufactured product during the inspection and check their quality on every product. Linear regression is a statistical method of modelling used to analyse the dependent and independent variable of the attributes and to find the relationship between input and output.

KEY WORDS: supply chain visibility, machine learning, quality management, Linear regression.

I.INTRODUCTION

This paper is about the analysis made on the ability to track, monitor the process and easily report on all freight movements from the point of origin to the final destination using machine learning algorithm. It is used to check out the quality and the regulatory reforms of the product. Machine learning is a type of artificial intelligence that extract patterns of the data by using algorithms. The dataset is imported ana analysed in Python – Jupyter Notebook. Python is an interactive and object-oriented high level programming language. Linear regression is used to the accuracy score i.e., R2 score of the attributes and to find the dependent variable value on a given independent variable. Seaborn is imported to plot and graph the attributes.Supply chain visibility (SCV) is the ability of products in transit to be tracked from the manufacturer to their final destination i.e., the customer. The main goal of supply chain visibility is to improve and strengthen the supply chain process by making data readily available to all suppliers and stakeholders, including the customer. And to refer the level of transparency across an entire supply chain. Quality control during inspection helps the company's reputation to better the control over supplier inputs, the risk of returns and product failures.

II.REVIEW OF LITRATURE

A supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer [4].Supply chain visibility is a commonly strived after ideal which recently has gained significant attention in times of globalization and digitalization. In providing transparency for all stakeholders, visibility of supply chains can optimize operational efficiency and minimize risks [2]. Smarter supply chains would have the analytic capability to evaluate myriad alternatives in terms of supply, manufacturing, and distribution – and the flexibility to reconfigure flows as conditions change [8].

Analysis of the visibility on the inbound supply chain. Structured model to identify and quantify the performance benefits of a visibility improvement [5]. The increasing interest in supply chain visibility and logistics has been driven by competitive pressure and has led to its eventual elevation to turn into a critical part of company operations and strategy [6]. Successful supply chain management requires cross-functional integration and marketing must play a critical role. The basic difference between vertically integrated firms and a supply chain is that firms in a supply chain are relatively free to enter and leave supply chain relationships if these relationships are no longer proving beneficial[3].

A commerce visibility network allows for the collection and distribution of real-time location and status information regarding the movement of goods and assets through a supply chain. Although visibility has become a popular buzzword in the supply chain literature it remains an ill-defined and poorly understood concept. It is assumed that if companies across supply chains have visibility of demand, inventory levels, processes, etc., that organizational performance improves [7].

Delivering the right product at the right time in the right amount are essential objectives of efficient and effective supply chain systems. Thus measures must be taken to ensure that all operational components of the supply chain system are operating efficiently. And quality measurement in a supply chain process is done to develop the process quality model to be used in the assessment, improvement and control of a manufacturing supply chain system.[1]

III.METHODOLOGY

A. Data Pre-processing

Data processing is the process of transforming raw data into understandable format. Data pre-processing includes data cleaning and transformation are methods used to remove outliers and standardize the data.

B. MatplotLib library

Matplotlib is a comprehensive multi-platform data visualisation library for creating static, animated,and interactive visualizations in Python. Matplotlib is a statistical plotting library for the Python programming language and its numeric mathematical extension NumPy.

C. Seaborn library

Seaborn is a python visualisation library for making statistical graphics based on matplotlib. Its plotting functions operate on data frames and arrays containing datasets and internally perform the semantic mapping and statistical aggregation to produce informative plots.
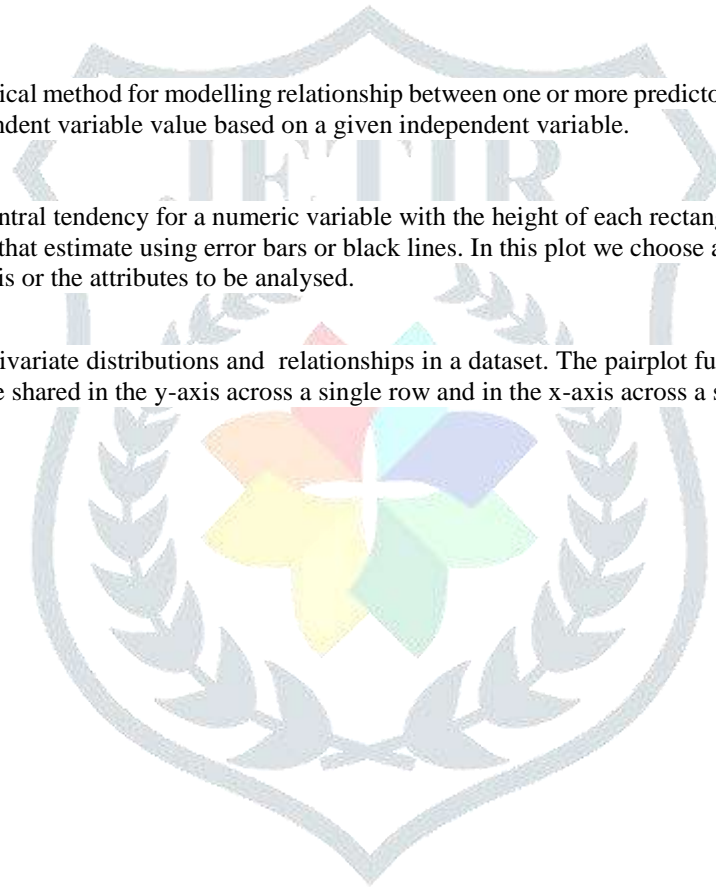
D. Linear regression

Linear regression is a statistical method for modelling relationship between one or more predictor variable and one outcome variable.It performs to predict a dependent variable value based on a given independent variable.
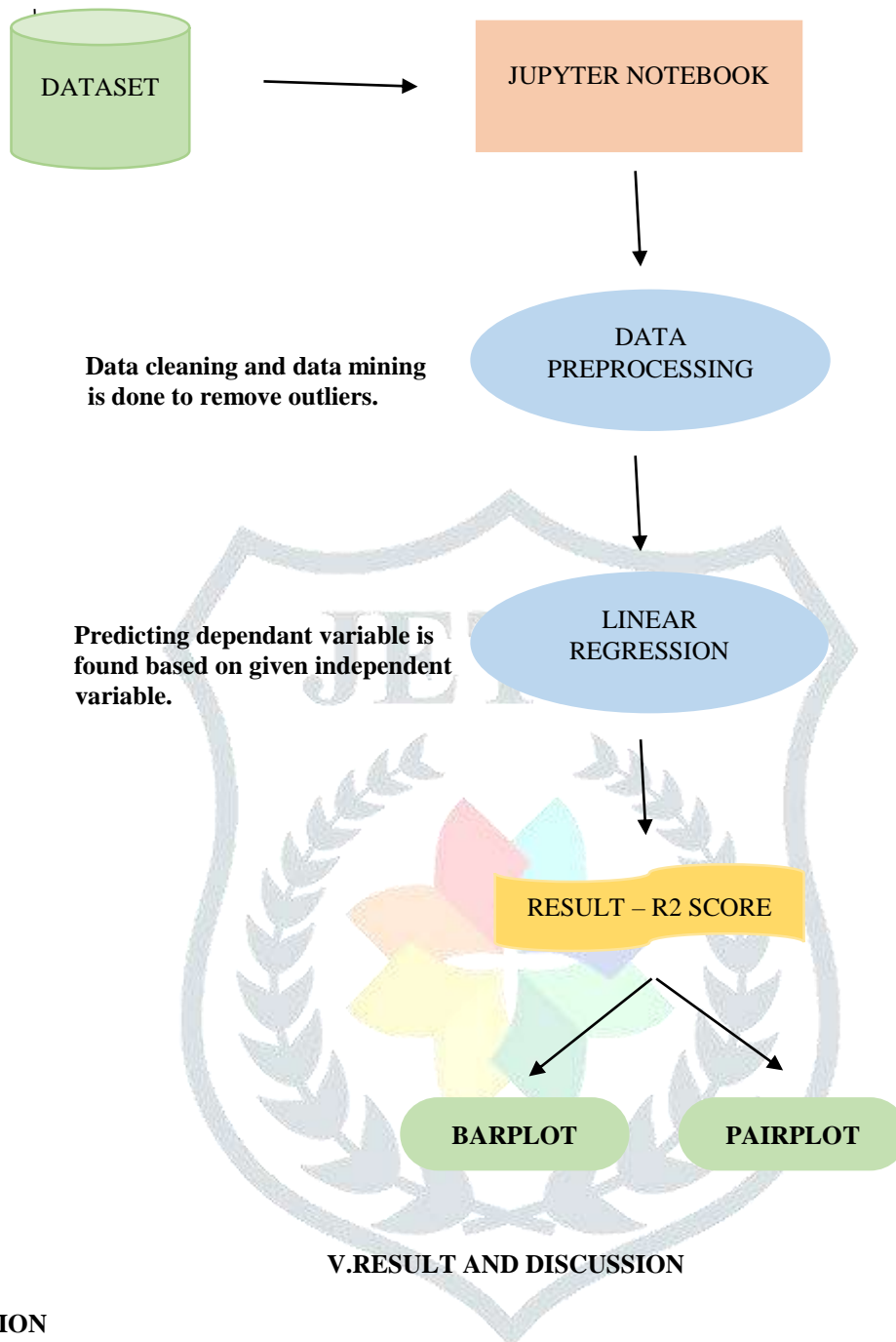
E. Bar plot

A bar plot represents the central tendency for a numeric variable with the height of each rectangle and provides some indication of the uncertainty around that estimate using error bars or black lines. In this plot we choose a categorical column for the x-axis and a numerical column for the y-axis or the attributes to be analysed.

F. Pair plot

A pairplot plot a pairwise bivariate distributions and relationships in a dataset. The pairplot function creates a grid of axes such that each variable in data will be shared in the y-axis across a single row and in the x-axis across a single column.

IV.FLOW CHART OF THE PROCESS

DATASET → **JUPYTER NOTEBOOK**

↓

Data cleaning and data mining is done to remove outliers.　　**DATA PREPROCESSING**

↓

Predicting dependant variable is found based on given independent variable.　　**LINEAR REGRESSION**

↓

RESULT – R2 SCORE

↙　　　　↘

BARPLOT　　**PAIRPLOT**

V.RESULT AND DISCUSSION

LINEAR REGRESSION

```
In [13]:   pred = model.predict(data)

In [14]:
           from sklearn.metrics import r2_score

In [15]:   r2_score(pred,dataset.DAMAGEDQTY)

Out[15]:   -5.299030426003748
```

Fig 4.1 R-Squared Value

In the above Fig 4.1,R-squared (R^2) score is a statistical measure that represents the proportion of the variance for a dependent variable by given independent variable or variables in a regression model. An R-Squared value of **-5.2990** indicates that the variance of the dependent variable being studied is explained by the variance of the independent variable.The negative value of R2 gives the bond strength between the two variables and it is the negative of the slope of the line.

BAR PLOT

```
In [16]: sns.barplot(dataset.RAWQTY,dataset.DAMAGEDQTY)

Out[16]: <matplotlib.axes._subplots.AxesSubplot at 0x2ada20f7278>
```
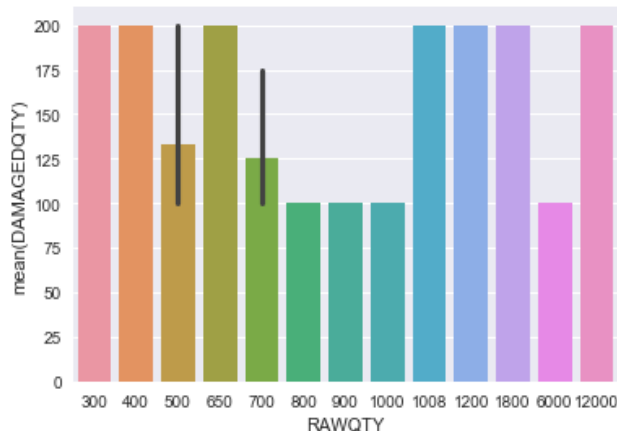

Fig 4.2 Bar Plot

The above figure 4.2 shows the seaborn barplot of RAWQTY AND DAMAGEDQTY.It shows the range of damaged quantity relatively to the raw quantity which has to produced once again and the black line indicates the quantity which have to be repacked.

```
In [26]: sns.barplot(dataset.TRANSPORTAGENCY,dataset.DAMAGEDQTY)

Out[26]: <matplotlib.axes._subplots.AxesSubplot at 0x2ada2889e48>
```
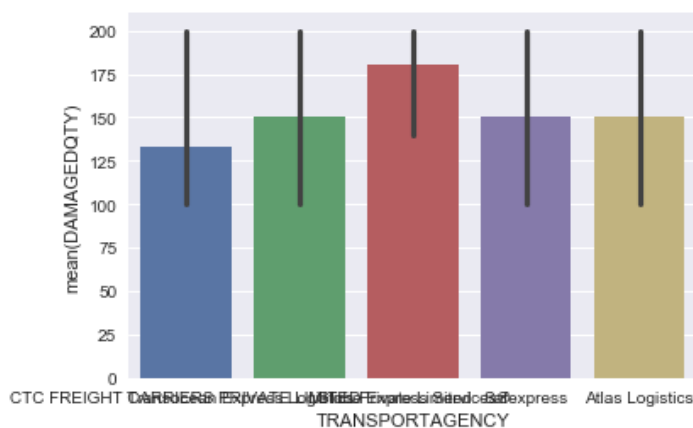

Fig 4.3 Bar plot

The above Fig 4.3 shows the seaborn barplot of TRANSPORTAGENCY AND DAMAGEDQTY.It shows the range of damaged quantity which are transported with their particular transport agency and the black line represent the amount of damaged quantity when it is being transported and others are the quantity which is damaged before it is being tranported.

VI.CONCLUSION

In this paper,Python is the tool used to analyse the quality control during the time of inspection using Linear Regression.The main objective it to improve the quality management and check the regulatory reforms during the inspection process to avoid the negative impression on the product when it reaches the customer.When this is sorted out at this stage the further process of the product will not be affected for their next stage.To predict the process,raw quantity and damaged quantity is taken to find out the amount of damaged quanitity and the quantity level which have to be repacked.Then,damaged quantity and transport agency is analysed to find the rate of damaged quanitity with accordance with their transport agency.In Linear Regression R2 score -5.299 implies the dependence of damaged quantity to raw quantity.This analysis helps to recify the quality errors and to reduce the time which is taking place to rectify those errors.

FURTHER WORK

As the main theme of this paper is supply chain visibility,apart from quality managemet the process may be extended to find the reason for the defective quanitity,minimising the time limit for each process,etc

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