

Automatic Processing of Bibliometric Data: Newest Literature Analysis Algorithms

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ABSTRACT

Automated processing of bibliometric data has become an integral element in understanding and measuring the impact of scientific research as well as trends in the academic literature. The purpose of this study was to evaluate and compare current literature analysis algorithms to identify advances in automated processing of bibliometric data. This study explores the use of the latest algorithms in literature analysis which includes identification of research themes, research network analysis, citation impact evaluation, and development of literature recommendation algorithms. This research exposes innovative applications that utilize the latest technologies in text processing and data analysis to assist researchers, libraries, and information professionals in revealing deep insights from the latest scientific literature. The results of this study illustrate that the automated processing of bibliometric data with the latest algorithms paves the way for a deeper understanding of the development of scientific research, its impact in the scientific community as well as improving bibliometric analysis methods and tools by integrating the latest algorithms, so that scientific research and trends can be identified more accurately and relevantly. The study could use more sophisticated multifaceted techniques to analyze simple productivity measures based on article citations. This research is also able to recognize and describe the development of new science and technology.

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INTRODUCTION

Scientific literature is the basis of knowledge in the scientific community, and an understanding of the trends, impacts, and evolution of research across multiple disciplines. In this study the use of algorithms will be discussed with literature analysis techniques with bibliometric data processing using the latest developments in text processing, data analysis, and artificial intelligence. This starts from making informative decisions in research, library management, and evaluating research performance. Bibliometric analysis has become an important approach in extracting insights from the scientific literature. Analyzing several

publications requires statistical methods, one of which is bibliometrics. Data analysis of bibliometric studies uses quantitative and qualitative clues such as author name, year of publication and keywords. Bibliometric studies are branches of science that analyze and evaluate scientific publications and related information. It involves the use of statistical and informatics methodologies to assess the production, citation, and dissemination of science in the scientific literature. Bibliometric studies can be used to measure the performance and contributions of individuals, institutions, and fields of science, as well as to understand the interactions and relationships between fields of science and publications. It can also assist in the identification and evaluation of trends and issues in the scientific literature. Some applications of bibliometric studies include citation network analysis, cluster analysis, and visibility analysis. Results from bibliometric studies can be used by researchers, government, and industry to understand developments and contributions in the field of science and to determine future research directions (Pratiwi, 2020).

One way to evaluate scientific journals is to use bibliometric analysis. Bibliometrics is currently a research method widely used by librarians or professionals to apply mathematical and statistical techniques to measure the results of certain publications. Bibliometrics are based on rules and principles that allow its users to conduct academic analysis in the field of interest. Bibliometrics can be interpreted as a statistical tool that can map and measure metrics, information and data published in the form of documents. The results can improve the understanding of science and technology research and management. Thus, bibliometric studies can measure the productivity levels of research centers, identify prolific individual authors, or uncover potential topics for further research (Muhammad et al., 2023).

Bibliometric research is a research method that measures and evaluates, through quantitative analysis, the scientific work contained in publications such as journals, books, and conferences, and the way scholars in a particular discipline use those publications. Bibliometric research uses bibliographic information such as author, title of publication, place of publication, and year of publication to obtain numerical and statistical information that helps understand patterns of development and trends of scientific organizations. In bibliometric research, a number of commonly used indices, such as citation index, journal impact factor, h-index, and g-index, can be used to measure the productivity, efficiency, and quality of scientific work or facilities of a particular researcher. Bibliometric research can provide important information to identify trends and trends in certain scientific fields and help strategic decision making in the development of scientific research and publishing (Wahyu & Budianto, 2023).

In searching for data sources, researchers extract data sources from Google Scholar using the Publish or Perish (PoP) application. According to Wahab et al. (2021), Google Scholar is an Online search engine that can easily index the full text or metadata of academic documents from various publications. Publish or Perish (PoP) is a software that searches and analyzes academic citations from various data sources. Researchers search and analyze information in the Google Scholar database and use evaluative and descriptive document analysis (Muhammad et al., 2023)

In the rapidly evolving age of digital information, the number of scientific publications continues to be overwhelming, making literature analysis even more challenging. Therefore, it is important to continuously develop and update the algorithms used in the automated processing of bibliometric data to ensure that we can identify the latest research trends, research impact, and relationships between researchers and scientific publications. Automated processing of bibliometric data is gaining importance as the number of scientific publications

increases as it leaves researchers and information professionals with the increasingly difficult task of managing, understanding and extracting insights from this large volume of information. Automatic processing helps in coping with this task in a more efficient manner; Automated processing allows for more accurate and fast identification of research trends. It helps researchers, publishers, and information professionals to understand the latest developments in their field.; Automated processing allows evaluation of research impact by identifying the most cited scientific works and measuring their influence in the scientific literature.; In the dynamic world of science, automated processing allows exploration of the latest literature to gain up-to-date insights into the latest research and developments. The main challenges of bibliometric analysis methods are in terms of diversity of data sources, data quality, identification of similar authors, complex network analysis, security and ethics, changes over time, varying terminology. In this context, education and digital literacy are very important. With the right knowledge and skills, we can leverage programming algorithms to create more efficient and effective solutions to various everyday problems. In addition, we can also ensure that the use of algorithms is done in an ethical and responsible manner. In addition, programming algorithms also allow personalization of user experience in various applications and services. For example, Recommendation algorithms are used by music and movie streaming platforms to provide suggestions tailored to users' tastes. These algorithms analyze data about users' listening or viewing habits, and use this information to create customized playlists or watchlists (Pulungan et al., 2023).

Based on the above problems, researchers want to manage, analyze, and understand bibliometric data on Algorithms in recent studies over the last 3 years which will include references, scientific publications and information related to the use of the latest Algorithms. Thus, this research will increase efficiency and process large volumes of data semi-quickly and accurately by exploring and analyzing the use of the latest algorithms in automated processing of bibliometric data. Researchers will explore developments in research theme identification, research network analysis, citation impact evaluation, as well as the development of literature recommendation algorithms. The research also aims to provide an in-depth look at how current technologies can be used to deal with the challenges faced by the scientific community in understanding the current literature.

Algorithms are useful tools in processing current problems based on research that has been reviewed by researchers, generally because they contain a collection of systematic or sequential steps to achieve a desired result. Also, the algorithm consists of a wide array of applications that will be implemented in the process of arranging elements in a certain order (Pratiwi, 2020).

Solving various problems with Algorithms in the latest research, making the existence of Algorithms very useful in processing or accessing data or variables related to solving these problems. In an Algorithm, a variable is an identifier formed from a collection of characters and serves to store data in which its value can be changed. Or in other words, the variable can be said to be a reservoir of data whose contents can change. This makes algorithms in future studies will appear with diverse contexts tailored to their respective problems and uses (Nengsih, 2022).

By continuously innovating and improving the methods of automated processing of bibliometric data, research can provide deeper and relevant insights in the development of scientific research. Through this research, the researchers hope to make a valuable contribution to the development of the bibliometric field and help researchers, information

professionals, and decision makers understand and utilize the scientific literature more effectively.

METHOD

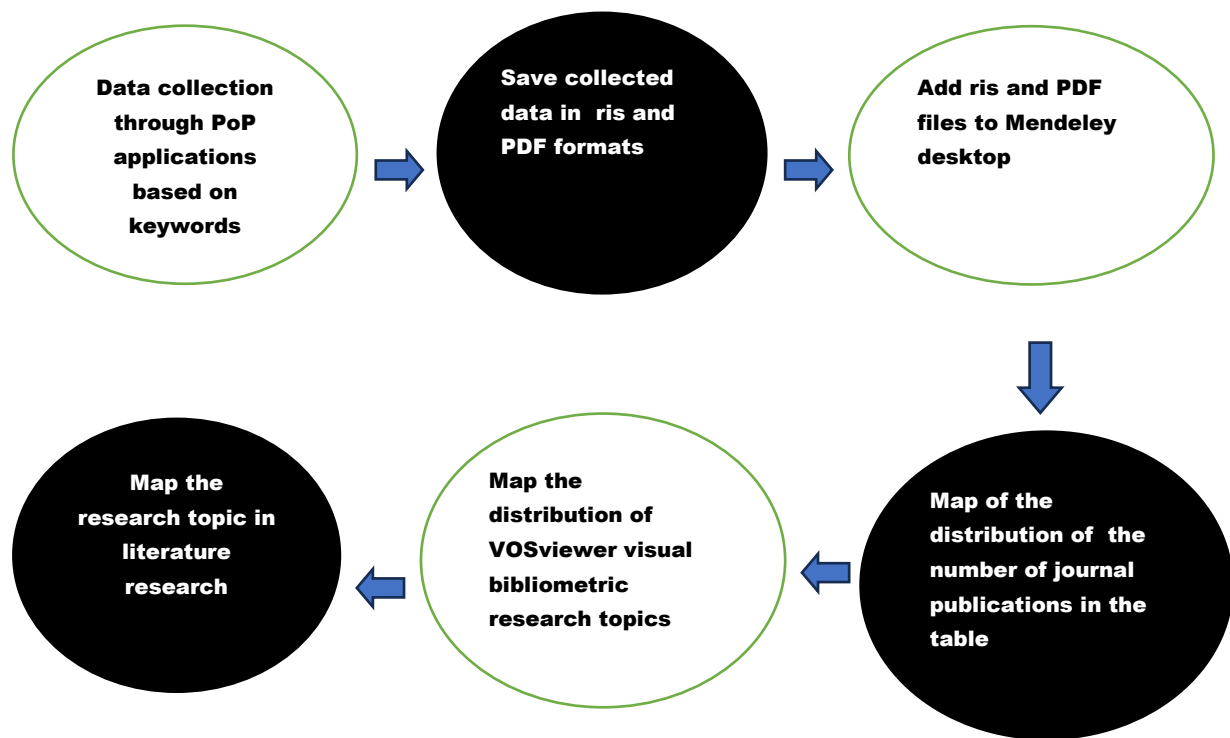


Figure 1. Research Procedure

The research method and approach used in this study is *mixmapethod*, which is a quantitative method in bibliometric studies and qualitative literature review studies. The purpose of this research is the development of Algorithms. The data used is secondary data. Scientific journal articles on automated processing of algorithm-related bibliometric data are used as data.

Data collection sources come from national journals through the website *Google Scholar* rather than PoP (*Publish or Destroy*). Data analysis tools using *Microsoft Excel*, *Mendeley Desktop* and PoP software (*Publish or Destroy*). Data collection techniques include: (1) opening a website *Google Scholar* and search journals based on title word categories with keywords "Literature Analysis Algorithm", "Impact of Algorithm Development and Research Direction" for the period 2020-2023; (2) collect journal title data in *Microsoft Excel* and identify duplicate journal titles, journal author names, publication dates and journal classifications as well as journal publishing sources. ; (3) download the PoP file (*Publish or Destroy*) from PDF (*Portable Document Format*) of all journals in which data were collected; then (4) add PoP and PDF data files to desktop *Mendeley*.

Data analysis techniques include: (1) algorithmic mapping of journal publications using *Microsoft Excel* From *Mendeley Desktop* based on the year published, name of the journal author, publication date, and journal and journal publication source; (2) Map the visualization results *Brave Bibliometrics* and Journal Publication Trends with Algorithmic Software *VOSviewer* (*Visualization of similarities*) By *Group* then the number of titles; and (3) Map research topics around algorithms using literature review studies (Rev. et al., 2023).

RESULTS AND DISCUSSION

Results

There are 10 national journals based on the results of data collection for the 2020-2023 period. With the following details:

Table 1. Algorithm-Related Journal Data

Rank	Heading	Year	Author
1	Predict the development of the number of electricity customers based on customer area using the backpropagation algorithm	2020	Saragih, I., Hartama, D., & Wanto, A.
2	Development of a Geographic Information System for Fixed Blood Donation in Bandar Lampung with Android-based Dijkstra Algorithm	2020	Syaiful Ahdan, Setiawansyah
3	Application of String Matching Using <i>Boyer-Moore Algorithm</i> in the Development of Online Book Search Systems	2022	Faqih, Y., Rahmanto, Y., Ari Aldino, A., & Waluyo, B
4	Expansion of <i>Prim</i> Algorithm to Determine <i>Minimum Spanning Forest</i>	2021	Sumardi Day
5	Development of Comic Media for Learning Logic Material and Computer Algorithms	2021	Ulfa Rahmatin, Muhammad Rifai Killer, Lillyan Hajaratie, Sitti Suhada
6	Utilization of the Quasi-Newton <i>BFGS algorithm</i> to see the potential for extensive coffee plant development on the island of Sumatra	2023	Safruddin Safruddin, Elfin Efendi, Rita Mawarni, Anjar Wanto
7	Naive Bayes <i>Algorithm Classification</i> in Predicting the Smooth Payment of MSME Core Rents	2021	Rizal Rachman, Rissa Nurfitriana Handayani
8	Development of Android-Based Online Smart Register Information System Application Using <i>BruteForce Algorithm</i>	2020	Dimas Dandy Aryarajendra Suprpto, Fauziah Fauziah, Iskandar Fitri, Nur Hayati
9	Determination of <i>overtime</i> schedule with employee data classification using C4 Algorithm.	2020	Ikhsan Romli, Ahmad Turmudi Zy
10	Application of <i>Sequential Search Algorithms</i> in Plant Scientific Language Dictionary Applications	2021	Yuri Rahmanto, Joni Alfian, Damayanti, Rohmat Indra Borman

Rank	Heading	Year	Author
11	K-means clustering algorithms: A comprehensive review, analysis of variance, and advances in the era of big data	2023	Abiodun M. Ikotun, Absolom E. Ezugwu, Laith Abualigah, Belal Abuhaija, Jia Hermina
12	Data Mining Algorithms for Smart Cities: Bibliometric Analysis	2021	Anestis Kousis, Christos Tjortjis

While the results of bibliometric studies using software VOSviewer, the visualization is as follows:

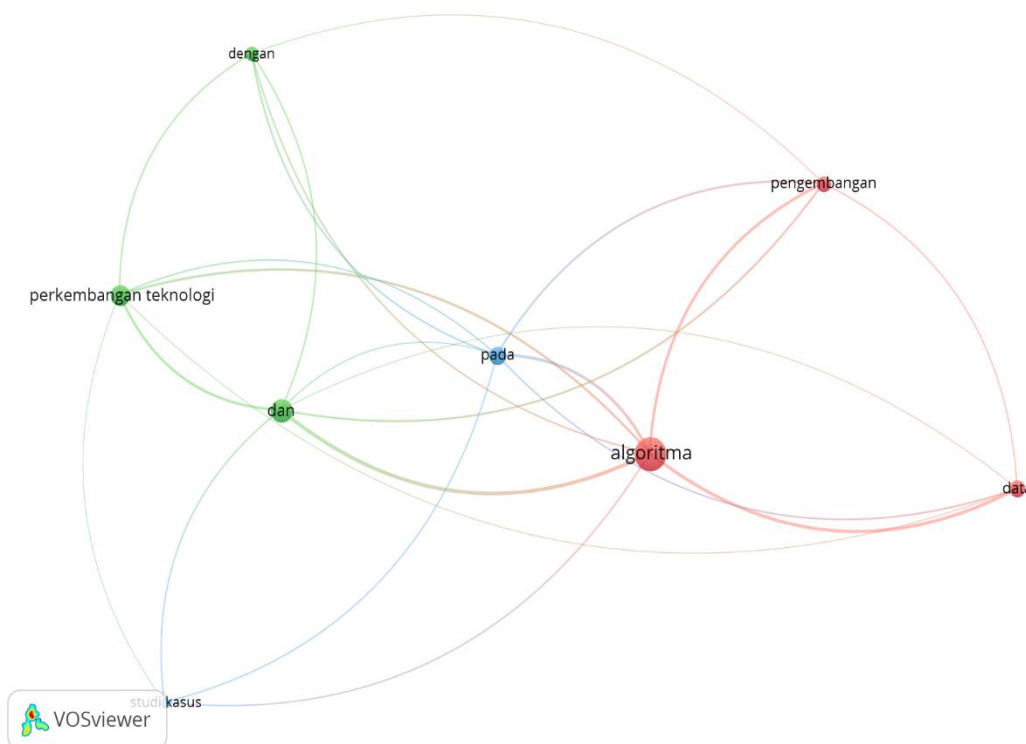


Figure 1. Network visualization of research development maps around Algorithms

The results of the visualization of VOSViewer software are related to the research map around algorithm ratios in algorithm application research there are 3 clusters and 8 topic items on mapping, including the following:

First, cluster 1 consists of 5 topic items, namely: *algorithms*, *data*, *case studies*, *on*, *technology development*. Second, cluster 2 consists of 1 topic item, namely: *and*. Second, cluster 3 consists of 2 topic items, namely: *development*, *with*.

Discussions

Mapping a Literature Review Study around Automated Processing of Bibliometric Data on Algorithms

Based on a literature review in previous scientific journals, researchers define algorithms as a series of logical steps to solve a problem Compose Systematically. Algorithms also

mentioned in other references are processes consisting of integrated steps or specific methods for solving practical problems. And the algorithm has two basic structures, namely, using a self-study system (self-study material) and then storing it on a computer. So that lecturers can visit anytime and anywhere, and use computers to see learning progress, curriculum schedules, learning progress results, and matters related to education at any time (Putri, 2021).

Algorithms are very useful in the application of research because they can optimize processes, produce more accurate analyses, and help solve complex problems efficiently. The use of algorithms in various studies has a number of compelling reasons. Here are some discussions about why algorithms are often used in research contexts (Bastian et al., 2018) :

1. **Process Optimization:** Algorithms can be used to optimize processes in research. They help reduce the time, resources, or labor required to achieve the desired results.
2. **Data Analytics:** In the world of research, there is often a large and complex amount of data that needs to be analyzed. Statistical algorithms and data mining can be used to analyze this data and gain valuable insights.
3. **Accuracy and Reproducibility:** Algorithms ensure accuracy in analysis and research results. They also allow this research to be reproduced by others, which is an important principle in the scientific method.
4. **Complex Problem Solving:** In many studies, there are complex problems that are difficult or even cannot be solved without the help of algorithms. Examples include optimal routing in networks, complex mathematical modeling, or machine learning tasks that require powerful training algorithms.
5. **Automation:** Algorithms allow automation of repetitive tasks and free researchers from routine work. This allows them to focus on the creative and interpretive aspects of research.
6. **Software Development:** Lilac research involves developing specific software to achieve research objectives. Algorithms are an important component in this development.
7. **Speed and Efficiency:** In the world of research, time is often precious. Efficient algorithms can save time and allow experiments and analyses to be completed faster.
8. **Interdisciplinary Applications:** Algorithms are often used in interdisciplinary research, where concepts and methods from different disciplines are applied to solve complex problems. Algorithms allow combining approaches from these different disciplines.

Researchers concluded that the use of algorithms as problem solvers based on *literature reviews* that have been processed into *publishing or perishing* data table software has a variety of different problems and is certainly very closely related to the world of life today. Here are some areas where algorithms can be used to solve problems:

1. **Computer Science:** Algorithms are the foundation of computer science. They are used for software development, database management, network design, image processing, artificial intelligence, and more.
2. **Mathematics:** in mathematics, algorithms are used for mathematical calculations, such as prime factorization algorithms, square root calculation algorithms, and algorithms used in cryptography.

3. **Data Science:** Algorithms are used in data analysis, machine learning, data mining, and data visualization to gain insights from complex data.
4. **Finance:** Algorithms are used in financial market analysis, risk management, stock price forecasting, and investment decision making.
5. **Biology and Genomica:** In computational biology, algorithms are used to understand and model biological processes, such as DNA sequences, evolution, and modeling protein structures.
6. **Medicine:** in medicine, algorithms are used for medical diagnosis, treatment planning, medical image analysis, and genetic research.
7. **Optimization:** Algorithms are used to find the best solution in various situations, such as shortest route planning, production planning, or efficient resource allocation.
8. **Graphs and Networks:** Algorithms are used to solve problems in graph and network theory, including shortest routes, maximum flow, and social network analysis.
9. **Computer Graphics:** In game development and computer graphics, algorithms are used for image rendering, collision detection, and visual effects.
10. **Energy Resources Optimization:** Algorithms are used to optimize the use of energy resources, including setting energy production schedules and energy consumption management.
11. **Logistics and Supply Chain Management:** Algorithms are used to optimize supply chain management, including inventory planning, shipping, and distribution.
12. **Natural Language Processing:** Algorithms are used in natural language processing to translate text, sentiment analysis, and automatic text generation.
13. **Robotics:** In robotics, algorithms are used to control the robot's movements, recognize objects, then plan trips.
14. **Planning and Manufacturing:** Algorithms are used in product planning, manufacturing process simulation, and material selection.

Mapping a Literature Review Study on Automatic Processing of Bibliometric Data on Algorithms Against Research Contained in *Software or Table Perish*

In this case, the researcher explains the development of the use of algorithms for problems in each study that has been published in the publish or perish software table and visualization software VosViewer.

First, in a study entitled "Prediction of the Development of the Number of Electricity Customers According to Regional Customers Using Backpropagation Algorithms". The research was raised with the intention to determine the development of the number of electricity customers, especially those in North Sumatra Province. This is solved using the Backpropagation algorithm, because based on the results obtained, the backpropagation algorithm is quite effective in predicting the number of electricity customers (Saragih et al., 2020)

Second, the next research is the development of a geographic information system for blood donation. Which, this research is equipped with the Android-based Dijkstra Algorithm. This study used algorithmic systematics so that researchers could develop blood donation information in the geographical area of Bandar Lampung. Researchers raised this study against the background of the problem when the blood sticks needed by patients will be easily

found through a system that can find blood donors in the Bandar Lampung area (Ahdan et al., 2020).

Third, research that discusses the problem of applying string matching using the Boyer-Moore algorithm online with the development process of online book development with the Boyer Moore algorithm method requires several research steps carried out in a planned, systematic and regular manner. Efforts are being made to facilitate this research for elementary and junior high school students to find books to study or get information about the desired subjects (Faqih et al., 2022).

Fourth, the problem raised by the researchers is to develop a prim algorithm to determine the minimum forest coverage of two classical algorithms in the MST algorithm, crucial and prim. This study aims to find out what MSF is by managing literature both from algorithms in the form of crucial and prim can produce MST. A forest is a diagram consisting of several trees. The tension forest of the G discontinuous diagram is the forest built from the G graph. The minimum voltage forest (MSF) of the G chart is the voltage forest with the smallest total side weight above all spanning forests on graph G (Sumardi & Panggabean, 2021). Fifth, research with the title of developing comic media for learning logic material and computer algorithms. In this study, researchers tried to foster students' interest in learning through the development of interesting learning materials, especially still being the main obstacles and challenges that must be faced by teachers of computer logic and algorithms of SMK Negeri 1 Suwawa face-to-face (Rahmatin et al., 2021).

Sixth, the development of an algorithm used for research entitled The use of quasi-Newtonian BFGS algorithm *to see the possibility of large-scale coffee plant development on Sumera Island*. This research was conducted because Sumatra Island is the largest coffee producer in Indonesia, so information about the possibility of developing this crop on a large scale must be obtained as soon as possible, especially to farmers / plantations and coffee farmers. So that coffee production can be maintained in the future. And data forecasting problems are solved with algorithms, one of which is the *quasi-newton broyden fletcher goldfarb Shanno (BFGS) algorithm* (Safruddin et al., 2023).

Seventh, the algorithm studied in the naïve bayes *algorithm classification* research predicts the smooth running of the core rental rate of MSMEs. For this study, namely for the smooth rental of MSME terraces assisted by processing historical tenant data using data mining techniques with *naïve Bayes* algorithms. The algorithm used to predict probability is the Bayes naïve algorithm (Rachman et al., 2021).

Eighth, the research discussed is entitled about the development of Android-based *online smart register* information system applications using *the BruteForce algorithm*. This research was raised based on the new student registration process (PMB) for various information displayed on the website-based PMB information system, still constrained in using the website to obtain information, especially in Camaba which will later be at risk of being left behind the latest information. So in this study researchers designed *an Android-based registry* information system application *using the Waterfall method, brute force algorithm*, integration with *real-time* Firebase databases and *Firestore* cloud storage to overcome these problems (Suprpto et al., 2020).

Ninth, the research raised with the title of determining *overtime schedules* with employee data classification using the C4 Algorithm. Researchers using the C4 Algorithm in research to generate overtime schedules for large and small companies also need fast and accurate information to facilitate decision making based on employee data classification (Romli & Zy, 2020).

Tenth, researchers used Algorithms in completing research papers on the implementation of sequential search algorithms on the application of plant scientific language dictionaries. The research contains how to develop an interesting plant language scientific dictionary application that can be used anytime and anywhere. Of course, this is helped by using an algorithm that will perform a search by combining data sequentially from all available data (Rahmanto et al., 2021).

Eleventh, the research presented on the wide application of algorithms in many areas of clustering applications can be attributed to the simplicity of their application and low computational complexity. However, the K-means algorithm has many challenges that negatively impact its clustering performance. In the process of initializing the Algorithm, the researcher must determine the number of clusters in a given data set a priori while the initial cluster center is chosen randomly. In addition, algorithm performance is vulnerable to this initial cluster selection and for large data sets, determining the optimal number of clusters to start with is complex and a very challenging task. This work will attempt to present an overview and taxonomy of K-means clustering algorithms and their variants. The history of K-means, current trends, open issues and challenges, and recommended future research perspectives are also discussed (Ikotun et al., 2023).

Twelfth, in this study, researchers highlight research that presents bibliometric analysis to provide a comprehensive picture of studies related to DM technology used in smart city applications. This research aims to identify the main DM techniques used in the smart city context and how the DM research field for smart cities is evolving over time. Researchers use the Scopus database to find relative articles published in scientific journals. The study included 197 articles published during the period 2013 to 2021. For bibliometric analysis, researchers used the bibliometrix library, developed in R. Our findings suggest that there is a wide range of DM technologies used in every layer of smart city projects. Several ML algorithms, supervised or unsupervised, are adopted to operate the instrumentation layer, middleware, and applications. So bibliometric analysis shows that DM for smart cities is a rapidly growing scientific field and scientists from all over the world can show great interest in researching and collaborating in this interdisciplinary scientific field (Kousis & Tjortjis, 2021).

The results of reviewing the development of studies on the use of algorithms that have been described, researchers concluded that the latest algorithms pave the way for a deeper understanding of the further development of scientific research, its impact in the scientific community and improve bibliometric analysis methods and tools by integrating the latest algorithms, so that scientific research and trends can be identified more accurately and relevantly.

CONCLUSION

Based on the results of the discussion above, the following conclusions can be drawn: first, based on the mapping of the distribution of journal publications and bibliometric studies of PoP (*Publish or Perish*) and VOSviewer on automatic processing of data on algorithms in the period 2020-2023 by national journals contained in the publish or perish software table and VosViewer software visualization, There are 10 research articles reviewed by researchers from 50 articles processed in *Publish or Perish* software. While the results of network visualization around algorithm ratios in studies on *Google Scholar* are divided into 3 clusters and 8 topic items on mapping, including cluster 1 consisting of 5 topic items, namely: Algorithms, data, case studies, on, technology development. While cluster 2 consists of 1 topic item, namely:

and. And cluster 3 consists of 2 topic items, namely: *development*, *with*. Second, based on a literature review mapping study around automated processing of bibliometric data on Algorithms, it reaps the results that the use of Algorithms in bibliometric data processing has increased rapidly. This is evidenced by the increasing number of researchers and practitioners in various fields who increasingly rely on algorithms to analyze bibliometric data in a more efficient way. In addition, bibliometric-based research analysis that has been summarized applies statistical and mathematical methods to analyze the publication of articles and journals. The purpose of bibliometric research is to examine and examine the map of literary development in scientific publishing. The study could use more sophisticated multifaceted techniques to analyze simple productivity measures based on article citations. This research is also able to recognize and describe the development of new science and technology. Various algorithms used in bibliometric data processing include complex network algorithms, text analysis, sentiment analysis, and various machine learning methods. It reflects the complexity of bibliometric data and various analytical purposes. Algorithms are also applicable in various disciplines so that the challenges and opportunities of subsequent research trends will continue to evolve more sophisticated and better bibliometric data processing methods.

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