

Customer Relationship Management Analytics Using Data Visualization

Shivalika Katoch¹ and Prof. Jayesh Bisane²

Student, Department of Computer Science and Engineering (Data Science)¹

Supervisor, Department of Computer Science and Engineering (Data Science)²

ORCID iD: 0009-0003-2422-2329

Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur, India

Abstract: *In this paper, a data analytics tool is designed to analyze CRM data using Python, Microsoft Excel, and Power BI. The process includes data pre-processing, data exploration, and data visualization to derive valuable insights from raw customer data. Dashboards are created to display KPIs such as customer distribution, sales trends, and regional performance. The findings show that data visualization has a great impact on decision-making and business knowledge.*

Keywords: Customer Relationship Management, Data Analytics, Power BI, Data Visualization, Exploratory Data Analysis, Business Intelligence, CRM Dashboard

I. INTRODUCTION

Customer Relationship Management (CRM) is essential in contemporary organizations because it enables efficient management of customer engagements and data. As customer data continues to grow due to various sources of customer information, it is difficult to extract meaningful insights.

Unstructured data in CRM comprises inconsistent elements, which include gaps in data and duplications. It becomes difficult for organizations to make effective use of such data without appropriate analysis. There is an urgent need for an analytic framework that can help with this issue.

In this paper, CRM data will be analyzed using data analytics approaches through the use of Python and Power BI. This paper will focus on discovering patterns in customer behavior, analyzing sales, and dashboarding.

II. LITERATURE REVIEW

A. CRM and Its Significance

CRM encompasses business processes, technology, and data that lead to better customer satisfaction and retention. From basic data storage systems to sophisticated decision support systems, CRM has undergone significant transformations.

B. The Role of Data Analytics in CRM

With the help of data analytics, organizations can derive useful information from large amounts of data. It helps in conducting sales analysis, segmenting customers, and identifying trends. Ultimately, it facilitates better decision-making processes.

C. Exploratory Data Analysis (EDA) and Visualization in CRM

EDA is an essential stage in data analysis aimed at understanding the features of datasets, detecting errors, and spotting patterns using statistics and visualization techniques.

Visualization involves the use of various tools like dashboards, charts, and graphs that simplify complex data. Power BI, for example, allows for dynamic visualizations of data.



D. Tools and Technologies

Python (Pandas, NumPy) - Data pre-processing
Excel - Initial data processing
Power BI - Data visualization

III. METHODOLOGY

The methodology suggested here adopts a systematic process as outlined below:

A. Data Collection

CRM database containing customer, sales, and regional information.

B. Data Preprocessing

- Missing value management
- Eliminating duplicates
- Formatting consistency

C. Exploratory data analysis (EDA)

Exploratory data analysis is conducted to determine customer behaviour patterns and sales trends.

D. Data Analysis

Data analysis will be done for the following purposes:

- Customer segmentation
- Sales trends
- Regional performance

E. Visualization

Dashboards are created in Power BI to visualize key performance indicators, such as total customers and sales revenue trends.

IV. SYSTEM DESIGN

A. System Architecture

The proposed system follows a three-layer architecture that is composed of a data layer, processing layer, and visualization layer. The data layer involves a CRM database that contains customer, sales, and regional data. The processing layer follows a procedure in which the data will undergo data cleaning and transformation, including handling of missing data and removal of duplicate data. For visualization, the use of Power BI was recommended for the purpose of showing the processed data in dashboards, allowing the creation of KPI representations.

B. Data Flow Design

For this process, data flow will start with data gathering and preprocessing, followed by data analysis and finally data visualization using dashboards in a sequence that ensures effective transformation of raw data into meaningful outputs.

C. Dashboard Design

Dashboard design involves the inclusion of several factors that ensure its effectiveness. Specifically, several dashboards will be designed to capture customers' distribution, sales, and regional performance in the form of different charts, including bar charts, line charts, and pie charts. The overall design emphasizes clarity, usability, and interactivity,



ensuring that complex data is presented in a simplified and accessible format. This enhances the ability of users to interpret insights quickly and supports data-driven decision-making.

V. RESULTS AND DISCUSSION

Analysis of the CRM data revealed several significant insights about customer behavior, sales performance, and business dynamics in general. First of all, it was found that one particular segment of customers accounted for considerable sales revenue, proving the existence of valuable customers. Customer segmentation becomes very useful when applied to develop appropriate retention strategies and increase profitability.

As far as sales performance is concerned, notable differences have been noted regarding regions and times when sales were taking place. Some regions showed higher sales compared to others; in addition, time-related dynamics also indicated the impact of seasonal demand and market situation. This allows for identifying the most effective regional performance and developing strategies to boost lagging segments.

Interactive dashboards proved extremely helpful in making the data understandable by showing the relevant performance indicators in charts. The total number of customers, sales performance, and revenue were successfully displayed in graphical form. At the same time, filters and slicers made it possible to perform an in-depth analysis of the data from various angles.

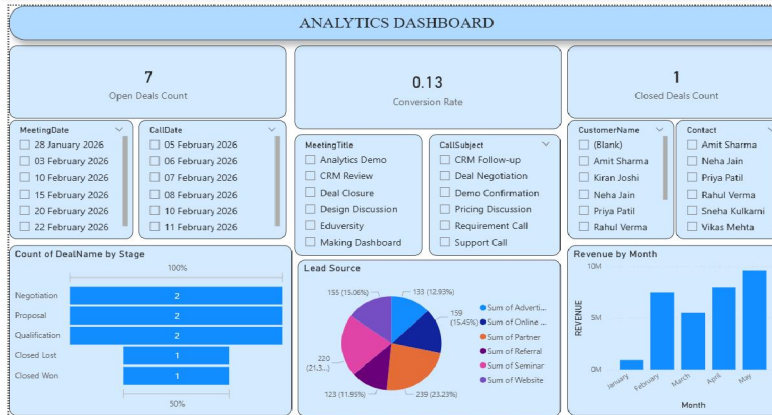


Figure1: CRM Analytics Dashboard

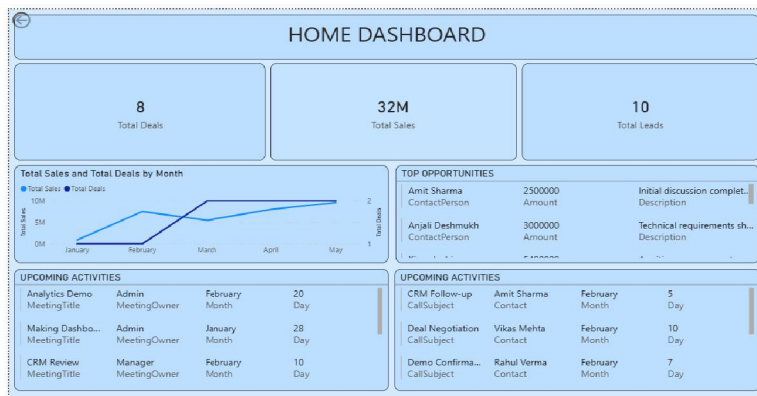


Figure2: Home Dashboard displaying overall CRM performance and activities.

The dashboards gave an easy and understandable interface to work on complex data, making the process more efficient and enabling quicker decisions. In conclusion, it can be said that the incorporation of data analytics along with data visualization methods helps in improving the performance of CRM systems.



VI. CONCLUSION

This study demonstrates the effective application of data analytics techniques in CRM. The integration of Python and Power BI enabled efficient data processing and visualization.

The developed dashboards improved understanding of customer behaviour and supported strategic decision-making. The study highlights the importance of data-driven approaches in improving business performance and customer satisfaction.

An important way forward would involve using machine learning to facilitate prediction analysis, such as predicting customer behaviour and churn. Another way to expand the project would be through real-time data analysis, which will allow the generation of insights that reflect changes in business situations.

Some of the future improvements could also involve automating the dashboard updates to minimize the manual process of doing so. Using additional data sets and more data attributes will give richer data analysis outcomes. Finally, integrating the developed system within CRM systems will allow a better and more effective analysis of customer data management.

The current research may be expanded through the application of sophisticated analytic tools. An important way forward would involve using machine learning to facilitate prediction analysis, such as predicting customer behaviour and churn. Another way to expand the project would be through real-time data analysis, which will allow the generation of insights that reflect changes in business situations.

Some of the future improvements could also involve automating the dashboard updates to minimise the manual process of doing so. Using additional data sets and more data attributes will give richer data analysis outcomes. Finally, integrating the developed system within CRM systems will allow a better and more effective analysis of customer data management.

VII. ACKNOWLEDGEMENT

The author would like to thank the Department of Computer Science and Engineering (Data Science), Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur, and project guide Prof. Jayesh Bisane for their continuous support and valuable guidance throughout this research work.

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