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Bibliometric Analysis of Big Data Visualization and Visual Analytics in Social Media Analysis: Techniques, Tools, and Trends

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Abstract

Background of Study: Big data visualization and visual analytics are essential in social media analysis because they help process large and complex data into more understandable information. With this technique, we can identify patterns, trends, and relationships in social media data, such as user interactions and social influences, that are difficult to analyze without visualization tools. This allows for faster, more accurate, and in-depth analysis, and helps with data-driven decision-making in a variety of areas.
Aims and Scope of Paper: The purpose of this paper is to review the literature related to big data visualization and visual analytics in the context of social media, using bibliometric analysis methods to identify current trends, techniques used, and important tools.
Methods: This study used a bibliometric design to analyze the literature in the Scopus database with three main keyword combinations: "Big Data Visualization" AND "Social Media Analysis", "Visual Analytics" AND "Bibliometric Analysis", as well as "Data Visualization" AND "Social Media Analytics". The literature analyzed consisted of journals published between 2015 and 2025. After data collection, filtering is carried out using OpenRefine to eliminate bias and duplication, ensure the accuracy and validity of the data, resulting in objective insights into trends in data visualization and social media analytics.
Results: A summary of key findings on the most widely used techniques and tools in big data visualization on social media.
Conclusion: Closing on the contribution of bibliometric analysis in understanding the development of big data visualization in social media research.

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INTRODUCTION

Background of Study:

The significance of big data visualization and visual analytics in social media analysis cannot be overstated, particularly in the contemporary data-driven landscape. With the exponential growth of social media platforms, vast amounts of data are generated daily, necessitating sophisticated analytical tools to extract meaningful insights. Big data visualization serves as an essential tool in this context, enabling stakeholders to comprehend complex datasets through graphical representations, thereby fostering informed decision-making processes. Big data is characterized by its volume, velocity, and variety, which traditional data management systems struggle to handle effectively. Visual analytics, therefore, presents a pivotal approach that blends data analysis and visualization to facilitate understanding of high-dimensional datasets (Younis et al., 2022). Conventional visualization methods, such as scatter plots and histograms, typically fall short when addressing the vast number of variables present in social media datasets. Advanced techniques, including

multidimensional projections and interactive visual analytics (IVA), have been proposed to navigate the complexities of high-dimensional data, ultimately supporting more insightful analyses (Younis et al., 2022; Grigorieva et al., 2020). Moreover, incorporating methods that merge social media data with census and remote-sensing imagery can enhance situational awareness during crises, such as natural disasters (Kersten & Klan, 2020). Additionally, social media analysis through visualization allows for the identification of sentiment trends and user engagement patterns, which are critical for content strategy development. For instance, analytical models leveraging machine learning algorithms can provide deeper insights into how users interact with content and the effectiveness of various social media campaigns (Zhang, 2024); (Brobbey et al., 2021). By employing sentiment analysis, stakeholders can gauge public opinion and adapt strategies accordingly, as visual analytics tools can translate user interactions into comprehensible formats, thus streamlining the insights extraction process (Brobbey et al., 2021; Kostygina et al., 2020).

Visualization also plays a critical role in effectively communicating findings to stakeholders, making complex data accessible to non-technical audiences. The use of visual network analysis (VNA), for example, helps to unravel the complexities inherent in relational datasets typical of social media (Venturini et al., 2021). This practice enhances the interpretation of relationships between entities, which in turn supports social media strategists in understanding audience behavior and preferences. As organizations become increasingly reliant on data-driven approaches, the integration of robust visual analytics into their strategies is essential for maintaining a competitive edge (Younis et al., 2022; Kumar & Kumar, 2022). The consolidation of insights drawn from visual analytics equips organizations with the capability to respond proactively to emerging trends within social media environments. Through effective data visualization, marketers and data analysts can collaboratively devise strategies that resonate with target audiences, thereby maximizing engagement and impact (Brobbey et al., 2021; Kostygina et al., 2020). This aligns with the dual objectives of enhancing operational efficiency and promoting effective communication between the organization and its stakeholders. Big data visualization and visual analytics are indispensable in the realm of social media analysis. They not only facilitate the management of extensive and intricate datasets but also empower organizations to derive actionable insights that are critical for strategic planning and decision-making. As the reliance on social media data continues to evolve, the importance of advanced visual analytics will only increase, underscoring the need for continued research and development in this domain.

LITERATURE REVIEW

The landscape of social media has evolved significantly with the advent of big data visualization and visual analytics, providing critical insights into public behavior and sentiment. As social media platforms gain traction, they have become sources of massive real-time data generation, presenting new avenues for social science research and business strategy formulation. This transformation is underpinned by various analytics trends that facilitate the understanding and presentation of complex data sets derived from user interactions on social media platforms. Big data encompasses diverse forms of information, including structured and unstructured data such as text, images, and videos from multiple channels (Tenya, 2024). The rapid pace at which social media generates data often classified under the "three Vs" of big data: volume, velocity, and variety has necessitated innovative visualization tools that can capture and portray this data in interpretable formats (Hamdam et al., 2021). For instance, Wang et al. emphasize the role of social media in understanding societal trends through sentiment analysis, highlighting its potential for real-time monitoring of public attitudes (Wang et al., 2025). By leveraging such capabilities, organizations can enhance their responsiveness to emerging trends and public opinions regarding significant events or products.

In the realm of visual analytics, social media analysis has shifted from traditional sentiment monitoring to more sophisticated predictive analytics utilizing machine learning and artificial intelligence (AI) tools. These techniques allow for the identification of trends within extensive data sets, enabling businesses and researchers to forecast consumer behavior and engagement factors with higher accuracy (Hussain et al., 2021); (Zhan et al., 2021). This trend is especially prominent in sectors such as retail, where understanding consumer interactions on platforms like Facebook can

significantly influence marketing strategies (Lee, 2020). The framework developed by Zhan et al. for enhancing operations through social media analytics illustrates how these visual tools help organizations streamline decision-making processes based on competitor and customer data analysis (Zhan et al., 2021). Moreover, the integration of spatial analytics in social media data, particularly during crisis situations, has opened doors for visual analytics to provide critical insights regarding public response and behavior across different geographical regions (Kersten & Klan, 2020). By fusing data from social media with census and remote-sensing datasets, organizations can visualize complex interactions and patterns that would otherwise remain obscured. The ability to present these insights visually is crucial for effective communication, especially to non-technical stakeholders who may not readily understand raw data (Mameli et al., 2022).

Challenges remain in extracting and quantifying qualitative data from social media. The inherent unstructured nature of social media data poses difficulties in ensuring representativeness and relevance of the insights derived (Mameli et al., 2022). However, ongoing advancements in natural language processing and machine learning are enabling more robust analysis frameworks that harness the strengths of social media data to yield actionable insights (Xu et al., 2024; Amin et al., 2024). As organizations increasingly adopt these technologies for social media analytics, the focus on visual analytics is expected to grow. There is a clear trend towards employing interactive visualizations that allow for real-time data exploration and dynamic interaction with data (McGuirk, 2021), enabling businesses to adapt strategies proactively as new trends emerge. Big data visualization and visual analytics play a pivotal role in analyzing social media data, transforming the way organizations understand consumer behavior and societal attitudes. By employing advanced analytical methods and tools, stakeholders can leverage vast amounts of data to enhance strategic decision-making, respond to public sentiment with agility, and ultimately gain competitive advantages in their respective fields. Bibliometric analysis in the context of big data visualization for social media is very important because it can provide in-depth insights into research trends and technological developments in this field. With bibliometric analysis, we can map the relationships between key topics, such as big data visualization, social media analytics, and machine learning techniques, as well as how those topics have evolved over time. In addition, this analysis allows the identification of important publications and the contributions of leading researchers in this field, which can be helpful in understanding the direction of further research. In the context of social media, enormous and complex volumes of data require effective visualization methods to extract relevant information. Therefore, by conducting a bibliometric analysis, we can identify the techniques and tools that are most often used in social media data visualization, as well as evaluate their effectiveness. This analysis also allows researchers and practitioners to understand the application and impact of recent innovations in big data visualization for social media, as well as open up opportunities for further collaboration between the various disciplines involved.

The aim of this study was to identify trends that exist in the literature related to big data visualization and visual analytics, as well as to understand how these tools and techniques are used in social media analysis. By analyzing the relevant literature, this study aims to provide a comprehensive overview of recent developments in the field of data visualization, including the utilization of advanced techniques such as machine learning and visual analytics to handle the large volumes of data generated by social media platforms. The study also focuses on identifying the most frequently used tools in big data visualization and social media analysis, as well as exploring their effectiveness in uncovering social insights that can make important contributions to real-world research and applications. By understanding emerging trends and techniques, this research is expected to contribute to advancing the use of data visualization in social media analysis and provide guidance for researchers and practitioners to choose the most effective methods for big data analysis in this digital age.

METHODOLOGY

This study uses a bibliometric research design that aims to analyze literature or articles contained in the Scopus database, using three main keyword combinations, namely: "Big Data Visualization" AND "Social Media Analysis", "Visual Analytics" AND "Bibliometric Analysis", as well as "Data Visualization" AND "Social Media Analytics". This combination of keywords was chosen to explore

the latest trends and developments in the areas of big data visualization, visual analytics, and social media analytics. The type of literature selected in this study was journals published between 2015 and 2025, to ensure that the data analysed covered relevant periods and reflected the latest developments in the topic. After data collection, data filtering is carried out to identify and eliminate possible biases or duplicates that may affect the results of the analysis. The application used for filtering author keyword data is Openrefine. This filtering process is important to ensure the validity and accuracy of the data used in this study, so that the results obtained can provide more objective and credible insights into the literature trends related to data visualization and social media analytics. To analyze the bibliometric data obtained using Vos Viewer.

RESULTS AND DISCUSSION

Results:

The following is an overview of the data taken from the filtered scopus database.

Table 1. Overview Data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2015:2025
Sources (Journals, Books, etc)	106
Documents	123
Annual Growth Rate %	-18.77
Document Average Age	4.88
Average citations per doc	26.02
References	1147
DOCUMENT CONTENTS	
Keywords Plus (ID)	1082
Author's Keywords (DE)	1348
AUTHORS	
Authors	837
Authors of single-authored docs	0
AUTHORS COLLABORATION	
Single-authored docs	0
Co-Authors for Doc	12.1
International co-authorships %	19.51
DOCUMENT TYPES	
article	123

From the data above, some information can be taken:

1. Main Information About Data

Timespan (2015:2025): The data spans from 2015 to 2025, indicating that the research or publications analyzed focus on literature published within this period. Sources (Journals, Books, etc) (106): There are 106 sources used in this study, which could include academic journals, books, and other relevant sources. Documents (123): A total of 123 documents are analyzed in this study. This indicates the total number of articles or publications considered. Annual Growth Rate (-18.77%): This shows a significant decline in annual publication growth, with a percentage decrease of -18.77%. This could reflect a decrease in the number of publications in this field over recent years. Document Average Age (4.88): The average age of the documents is 4.88 years, meaning most of the publications analyzed are relatively recent, with a few older documents. Average Citations per Document (26.02): The average number of citations per document is 26.02, indicating that these documents are well-regarded and have a significant impact in their field. References (1147): A total of 1147 references are cited across all documents, suggesting a high level of interconnectivity between the documents and a large body of literature being referenced.

2. Document Contents

Keywords Plus (ID) (1082): There are 1082 additional keywords (Keywords Plus) used, indicating a wide range of topics or subtopics related to the research. Author's Keywords (DE) (1348): The number of keywords defined by the authors themselves is 1348, showing that the authors provided many keywords to describe the topics discussed in the documents.

3. Authors

Authors (837): There are 837 authors involved in the publications analyzed. This suggests that the topic being discussed involves contributions from a large number of researchers. Authors of Single-authored Docs (0): There are no documents authored by a single person, indicating that all publications in this dataset are collaborative.

4. Authors Collaboration

Single-authored Docs (0): There are no single-authored documents, which shows that all the publications are collaborative in nature. Co-Authors per Document (12.1): On average, there are 12.1 authors per document, indicating a high level of collaboration among authors. International Co-authorships % (19.51%): 19.51% of the co-authorships involve international collaboration, showing that there is some degree of international research collaboration on this topic.

5. Document Types

Article (123): All the documents analyzed are articles, suggesting that the research focuses on academic article publications.

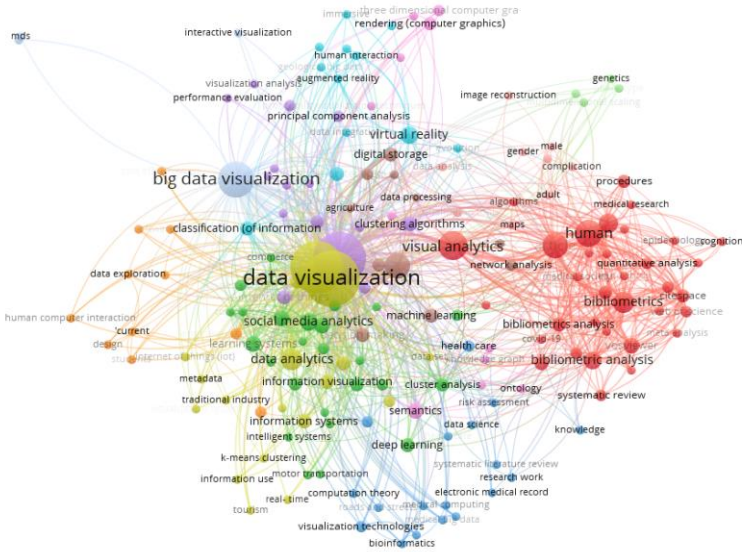

Figure 1. Network Visualization

Figure 1 above is the result of network visualization generated using VOSviewer, a tool for bibliometric analysis and data visualization that is often used to illustrate the relationships between various terms or concepts in the academic literature. Here's a comprehensive explanation of the image.

1. Overview Network Visualization

In this image, we can see different terms or keywords that are interconnected with each other, which indicate a relationship or co-emergence in the scientific publication analyzed. Large dots represent the main keywords that appear frequently, while the lines connecting the dots indicate the relationship or association between the words. Each color represents a group of keywords related to a particular topic, and the dot size describes the frequency with which the term appears in the data being analyzed.

2. Dominant Areas and Themes

Big Data Visualization: The large yellow dot in the center depicts Big Data Visualization as the main concept in this image. This term is connected with many other keywords, such as data analytics, data exploration, data processing, and data visualization. This keyword shows how important big data visualization is in the context of data analysis, both in research and practical applications. Visual Analytics: The group of green dots in the upper right represents the terms visual analytics, which are closely related to big data visualization and machine learning. This signifies that visual analytics is often used in big data analysis and is applied by using techniques such as machine learning to identify patterns and trends in big data. Social Media Analytics on the left, there is a group of keywords that include social media analytics and social media analysis which are also connected to data analytics and visual analytics. This shows a strong relationship between social media analytics and data visualization techniques in understanding user behavior and social trends through digital platforms.

3. Relevance to Bibliometrics

Bibliometric Analysis: In the red section, we can see the keywords bibliometrics and bibliometric analysis that are closely related to systematic literature review. It shows that bibliometric analysis is used to map the literature related to data visualization and visual analytics, as well as identify trends and developments in these areas. This close relationship also leads to bibliometric mapping, which is a method of describing the relationships between concepts found in the relevant literature. Systematic Literature Review (SLR): Systematic Literature Review is a method used to analyze and synthesize existing literature on specific topics, such as data visualization and analytics. This image shows the strong linkage between bibliometric analysis and SLR research which allows for a deeper understanding of research developments in the field of big data visualization.

4. Emerging Supporting Keywords

In addition to key terms such as big data visualization and visual analytics, there are many other terms that indicate relevant supporting topics, such as: Machine Learning: Used in data visualization to recognize patterns and trends in big data. Human Interaction: Demonstrates the relevance of human interaction in using data visualization, perhaps in the context of using device-based visualization or user interface. Virtual Reality (VR) and Augmented Reality (AR): Technologies that are increasingly developing in data visualization, especially in the context of immersive big data applications. Health Care: Demonstrates the application of data visualization in the health field, such as in medical data analysis. Data Science: It is a discipline that is often connected with visualization techniques to process big data and find useful insights.

5. Insights That Can Be Gained

From this visualization, we can draw conclusions about several things, namely Big Data Visualization and Visual Analytics are very important topics in research related to big data and social media analytics. Bibliometrics is used to understand how the development of the field of data visualization

is measured through the analysis of citations and publication trends. The use of Machine Learning and AR/VR in big data visualization is increasingly dominating, which indicates the integration of new technologies in strengthening big data analytics.

6. Relationship Between Concepts

Big Data Visualization has a strong relationship with concepts such as social media analytics, data processing, and machine learning. This shows that big data visualization is not just about displaying data, but also about deeper processing and analysis to gain valuable insights. Bibliometrics and systematic literature review are used to explore the literature and research trends in data visualization and visual analytics, which supports further development and innovation in this area. Thus this network visualization gives an idea of how Big Data Visualization and Visual Analytics are evolving and interrelated in various disciplines and applications. Bibliometric analysis is becoming a very useful tool for tracking research progress and understanding trends in this field.

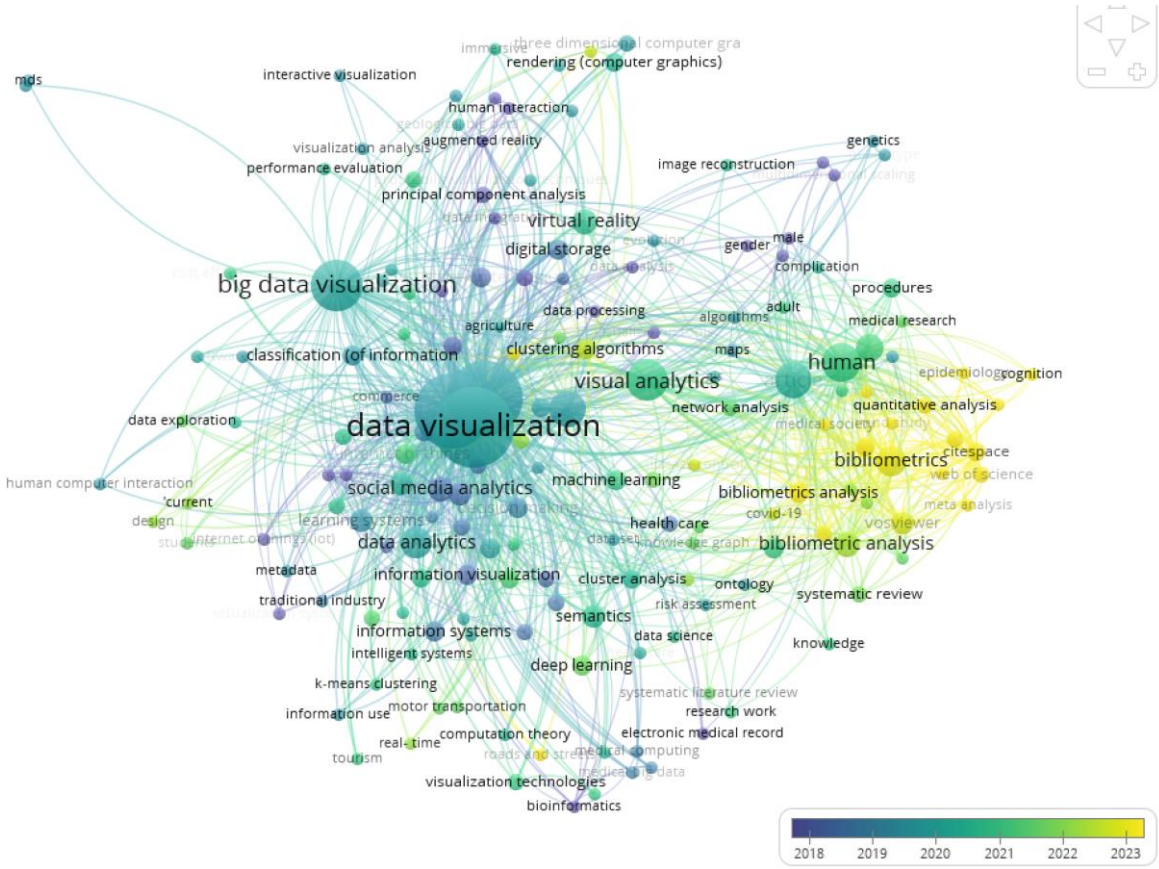

Figure 2. Overlay Visualization

Figure 2 above is the result of an Overlay Visualization generated by VOSviewer, which is used to display bibliometric data and illustrate the temporal relationships between terms in the literature being analyzed. Overlay visualization combines the temporal aspect (time) with the relationships between keywords in the network, providing an idea of how the topic has evolved over time.

1. Time as an Overlay Aspect

In this image, the colors on the dots representing the keywords indicate the year of publication of the article containing the term. Colors range from blue (for earlier years) to yellow (for newer years). It provides insight into the evolution of research topics and trends over time: Blue (2018 and earlier): Indicates that the term is more commonly found in the older literature (2018 or earlier). Green (2019-2020): Indicates the appearance of keywords in newer literature. Yellow (2021-2023): Signifies terms that appear more in newer research, reflecting emerging trends and topics.

2. Grouping and Temporal Trends

Big Data Visualization & Data Visualization: The large green and blue dot in the middle depicts Big Data Visualization and Data Visualization as the main topics. The newer use of colors (yellow and green) in this term suggests that data visualization is still a highly relevant and growing topic, especially related to big data which is constantly being used in various disciplines. Visual Analytics: The term visual analytics has also undergone significant development in recent years. This can be seen from its color transition from blue (earlier) to yellow (newer), suggesting that the use of visual analytics in the context of big data and social data continues to evolve as technology advances. Social Media Analytics: This keyword also appears to be evolving with the advent of green and yellow, suggesting that social media analytics has increasingly become a focus of research in recent years, especially in analyzing data from ever-evolving social platforms. Bibliometrics and Bibliometric Analysis: The dots related to bibliometrics and bibliometric analysis are yellow and green, indicating that bibliometric analysis has become a rapidly growing area in recent years, especially in the context of literature mapping and publication trend analysis in the field of data visualization.

3. Supporting Keywords and the Evolution of Their Research

In addition to the main terms mentioned above, there are a number of keywords that have also appeared and evolved over time: Machine Learning: The green and yellow colors of this term indicate that machine learning is becoming increasingly connected to data visualization and analytics as the adoption of machine learning techniques to identify patterns in big data. Health Care: There is an increased focus on the application of data visualization in healthcare, which is reflected in the colors green and yellow. This shows that the use of visual analytics in the medical field is increasing, particularly in medical data visualization and prediction. Human Interaction: Although it appears in older shades of blue, the term is still relevant in data visualization, reflecting the importance of human interaction in the use of visualization tools.

4. Linkages Between Concepts

Through the visualization overlay, we can also see how keywords are connected to each other in different times. For example, Big Data Visualization and Data Visualization are closely linked to Social Media Analytics and Machine Learning, reflecting the relationship between data visualization and the use of new analytics techniques, as well as their application in the context of social media and big data.

5. Insights Gained from Overlay Visualization

Emerging Topics: Topics such as Visual Analytics, Bibliometrics, and Social Media Analytics show rapidly growing trends in recent years, with increased attention to the use of machine learning, big data, and data-driven visualization in social analytics and other industries. Changes in Research Focus: From year to year, the focus of research is seen shifting, with the increasing use of new technologies such as machine learning, virtual reality (VR), and augmented reality (AR) in data visualization and analytics. Linkages Between Research Areas: Big data visualization and visual analytics continue to be closely related to various other fields, such as healthcare, data science, machine learning, and social media analytics. Research in this area tends to be more dynamic, combining new technologies and practical applications across a wide range of disciplines.

From the data Overlay Visualization above provides important insights into how topics in big data visualization and visual analytics have evolved over time. Recent trends show an increase in the adoption of machine learning and social media analytics, as well as the growing development of new technologies such as VR and AR in the context of data visualization. Bibliometric analysis is an effective tool for understanding the direction of research development and how new topics emerge and evolve along with technological advances and industry needs.

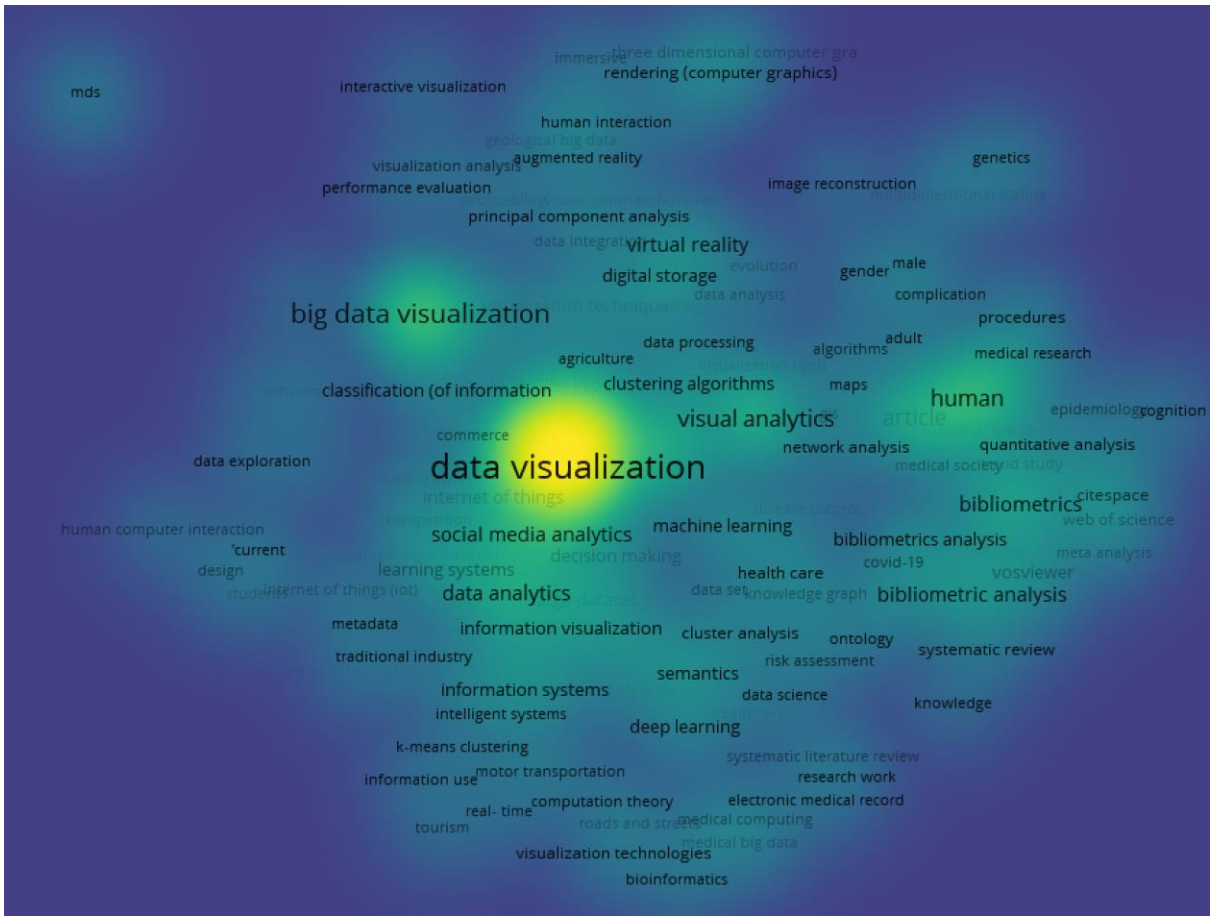

Figure 3. Density Visualization

Figure 3 above is the Density Visualization generated by VOSviewer, which is used to display the density or frequency of keywords related to a particular topic in a bibliometric network. This visualization describes the intensity of a keyword or term based on its appearance in the literature being analyzed, with denser or brighter areas indicating keywords that are more frequently used or more relevant in a given context.

1. Density Visualization Explanation

In this image, color indicates the density or intensity of the relationship between terms in the analyzed bibliometric data. Lighter colors indicate high density, while darker colors indicate low density. Yellow (Lightest): The bright yellow area, which is in the center of the image, describes the highest density of terms associated with Big Data Visualization and Data Visualization. This signifies that this topic is very dominant in the literature analyzed, indicating a high frequency in related publications. Light Green to Blue Colors: Terms like Visual Analytics, Bibliometric Analysis, Social Media Analytics, and Machine Learning are seen in green and light blue. This shows that these topics are also discussed quite often in the literature, although not as dominant as the main topic (Big Data Visualization). Dark Blue and Dark Green Colors: Areas with dark blue and dark green colors, located outside the center, show lower density. This includes terms such as Human Interaction, Data Exploration, Information Systems, and Virtual Reality, which while important, are not as popular as the main keywords in data visualization.

2. Related Main Topics

Big Data Visualization & Data Visualization: A very bright central point (yellow) illustrates that Big Data Visualization and Data Visualization are very dominant topics in the literature. Big data visualization is closely related to many related concepts such as Data Analytics, Machine Learning, and Social Media Analytics, all of which have high density (green and light blue colors). Visual Analytics: This term also has a high level of density, connected to Big Data Visualization and Data Visualization. This density suggests that visual analytics is one of the key techniques used to visualize

big data and identify patterns and trends in that data. Bibliometrics & Bibliometric Analysis: The bright yellow terms in the upper right indicate that Bibliometrics and Bibliometric Analysis have a high density in the literature being analyzed, indicating that bibliometric analysis is used to map relationships and developments in the topics of data visualization and analytics.

3. Supporting Keywords and Density

Several other keywords also show great relevance, albeit with lower density: Social Media Analytics: Although the density is not as high as Big Data Visualization, Social Media Analytics is still a fairly relevant topic and is often discussed in the context of data visualization and analytics. This is reflected in the green and light blue colors that indicate that the use of visualization to analyze social media data is growing rapidly. Machine Learning: With its high density, Machine Learning plays a critical role in big data analytics, especially for identifying patterns and trends from the visualized big data. This high density demonstrates the relevance of this technique in data processing and analysis. Health Care: Health Care is also emerging as a growing area, with high density in some areas, suggesting that data visualization is also increasingly being applied in medical and health data analysis.

4. Associations and Relationships Between Topics

Big Data Visualization and Data Visualization are highly connected to many other topics, including Social Media Analytics, Data Analytics, Machine Learning, and Visual Analytics, which show that data visualization is a very useful tool in a variety of disciplines, from social media to data science. Bibliometrics and Bibliometric Analysis are closely related to Systematic Literature Review and Research Work, which demonstrate the use of bibliometric analysis in mapping the literature and identifying research trends in data visualization. Insights from Density Visualization. High Density on Big Data Visualization: The high density center suggests that Big Data Visualization and Data Visualization are very active areas of research today, covering many aspects ranging from visualization techniques to practical applications in various disciplines. Supporting Topics: Machine Learning, Social Media Analytics, and Bibliometrics show that there is a close relationship between data visualization and new analytical techniques, such as machine learning, as well as applications in social media analysis and bibliometric analysis. Evolving Trends: This data shows that topics such as Machine Learning and Bibliometrics are increasingly relevant in research on big data visualization and visual analytics.

From this Density Visualization data, it provides an overview of the density or frequency of use of terms in the analyzed literature. The main topics of Big Data Visualization and Data Visualization dominate, with many other keywords, such as Visual Analytics, Social Media Analytics, and Machine Learning, showing a close relationship with data visualization and analytics techniques. This reflects the latest developments in the field of data visualization, with new technologies increasingly being applied in big data analytics and social.

Discussion:

Big data visualization and visual analytics have increasingly emerged as dominant techniques in social media analysis, largely due to their ability to distill vast amounts of unstructured data into meaningful insights. This transformation in the analytical landscape is driven by the rapid proliferation of social media platforms and the accompanying increase in data generation. Recent years have witnessed an expansion in the utilization of these tools, as organizations seek to leverage insights for strategic decision-making and crisis management. The essence of big data visualization lies in its capability to convert complex, loosely structured data from social media into interpretable formats. Dalmau & Cladera (2021) highlight how sophisticated visualization methodologies grounded in spatial statistics can effectively analyze tourism activity as captured through social media interactions. Such approaches enable the distillation of data into visual representations that enhance understanding for policymakers and urban planners, informing sustainable urban management strategies. The principles of the grammar of graphics aid in making these visualizations reproducible and accessible, enhancing their utility in real-world applications. Moreover, the significance of visual analytics extends into governance and policy-making, where real-time data

feeds from social media can dramatically influence decision-making processes. Hossin et al., (2023) discuss how big data-driven tools foster smart governance through the provision of visual analytics. These tools allow policymakers to monitor educational outcomes and adapt strategies to improve learning experiences, showcasing the versatility of visual analytics across various fields. In the educational context, learning analytics platforms can integrate social media-derived data to yield actionable insights that contribute to personalized student experiences, as reported in their findings. Furthermore, the rise of sentiment analysis exemplifies the practical applications of visual analytics in capturing public opinion during critical periods, such as the COVID-19 pandemic. Samuel et al., (2020) emphasize the utility of big data and sentiment analysis tools in gauging public sentiment regarding reopening procedures in the U.S. The integration of natural language processing (NLP) with social media data allows organizations to tap into the collective sentiment of users, providing a critical understanding of societal attitudes during periods of uncertainty and rapid change.

The advancements in visualization methods also reflect broader technological developments. While (Lamperti et al., 2023) focus on the integration of deep learning techniques in ecological applications, they highlight the growing importance of utilizing advanced data interpretation techniques that can enhance visualization capabilities. Although their research is more centered on ecological data, it parallels trends in social media analysis where machine learning plays a crucial role in transforming how data is visualized and interpreted. the increase in big data visualization and visual analytics adoption in social media analysis reflects an ongoing shift towards data-driven decision-making across diverse sectors. As organizations continue to navigate complex data environments, the utilization of advanced visualization tools demonstrates the necessity of translating vast datasets into actionable insights. The continued evolution of these techniques promises to further enhance our understanding of public sentiment and engagement in real-time, ensuring that stakeholders remain responsive in an increasingly data-centric world.

Implications:
The implications of these findings for researchers and practitioners in the field of data visualization and social media analytics are significant, as they show that current tools and techniques, such as visual analytics and big data visualization, can improve the efficiency and depth of analysis in understanding user behavior as well as emerging trends in social media. For the researchers, these findings provide insights to further explore the use of machine learning in processing large social data, as well as utilize interactive visualizations to explore the relationships between elements in social networks. Meanwhile, for practitioners, these results emphasize the importance of adopting advanced visualization and analytics tools for faster and more accurate data-driven decision-making, especially in the areas of marketing, online reputation management, and sentiment analysis. These findings also encourage increased collaboration between researchers and practitioners to develop more innovative and effective applications in leveraging big social data.

Research Contribution:
The contribution of this bibliometric research to the understanding of research trends in the field of big data visualization and visual analytics is essential, as it provides a comprehensive overview of the development and direction of key topics in this field. Through bibliometric analysis, this study managed to identify the patterns of occurrence of the most widely used keywords, techniques, and tools, as well as changes in trends over time. This allows researchers to understand how key concepts, such as big data visualization, visual analytics, and social media analysis, interconnect and evolve. This research also provides insight into the latest technological advancements, such as machine learning and interactive visualization, which are increasingly dominating research related to data visualization. Thus, this research makes a significant contribution in directing further research, as well as providing a solid foundation for the development of new tools and techniques that can be used in big data analysis in various fields, including social media and other industries.

Limitations:
The limitation of this study lies in the limitation of the literature which only includes journal publications available in the Scopus database, so it is possible that there are some relevant articles

that would not have been detected if they had not been published on the platform. Additionally, the study only focused on a specific time period between 2015 and 2025, which may not include some important studies that are older or that have recently been published after that period. These limitations may affect the completeness of trend mapping and developments in the areas of big data visualization and visual analytics, as important innovations or changes in these areas may not be fully covered. In addition, the data filtering process used to eliminate duplication and bias can also reduce the amount of relevant literature, despite efforts made to minimize this.

Suggestions for Future Research:
The suggestion for further research is to expand the scope of the analysis to include more recent literature, especially articles published after 2025, in order to get a more complete picture of the latest trends and developments in the field of big data visualization and visual analytics. In addition, further research can also explore other analytical techniques, such as deep learning or natural language processing (NLP), which are increasingly being applied in social data analysis and big data visualization. Further research could include also analyzing data from other, more specific social media platforms or expanding the use of databases other than Scopus to obtain a more diverse literature. By expanding this approach, subsequent research is expected to provide more comprehensive insights into the latest innovations and techniques in visual analytics and their application across various sectors.

CONCLUSION

This research provides a deeper insight into the developments and trends in the use of big data visualization for social media analysis, highlighting the importance of tools and techniques that are increasingly dominant in the literature, such as visual analytics and big data visualization. These findings show how these techniques are increasingly being applied to understand user behavior, interaction patterns, and social trends at scale. In addition, this study emphasizes the crucial role of machine learning and interactive visualizations in increasing the effectiveness of social media analytics. The findings also offer a direction for further research, which could expand the scope of the techniques and tools used. This study found that VOSviewer was the most frequently used tool, while machine learning and interactive visualization emerged as dominant research trends.

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AUTHOR CONTRIBUTION STATEMENT

The first author, is responsible for the research design, data collection, bibliometric analysis, and writing the initial draft of the article. The second author contributes to the process of filtering data, compiling methodologies, and conducting in-depth analysis of relevant literature. The third author, provides critical input in the interpretation of the results of the analysis and revision of the article, as well as plays a role in the preparation of conclusions and suggestions for further research. All authors have participated in the discussion and revision of the article to ensure the scientific quality and integrity of the study.

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