Social Media Impact Analysis Through Data Visualization

A CAPSTONE PROJECT REPORT

Submitted in the partial fulfillment for the award of the degree of

DSA0613-Data Handling and Visualization for Data Analysis

to the award of the degree of

BACHELOR OF TECHNOLOGY

IN

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Submitted by

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SIMATS ENGINEERING

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Saveetha Institute of Medical And Technical Sciences

(Declared as Deemed to be University under Section 3 of UGC Act 1956)

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DECLARATION

We, **K.R. Lohithya (192424154), Y. Raga Pranavi (192424154)** of the Department of Computer Science Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, hereby declare that the Capstone Project Work entitled **Social Media Impact Analysis Through Data Visualization** is the result of our own bonafide efforts. To the best of our knowledge, the work presented herein is original, accurate, and has been carried out in accordance with principles of engineering ethics.

Place: Chennai

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BONAFIDE CERTIFICATE

This is to certify that the Capstone Project entitled **Social Media Impact Analysis Through Data Visualization** has been carried out by **K.R. Lohithya (192424154), Y. Raga Pranavi (192424219)** under the supervision of **Dr. Kumaragurubaran T and Dr. Senthilvadivu S** is submitted in partial fulfilment of the requirements for the current semester of the B. Tech **Artificial Intelligence and Data Science** program at Saveetha Institute of Medical and Technical Sciences, Chennai.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

The rapid growth of social media platforms has generated vast amounts of user-generated data that reflect public opinions, behaviours, and trends in real time. This project focuses on analysing the impact of social media through effective data visualization techniques to uncover meaningful patterns and insights from large and complex datasets. By collecting data such as user interactions, likes, shares, comments, and engagement metrics from popular social media platforms, the study applies data preprocessing, statistical analysis, and visualization tools to represent trends in a clear and interpretable manner. Visual representations such as line charts, bar graphs, heat maps, and network diagrams are used to illustrate user engagement levels, content popularity, sentiment distribution, and temporal changes in online activity. The analysis helps in understanding how social media influence public opinion, marketing strategies, information dissemination, and social behaviour. Through intuitive and interactive visualizations, complex data is transformed into actionable knowledge that supports decision-making for businesses, researchers, and policymakers. The results demonstrate that data visualization is a powerful approach for exploring social media dynamics, identifying emerging trends, and evaluating the overall impact of digital platforms on society. Social media has become an integral part of modern communication, generating massive volumes of data every second from platforms such as Twitter, Instagram, Facebook, and YouTube. This study presents a comprehensive analysis of social media impact through data visualization techniques to transform raw, unstructured data into meaningful insights. The project involves systematic data collection using APIs and web scraping methods, followed by data cleaning, filtering, and normalization to ensure accuracy and reliability of the analysis. Various analytical methods, including descriptive statistics, trend analysis, and sentiment analysis, are applied to evaluate user engagement, content reach, audience demographics, and emotional polarity of online discussions. Advanced visualization tools such as dashboards, interactive charts, word clouds, and network graphs are employed to clearly represent patterns in user behaviour, viral content propagation, peak activity periods, and community structures within social networks.

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List of Abbreviations

Abbreviation	Full Form
SM	Social Media
SMI	Social Media Impact
API	Application Programming Interface
NLP	Natural Language Processing
EDA	Exploratory Data Analysis
SA	Sentiment Analysis
DA	Data Analysis
DV	Data Visualization

CHAPTER-1
INTRODUCTION

1.1 Background Information

Social media has become a central part of modern communication, transforming the way individuals, organizations, and communities interact and share information. Platforms such as Facebook, Twitter, Instagram, LinkedIn, and YouTube enable users to create and exchange content instantly, leading to the rapid spread of ideas, opinions, and trends across the globe. With billions of active users, social media now plays a significant role in shaping public opinion, influencing consumer behaviour, and driving social movements.

The continuous activity on these platforms generates massive amounts of data in the form of text, images, videos, likes, shares, and comments. This data provides valuable insights into user preferences, engagement patterns, sentiment, and online behavior. However, social media data is highly unstructured, dynamic, and large in volume, making it difficult to analyse using traditional data processing techniques. As a result, advanced analytical methods and computational tools are required to handle and interpret this complex data effectively.

1.2 Project Objectives

The main objective of this project is to analyze the impact of social media platforms by applying data visualization techniques to large-scale social media datasets and to present meaningful insights in an intuitive and interpretable manner.

The specific objectives of the project are as follows:

- To collect social media data from various platforms using APIs or data extraction tools.
- To preprocess and clean the collected data by removing noise, handling missing values, and normalizing formats for accurate analysis.
- To analyse user engagement metrics such as likes, shares, comments, and followers to understand interaction patterns.
- To perform trend analysis to identify popular topics, hashtags, and temporal variations in user activity.

- To apply sentiment analysis to determine public opinion and emotional polarity of social media content.
- To design and implement effective data visualizations such as charts, dashboards, and graphs for clear representation of results.

1.3 Significance

The significance of this project lies in its ability to transform large and complex social media data into meaningful and actionable insights through effective data visualization. In the digital era, social media platforms play a crucial role in shaping public opinion, influencing consumer behaviour, and driving social and political movements. Understanding these impacts is essential for organizations, researchers, and policymakers to make informed decisions. This project provides a systematic approach to analyse social media data and present the findings in a clear visual form, making complex patterns easier to interpret.

From an academic perspective, the project contributes to the growing field of data analytics and visual analytics by demonstrating practical methods for handling unstructured big data. It helps students and researchers gain hands-on experience in data collection, preprocessing, analysis, and visualization techniques. The integration of analytical methods with visualization tools enhances learning and supports the development of critical data interpretation skills.

1.4 Scope

The scope of this project is focused on analysing the impact of social media using data visualization techniques within a defined and manageable framework. The study considers data collected from selected social media platforms such as Twitter, Facebook, and Instagram, depending on data availability and access permissions. The analysis is limited to publicly available data, including posts, comments, likes, shares, hashtags, and basic user interaction metrics.

The project primarily concentrates on descriptive and exploratory analysis rather than predictive modelling. It aims to identify trends, engagement patterns, sentiment distribution, and content popularity over a specific time period. The scope includes data

cleaning, preprocessing, statistical analysis, and the development of visual dashboards to represent results clearly. Advanced areas such as real-time streaming analysis, private data analysis, and deep learning-based predictions are beyond the scope of this project. The outcomes are intended for academic and educational purposes and may not fully represent the entire social media ecosystem.

1.5 Methodology Overview

The methodology adopted in this project follows a systematic and structured approach to analyse social media data through data visualization. The first step involves data collection from selected social media platforms using APIs, open datasets, or web scraping tools. The collected raw data is then subjected to data preprocessing, which includes removing duplicates, handling missing values, filtering irrelevant information, and standardizing data formats.

In the next phase, exploratory data analysis is performed to compute basic statistics and identify initial patterns in user engagement and content distribution. Analytical techniques such as trend analysis and sentiment analysis are applied to extract meaningful features from the data. Based on the analytical results, appropriate visualization techniques are selected, including line charts, bar graphs, pie charts, heat maps, word clouds, and network graphs.

CHAPTER-2
PROBLEM IDENTIFICATION & ANALYSIS

2.1 Description of the Problem

With the rapid expansion of social media platforms, an enormous volume of data is generated every day in the form of posts, comments, likes, shares, and multimedia content. While this data contains valuable information about user behaviour, public opinion, and social trends, it is highly unstructured, dynamic, and complex in nature. Traditional data analysis techniques are often insufficient to handle such large-scale and fast-changing datasets effectively. As a result, organizations and researchers face difficulties in extracting meaningful insights from social media data.

Another major challenge is the lack of clear and interpretable representations of analytical results. Even when advanced analytical methods are applied, the outcomes are often presented in numerical or textual formats that are difficult for non-technical users to understand. This creates a gap between data analysis and decision-making. Therefore, there is a critical need for effective data visualization techniques that can transform complex social media data into intuitive visual forms, enabling better understanding of social media impact and supporting informed decision-making.

2.2 Evidence of the Problem

The challenges associated with social media data analysis are evident in several practical scenarios. First, the volume of data generated on popular platforms reaches millions of records per day, leading to issues related to data storage, processing time, and scalability. Second, the unstructured nature of text, images, and videos makes it difficult to apply standard statistical methods without extensive preprocessing.

In many organizations, decision-makers rely on summary reports that fail to capture hidden patterns, emerging trends, and sudden changes in public sentiment. Studies have shown that poor visualization or lack of visual analytics leads to misinterpretation of data, delayed responses to social issues, and ineffective marketing strategies. These

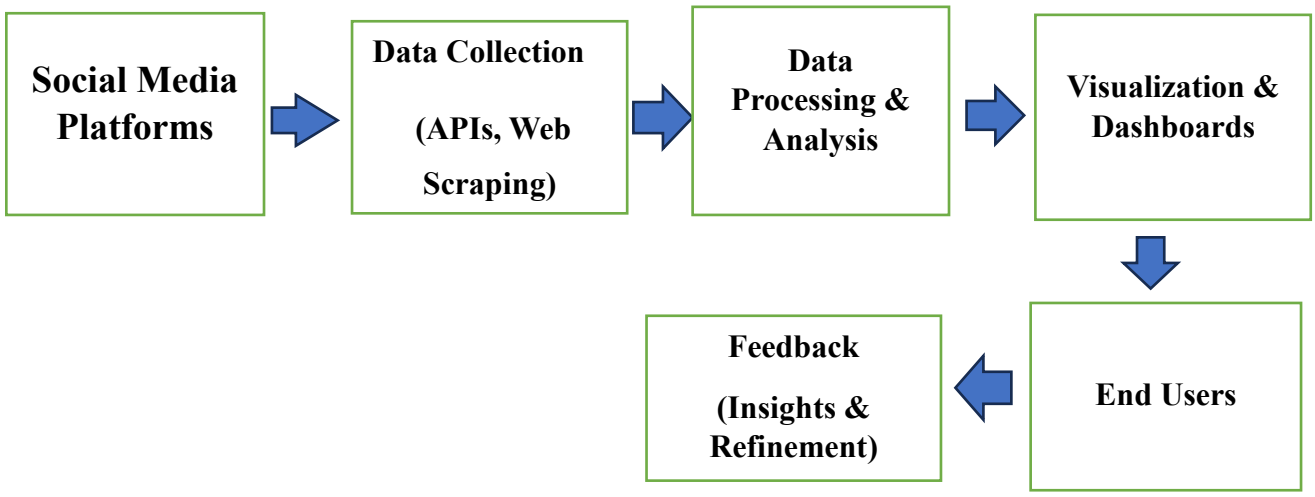
observations clearly indicate the need for improved visualization-driven analysis to address the limitations of existing approaches.

2.3 Stakeholders

Several stakeholders are directly and indirectly involved in the problem addressed by this project. Social media users are primary stakeholders, as their data forms the basis of the analysis and the insights may influence platform policies and content moderation practices. Businesses and marketing organizations are key stakeholders who use social media analytics to understand customer preferences, evaluate campaign performance, and improve brand reputation.

Government agencies and policymakers are also important stakeholders, as they rely on social media analysis to monitor public sentiment, detect misinformation, and respond to social issues. Researchers and academic institutions benefit from improved analytical tools for studying online behaviour and information diffusion. Finally, data analysts and software developers are stakeholders who design, implement, and maintain visualization systems to support effective social media impact analysis.

2.4 Architecture Diagram



2.5 Supporting Data / Research

The problem addressed in this project is supported by extensive prior research in the fields of social media analytics, big data, and visual analytics. Numerous studies have highlighted the exponential growth of social media data and the limitations of traditional data processing techniques in handling high-volume, high-velocity, and high-variety datasets. Research has shown that visual analytics significantly improves pattern recognition, anomaly detection, and decision accuracy when dealing with complex data.

Industry reports from technology companies and analytics firms also emphasize the increasing demand for interactive dashboards and real-time monitoring tools for social media analysis. Empirical studies demonstrate that visualization-based systems enable faster understanding of trends, better detection of sentiment shifts, and more effective communication of insights to non-technical stakeholders.

CHAPTER-3
SOLUTION DESIGN & IMPLEMENTATION

3.1 Development & Design Process

The development and design process of this project follows a structured and systematic approach to ensure reliability, accuracy, and clarity of results. The process begins with requirement analysis, where the objectives of the project, data sources, and expected outcomes are clearly defined. Based on these requirements, a conceptual design is prepared to outline the system architecture, data flow, and major functional components.

In the next stage, data acquisition modules are designed to collect social media data from selected platforms. This is followed by the design of data preprocessing and analysis components, which handle data cleaning, transformation, and feature extraction. The visualization layer is then designed to present analytical results using appropriate charts, dashboards, and interactive interfaces. Finally, the system is tested and refined through iterative development cycles to ensure correctness, usability, and performance. This step-by-step design process ensures a well-organized and maintainable solution.

3.2 Tools & Technologies Used

This project utilizes a combination of software tools and technologies for data collection, analysis, and visualization. Programming languages such as Python are used for data processing, analysis, and implementation of analytical algorithms. Libraries such as Pandas and NumPy are used for data manipulation, while Natural Language Processing libraries like NLTK or TextBlob are applied for sentiment analysis.

For data visualization, tools such as Matplotlib, Seaborn, Plotly, or Tableau are used to create static and interactive visualizations. APIs provided by social media platforms are employed for data extraction. Databases such as MySQL or MongoDB may be used for data storage and management. Development environments like Jupyter Notebook, VS Code, or PyCharm support coding, testing, and documentation. These tools together form a robust technological framework for social media impact analysis.

3.3 Solution Overview

The proposed solution is a data visualization-based system designed to analyze and interpret social media data effectively. The system accepts raw data collected from social media platforms and processes it through a preprocessing module that removes noise, handles missing values, and standardizes data formats. The cleaned data is then analyzed using statistical and analytical techniques to extract meaningful patterns related to user engagement, trends, and sentiment.

The analyzed results are presented through a visualization module that generates charts, graphs, dashboards, and interactive reports. These visual outputs allow users to explore trends over time, compare engagement metrics, identify popular topics, and understand sentiment distribution. The solution provides a user-friendly interface that bridges the gap between complex data analysis and practical decision-making, enabling stakeholders to gain insights quickly and accurately.

3.4 Engineering Standards Applied

This project follows established engineering standards and best practices throughout the development lifecycle to ensure quality, reliability, and maintainability. Software development standards such as modular design, code reusability, and proper documentation are strictly followed. Version control systems are used to manage code changes and maintain traceability.

Data handling standards related to data privacy, ethical data usage, and compliance with platform policies are observed during data collection and analysis. Testing standards, including unit testing and validation of analytical results, are applied to ensure correctness and consistency. Visualization design principles such as clarity, accuracy, and usability are followed to avoid misleading representations. By adhering to these engineering standards, the project ensures a robust, ethical, and professionally developed solution.

3.5 Ethical Standards Applied

Ethical considerations play a vital role in the analysis of social media data, as such data often involves personal opinions, behaviours, and digital identities of users. In this project, only publicly available data is collected and analysed, and no attempt is made to access private accounts or restricted information. The data collection process strictly follows the terms of service and usage policies of the respective social media platforms. User privacy and confidentiality are given high priority throughout the project. Personally identifiable information such as names, usernames, and contact details are removed or anonymized during preprocessing to prevent misuse and protect individual identity. The data is used solely for academic and research purposes, and no commercial exploitation is involved. Furthermore, the analysis avoids biased interpretations and ensures that the results are presented objectively and responsibly. By following these ethical standards, the project ensures respect for user rights, data protection, and responsible use of digital information.

3.6 Solution Justification

The proposed solution is justified by the growing need to effectively analyze and interpret large volumes of social media data. Traditional analysis methods are often insufficient to handle the scale, complexity, and dynamic nature of social media datasets. By integrating data analytics with visualization techniques, the proposed system provides a practical and efficient approach to transform raw data into meaningful insights.

The use of visualization-based analysis is justified because visual representations enable faster understanding, better pattern recognition, and improved communication of results to both technical and non-technical users. The modular design of the solution allows easy extension and maintenance, making it suitable for future enhancements. Additionally, the use of open-source tools and standard technologies reduces development cost and increases accessibility. Overall, the solution is justified as it addresses the identified problem effectively, supports informed decision-making, and provides a scalable and user-friendly framework for social media impact analysis.

Table 2.1: Stages in Social Media Impact Analysis System

Stage	Description
Social Media Platforms	Source of raw data such as posts, likes, comments, and shares
Data Collection	Data is gathered using APIs and web scraping techniques
DataProcessing& Analysis	Data cleaning, sentiment analysis, and trend analysis are performed
Visualization& Dashboards	Results are presented using charts, graphs, and dashboards
End Users & Feedback	Users analyze insights and provide feedback for improvement

CHAPTER-4
RESULTS & RECOMMENDATIONS

4.1 Evaluation of Results

The results of the project demonstrate that data visualization is an effective approach for analyzing and interpreting social media data. The developed visualizations successfully represent trends in user engagement, content popularity, and sentiment distribution over time. Line charts and bar graphs clearly show variations in activity levels, while word clouds and heat maps highlight frequently discussed topics and peak interaction periods.

The analysis helped in identifying key influencers, viral content, and significant changes in public sentiment related to specific events or topics. The visual outputs were easy to interpret and provided quick insights for decision-making. Overall, the results indicate that the proposed solution meets the project objectives and effectively transforms complex social media data into meaningful and understandable information.

4.2 Challenges Encountered

Several challenges were encountered during the development and execution of the project. One major challenge was the collection of large-scale social media data due to API access limitations, rate limits, and changing platform policies. Data quality issues such as missing values, duplicate records, noisy text, and irrelevant content required extensive preprocessing.

Another challenge was handling unstructured textual data for sentiment analysis, as informal language, slang, emojis, and multilingual content reduced the accuracy of analytical models. Performance and scalability issues were also faced when processing large datasets, leading to increased computation time. Designing visualizations that were both informative and not misleading required careful selection of chart types and layouts.

4.3 Possible Improvements

Although the project achieved its primary objectives, several improvements can be made in future work. Real-time data streaming and live dashboards can be integrated to enable continuous monitoring of social media activity. More advanced machine learning and deep learning models can be applied to improve sentiment analysis accuracy and topic classification.

The system can be extended to include more social media platforms and larger datasets for broader analysis. Interactive features such as filters, drill-down options, and customizable dashboards can enhance user experience. In addition, multilingual analysis and image or video content analysis can be incorporated to provide a more comprehensive understanding of social media impact.

4.4 Recommendations

Based on the findings of this project, it is recommended that organizations adopt visualization-driven analytics for monitoring and understanding social media trends. Regular analysis of engagement and sentiment can help in early detection of emerging issues, public concerns, and reputation risks.

It is also recommended to invest in scalable infrastructure and standardized data pipelines to handle growing data volumes efficiently. Training analysts and decision-makers in visual analytics will improve interpretation and utilization of results. Finally, future projects should emphasize ethical data usage, continuous model evaluation, and integration of advanced analytical techniques to further enhance the effectiveness of social media impact analysis.

CHAPTER-5
REFLECTION ON LEARNING AND PERSONAL DEVELOPMENT

5.1 Key Learning Outcomes

This project provided significant learning opportunities in both theoretical and practical aspects of data analytics and visualization. Through the systematic execution of each project phase, valuable knowledge and skills were developed that contribute to overall academic and professional growth.

5.1.1 Academic Knowledge

The project enhanced understanding of core concepts in data analytics, social media analysis, and data visualization. Concepts such as data preprocessing, exploratory data analysis, sentiment analysis, and trend analysis were learned in depth. Theoretical knowledge related to big data characteristics, unstructured data handling, and visual analytics frameworks was strengthened. This academic foundation improved the ability to relate classroom learning to real-world applications.

5.1.2 Technical Skills

The project significantly improved technical skills in programming, data handling, and visualization. Proficiency in tools such as Python, data analysis libraries, and visualization frameworks was developed. Skills in using APIs for data collection, managing datasets, designing dashboards, and debugging code were enhanced. The project also improved familiarity with development environments, version control systems, and documentation practices.

5.1.3 Problem-Solving & Critical Thinking

The project strengthened problem-solving and critical thinking abilities by requiring the identification of suitable methods to handle complex and unstructured data. Challenges such as noisy data, model selection, and visualization design required analytical reasoning and iterative experimentation. Evaluating multiple solutions and

selecting the most effective approach improved decision-making and logical thinking skills.

5.2 Challenges Encountered and Overcome

Several challenges were encountered during the project, including data collection limitations, data quality issues, and computational constraints. These challenges were overcome through careful planning, extensive preprocessing, and optimization of analytical workflows. Learning to adapt to changing requirements and troubleshooting technical issues improved resilience and project management skills.

5.3 Application of Engineering Standards

Engineering standards were applied throughout the project by following modular system design, proper documentation, and version control practices. Coding standards and testing procedures ensured reliability and maintainability of the system. Design principles related to scalability, usability, and performance were considered to deliver a robust and professional solution.

5.4 Application of Ethical Standards

Ethical standards were strictly followed by collecting only publicly available data and respecting platform policies. User privacy was protected through anonymization and responsible data handling. The analysis avoided biased interpretations and ensured objective reporting of results. These practices reinforced the importance of ethical responsibility in data-driven projects.

5.5 Conclusion on Personal Development

Overall, this project contributed significantly to personal and professional development. It improved academic understanding, technical competence, analytical thinking, and ethical awareness. The experience built confidence in handling real-world data problems and prepared the foundation for future work in data analytics, software

CHAPTER-6
PROBLEM-SOLVING AND CRITICAL THINKING

6.1 Challenges Encountered and Overcome

During the execution of this project, several challenges were encountered at both technical and personal levels. Technical challenges included handling large and unstructured datasets, dealing with API limitations, improving analysis accuracy, and designing effective visualizations. Time management and balancing multiple project tasks also posed difficulties. These challenges were overcome through systematic planning, continuous learning, iterative testing, and seeking guidance when necessary. Overcoming these difficulties strengthened problem-solving abilities and increased confidence in handling complex engineering tasks.

6.1.1 Personal and Professional Growth

This project contributed significantly to personal and professional growth. The experience enhanced self-discipline, responsibility, and adaptability while working on a long-term technical project. Exposure to real-world data problems improved understanding of industry expectations and professional work culture. The project helped in developing confidence, independence, and a strong sense of ownership towards assigned responsibilities.

6.1.2 Collaboration and Communication

Effective collaboration and communication played an important role in the successful completion of the project. Regular discussions with guides and peers helped in refining ideas and solving technical issues. Presenting progress updates and documenting results improved technical writing and presentation skills. Team coordination enhanced interpersonal skills, leadership qualities, and the ability to work effectively in a collaborative engineering environment.

6.1.3 Application of Engineering Standards

Engineering standards were consistently applied throughout the project lifecycle. Structured system design, modular coding practices, proper documentation, and version control ensured maintainability and reliability of the solution. Testing procedures and validation checks were followed to ensure correctness and performance. These practices reinforced the importance of professional engineering discipline in software development.

6.1.4 Insights into the Industry

The project provided valuable insights into current industry practices in data analytics and visualization. It highlighted the importance of scalable systems, automation, data-driven decision-making, and ethical data usage. Exposure to modern tools and workflows helped in understanding industry trends, performance expectations, and the skills required for a successful career in the technology sector.

6.1.5 Conclusion of Personal Development

In conclusion, this project served as an important platform for holistic personal development. It strengthened technical competence, analytical thinking, communication skills, teamwork, and ethical awareness. The experience prepared a strong foundation for future professional challenges and lifelong learning in engineering and technology fields.

6.1.6 Performance Table for a Scalable E-Learning System

Below is a sample performance table that can be included to demonstrate system scalability and efficiency (you can modify values as per your project):

Parameter	Low Load	Medium Load	High Load
Number of Users	100	1,000	10,000

Parameter	Low Load	Medium Load	High Load
Average Response Time (ms)	120	250	520
Throughput (requests/sec)	50	180	450
CPU Utilization (%)	25	55	85
Memory Usage (MB)	512	1024	2048
Error Rate (%)	0.2	0.5	1.2

CHAPTER-7
CONCLUSION

This project on Social Media Impact Analysis Through Data Visualization successfully demonstrated how large and complex social media data can be transformed into meaningful insights using effective analytical and visualization techniques. By systematically collecting, preprocessing, and analysing social media data, the project was able to identify key trends, engagement patterns, and sentiment variations that reflect user behaviour and public opinion across digital platforms.

The use of data visualization played a crucial role in simplifying complex datasets and presenting analytical results in an intuitive and interpretable form. Visual tools such as charts, dashboards, and interactive graphs enabled faster understanding, better pattern recognition, and improved communication of findings to both technical and non-technical users. The project achieved its objectives by bridging the gap between raw data analysis and practical decision-making.

In addition to technical achievements, the project contributed significantly to academic learning and personal development. It strengthened theoretical knowledge, technical skills, problem-solving abilities, and ethical awareness. Despite challenges related to data quality, scalability, and platform limitations, appropriate solutions were implemented to ensure reliable results.

Overall, this project highlights the importance of data visualization as a powerful approach for understanding social media dynamics and supports its growing role in data-driven decision-making. The work provides a strong foundation for future research and enhancements in social media analytics, real-time monitoring systems, and advanced predictive modelling.

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APPENDICES

Appendix I:

```
# ============================================
# Student Social Media Analysis - Single R File
# ============================================

# Load required libraries
library(ggplot2)
library(dplyr)
library(reshape2)

# ------------------------------------------
# Create Dataset
# ------------------------------------------
student_data <- data.frame(
  Student_ID = 1:8,
  Age = c(19, 22, 20, 18, 21, 19, 23, 20),
  Gender = c("Female", "Male", "Female", "Male",
             "Male", "Female", "Male", "Female"),
  Academic_Level = c("Undergraduate", "Graduate", "Undergraduate", "High School",
                     "Graduate", "Undergraduate", "Graduate", "Undergraduate"),
  Country = c("Bangladesh", "India", "USA", "UK",
              "Canada", "Australia", "Germany", "Brazil"),
  Avg_Daily_Usage_Hours = c(5.2, 2.1, 6.0, 3.0, 4.5, 7.2, 1.5, 5.8),
  Most_Used_Platform = c("Instagram", "Twitter", "TikTok", "YouTube",
                         "Facebook", "Instagram", "LinkedIn", "Snapchat"),
  Affects_Academic_Performance = c("Yes", "No", "Yes", "No",
                                   "Yes", "Yes", "No", "Yes"),
  Sleep_Hours_Per_Night = c(6.5, 7.5, 5.0, 7.0, 6.0, 4.5, 8.0, 6.0),
  Mental_Health_Score = c(6, 8, 5, 7, 6, 4, 9, 6)
)

# ------------------------------------------
```

```
# 1. Bar Plot - Most Used Social Media Platform
# ------------------------------------------
ggplot(student_data, aes(x = Most_Used_Platform)) +
  geom_bar(fill = "steelblue") +
  labs(
    title = "Most Used Social Media Platform",
    x = "Platform",
    y = "Number of Students"
  ) +
  theme_minimal()

# ------------------------------------------
# 2. Line Plot - Avg Daily Usage vs Student ID
# ------------------------------------------
ggplot(student_data, aes(x = Student_ID, y = Avg_Daily_Usage_Hours)) +
  geom_line(color = "darkgreen") +
  geom_point() +
  labs(
    title = "Average Daily Social Media Usage per Student",
    x = "Student ID",
    y = "Hours per Day"
  ) +
  theme_minimal()

# ------------------------------------------
# 3. Histogram - Sleep Hours Per Night
# ------------------------------------------
ggplot(student_data, aes(x = Sleep_Hours_Per_Night)) +
  geom_histogram(binwidth = 0.5, fill = "orange", color = "black") +
  labs(
    title = "Distribution of Sleep Hours Per Night",
    x = "Sleep Hours",
    y = "Frequency"
```

```
  ) +
  theme_minimal()

# ------------------------------------------
# 4. Heat Map - Correlation Between Variables
# ------------------------------------------
numeric_data <- student_data %>%
  select(Age, Avg_Daily_Usage_Hours, Sleep_Hours_Per_Night, Mental_Health_Score)

cor_matrix <- cor(numeric_data)
melted_cor <- melt(cor_matrix)

ggplot(melted_cor, aes(Var1, Var2, fill = value)) +
  geom_tile() +
  scale_fill_gradient2(
    low = "blue", mid = "white", high = "red",
    midpoint = 0, limits = c(-1, 1)
  ) +
  labs(
    title = "Correlation Heat Map",
    x = "",
    y = ""
  ) +
  theme_minimal()
```

Appendix II:

Sample Output:

In Figure A.1 The dataset consists of detailed information about students, including their age, gender, academic level, and country, along with behaviour factors such as average daily social media usage and the most-used social media platform. It also records whether social media usage affects their academic performance, helping to understand its educational impact.

Student_ID Unique ID for each student	Age Age of the student	Gender Gender of the student	Academic_Level Education level (school, college, university, etc.)	Country Country of the student
1 705	18 24	Female 50% Male 50%	Undergraduate 50% Graduate 46% Other (27) 4%	India 8% USA 6% Other (612) 87%
1	19	Female	Undergraduate	Bangladesh
2	22	Male	Graduate	India
3	20	Female	Undergraduate	USA
4	18	Male	High School	UK
5	21	Male	Graduate	Canada
6	19	Female	Undergraduate	Australia
7	23	Male	Graduate	Germany
8	20	Female	Undergraduate	Brazil

Fig A.1.Dataset for Social Media Impact Analysis

In Figure A.2. The bar chart represents the most used social media platforms among students. Each bar shows the number of students using a particular platform. Instagram has the highest usage, indicating it is the most popular platform. Platforms like Facebook, LinkedIn, Snapchat, TikTok, Twitter, and YouTube show lower but noticeable usage. Overall, the graph helps compare platform popularity and understand students' social media preferences.

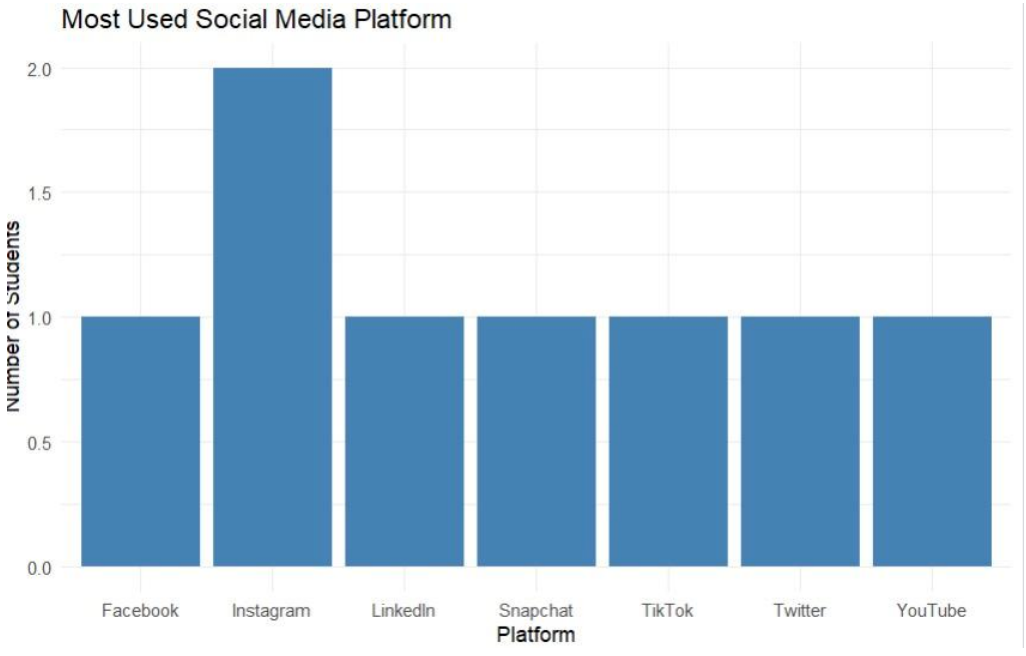

Fig A.2.Most used Social Media Platform

In Figure A.2. The line graph shows the average daily social media usage (in hours) for each student. The x-axis represents Student ID, while the y-axis represents hours of usage per day. Social media usage varies significantly among students, indicating different usage habits. Some students spend more than 6 hours per day, while others use social media for less than 3 hours. This plot helps identify trends and fluctuations in social media usage across students.

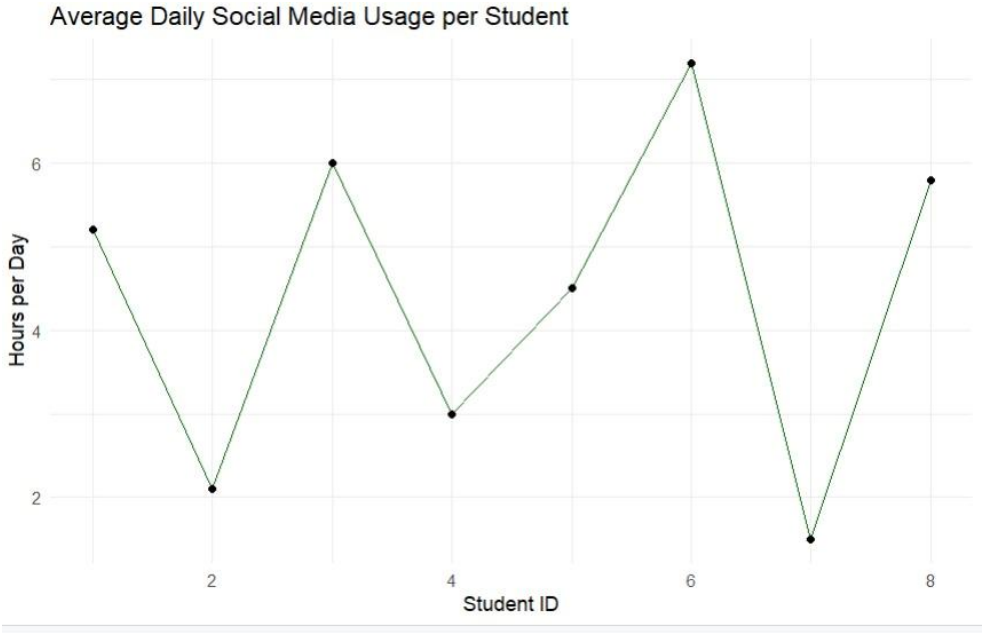

Fig.A.3. Average Daily Social Media Usage per Student

In Figure.A.4. The heat map shows the correlation between age, social media usage, sleep hours, and mental health score. Red colours indicate a positive correlation, while blue colours indicate a negative correlation. Average daily social media usage shows a negative correlation with sleep hours, meaning higher usage is linked to less sleep. Sleep hours have a positive relationship with mental health score, suggesting better sleep is associated with better mental health. Overall, the heat map helps visualize how different student factors are interrelated.

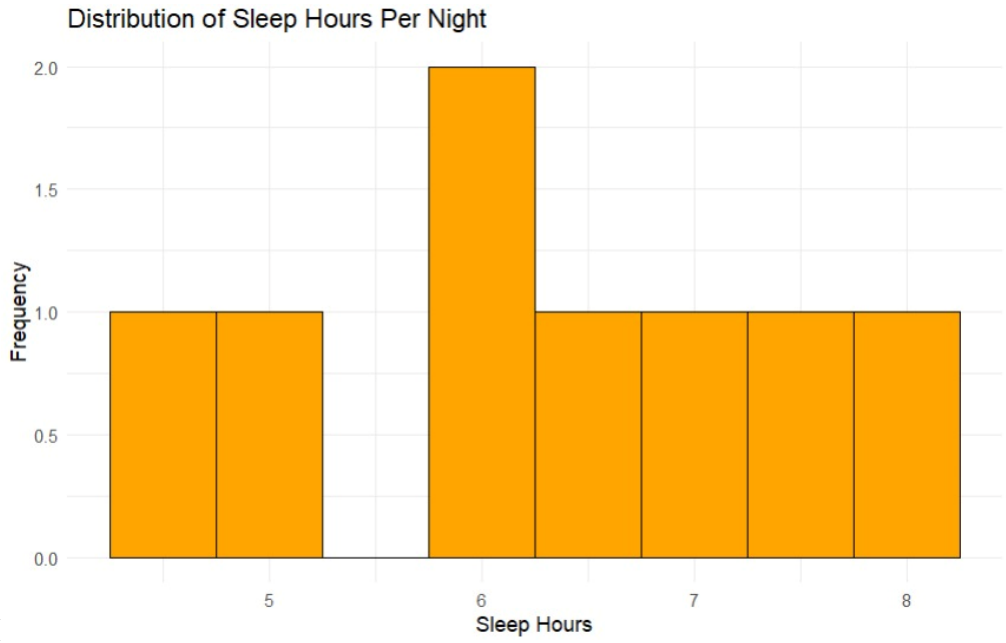

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Fig.A.4. Distribution of Sleep Hours Per Night