



A Comprehensive Study of Artificial Intelligence on Financial Analysis: A Bibliometric Analysis

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ARTICLE INFO

Article history

Received : 26 September 2023

Revised : 18 March 2024

Accepted : 23 April 2024

Keywords

Artificial intelligence
Bibliometric
Biblioshiny
Financial statement analysis

Kata Kunci

Analisis laporan keuangan
Bibliometric
Biblioshiny
Kecerdasan buatan

ABSTRACT

This study aims to analyze various scientific literature using bibliometric analysis to find the main topics, sources, authors, and articles that are widely cited and countries that study the implementation of artificial intelligence for financial statement analysis. This study consists of 181 articles in Scopus-indexed journals published during 2000-2023. The research results are presented in two parts. First, the quantitative analysis provides an overview of the implementation of artificial intelligence for financial statement analysis. This analysis is presented as tables, graphs, and maps. Second, conduct a literature review of ten articles with the most significant citations. The findings suggest that the potential for future research into the application of AI in financial statement analysis is still rather significant. Further study could focus on the implementation of AI in fraud prevention and the implementation of AI in financial crime prevention.

ABSTRAK

Penelitian bertujuan menganalisis berbagai literatur ilmiah menggunakan analisis bibliometrik untuk menemukan topik utama, sumber, penulis, artikel yang banyak dikutip, dan negara-negara yang mengkaji implementasi kecerdasan buatan untuk analisis laporan keuangan. Analisis bibliometrik dalam penelitian ini difokuskan pada artikel jurnal terindeks Scopus yang dipublikasikan dalam rentang tahun 2000 hingga 2023. Hasil penelitian disajikan dalam dua bagian. Pertama, analisis kuantitatif yang memberikan gambaran umum tentang implementasi kecerdasan buatan untuk analisis laporan keuangan. Analisis ini disajikan dalam bentuk tabel, grafik, dan pemetaan. Pada analisis ini ditemukan sebanyak 181 artikel yang telah terbit. Kedua, melakukan kajian literatur yang memiliki pada sepuluh artikel dengan jumlah sitasi terbesar. Hasil penelitian bermuara pada suatu konklusi bahwa prospek riset ke depan terkait implementasi AI dalam analisis laporan keuangan masih relatif tinggi. Penelitian terkait implementasi AI dalam penanggulangan fraud dan implementasi AI dalam pencegahan kejahatan finansial dapat menjadi topik yang relevan untuk diteliti selanjutnya.

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1. Introduction

The vast digital transformation that happened with the development of numerous technical advancements throughout the fourth industrial revolution has resulted in significant changes in life, work, and human contact patterns. These innovations have ushered humanity into a new age known as the era of society 5.0, the era of super-smart society. At the time, society and the economy underwent a profound transformation toward a new paradigm that balances economic progress with resolving social and environmental problems, with humans positioned as the heart of innovation (Carayannis & Morawska-Jancelewicz, 2022). Fukuda (2020) defines Society 5.0 as creating new knowledge and values to contribute to economic growth and social well-being. This period is fueled by digitalization, change, development, and technical advancement.

Artificial intelligence (AI) has become a key pillar in the technological revolution. AI is a machine capable of collectively reproducing individual tasks to the same level as human intelligence (Jarrahi, 2018). AI is distinguished by high computation, sophisticated algorithms, and the correctness of standardized methods that integrate high-quality data with fast processing capabilities (Grima, 2023). AI has progressed to such an extent. The market value of AI-based software reached 9.5 billion in 2018 and is expected to triple to 118.6 billion by 2025 (Gralla, 2019). Indeed, scientists such as Müller and Bostrom (2016) anticipate that by 2075, AI systems will have surpassed human skills in general.

The application of artificial intelligence (AI) in different fields of life has become a significant phenomenon in recent years, and accounting is no exception. As a critical component of business operations, accounting must become more efficient and accurate in processing information to generate financial statements. This is where AI's function in assisting with the creation of financial statements becomes very important to create high-quality, relevant financial information that accurately portrays the company's position. AI helps improve the efficiency and accuracy of the financial statement analysis process and create financial statements. AI can find relevant trends in financial reporting, uncover potential dangers, and make business decisions using machine learning algorithms and natural language processing techniques (Ernis & Pirdaus, 2022).

The implementation of AI in accounting is a growing concern today. While significant attention has been given to the application of AI in various domains, including accounting, there appears to be a notable gap in the literature regarding the comprehensive exploration of the role of AI specifically in financial statement analysis. Although existing research has delved into AI applications in areas such as taxation (Jayasuriya & Sims, 2022), enterprise resource planning (Akturk, 2021), audit procedures (Khan et al., 2021), and forecasting within accounting contexts (Kureljusic, 2023), there is limited discourse on its direct impact on financial statement analysis. This gap provides an opportunity for further research to highlight the subtleties and possible benefits of incorporating AI technologies into financial statement analysis. Furthermore, while there has been a noticeable increase in research on AI deployment in financial statement analysis, as evidenced by bibliometric citation analysis, there is still a need to delve deeper into the specific themes, methodologies, and interrelationships within this domain, paving the way for a more comprehensive understanding and future directions in research. As a result, the purpose of this study is to undertake a bibliometric analysis to identify and close this gap by offering insights into the most recent advancements, emerging trends, and potential pathways for future research in AI-driven financial statement analysis.

Bibliometric analysis can be done to examine areas that previous studies have not touched in terms of themes, methods, and interrelationships between themes that authors in various countries have developed. Various articles, conference proceedings, books, and book chapters were reviewed from the Scopus database to produce a comprehensive investigation. The Scopus database period chosen in this study is the 21st century, namely 2000 to 2023, based on the consideration that in the 21st century, AI experienced massive development marked by the invention of graphic processing units (GPUs) and the increasing amount of data so that machine learning can learn many data and be able to solve complex things (AI Topics, 2020).

Based on bibliometric citation analysis of Scopus-indexed journal articles from 2000 to 2023 (August), it is possible to determine that the trend of research on AI deployment in financial statement analysis tends to increase. It can be seen in Figure 1. Massive research began in 2014 and will peak between 2020 and 2022. The statistics reveal prospects for future research directions connected to the use of AI in financial statement analysis, as demonstrated in this study. This study is likely to multiply and expand previous studies on the use of AI in financial statement analysis for future research.

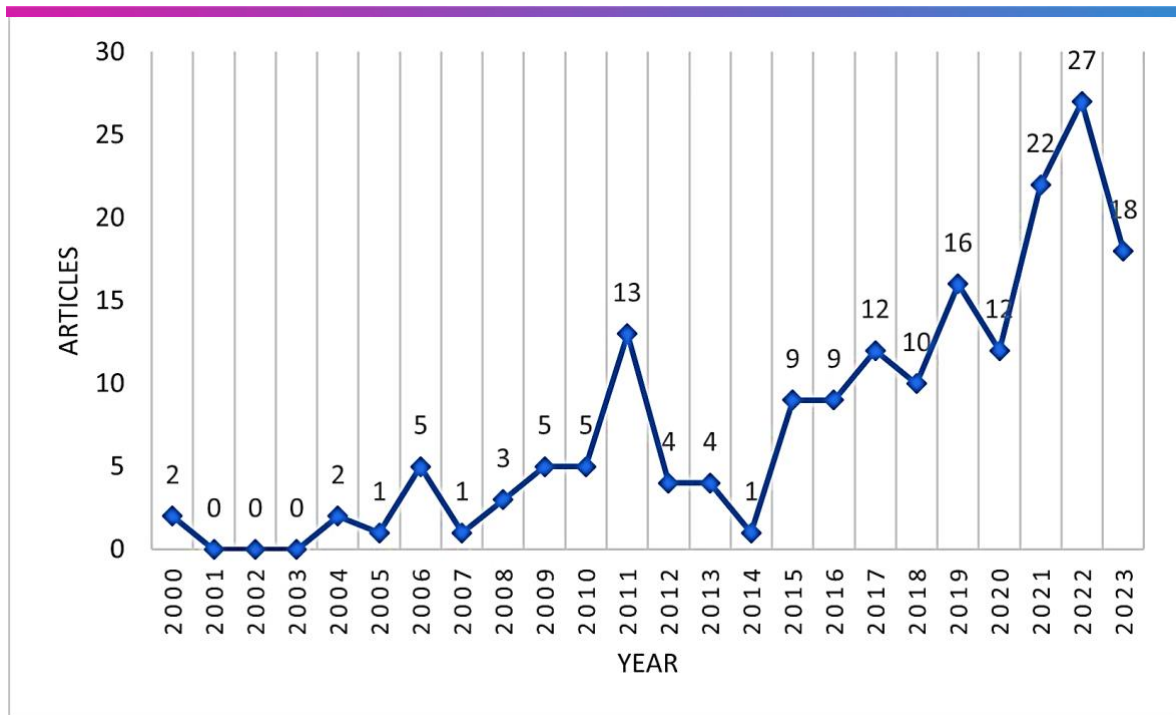


Figure 1. Annual Scientific Production

1.1. Our Research

This study will undertake a bibliometric analysis of corporations applying AI in financial statement analysis. This study will conduct a systematic literature analysis through important literature, countries, authors, keywords, thematic evolution, citations, citations, and social network analysis, which researchers can use as a reference in future research related to the implementation of AI in financial statement analysis. Bibliometric analysis techniques are used because it is possible to determine the journals with the highest impact. This is useful for determining the most important articles and journals in a particular field, identifying leading researchers and articles in a particular field, and identifying influential and widely cited articles and researchers (Agarwal et al., 2016). Furthermore, bibliometric analysis with the R biblioshiny program can provide recommendations for research topics based on keywords that can still be further developed through thematic map output (Yu & Muñoz-Justicia, 2020).

1.2. Research Questions and Research Objectives

This study's research questions are as follows:

- RQ1: Whose authors and journals have studied the deployment of AI in financial statement analysis, and whose articles have received the most citations between 2000 and 2023?
- RQ2: What are the primary research themes, which nations contribute the most to scholarly production, and which keywords are commonly employed in studying AI deployment in financial statement analysis?
- RQ3: What is the conceptual structure, intellectual structure, social structure, and knowledge base in the study of artificial intelligence deployment in financial statement analysis?
- RQ4: What are the main ideas, research designs, and research findings in the study of AI deployment in financial statement analysis in the most cited articles?

This research has the main objective to analyze research on AI implementation in financial statement analysis that has been published on the Scopus database, reveal trends or publication patterns, examine the knowledge structure, and produce knowledge synthesis. Specifically, this research has several objectives, namely: (1) Bibliometric profile of AI research in financial statement analysis; (2) Datasets and document distribution of publications; (3) The most cited publications and sources in the field of AI in financial statement analysis; (4) Publication growth and average citations; (5) Country of origin of research and most cited geographical collaboration networks; (6) Author impact and source impact in the field; (7) Collaborative network of widely published documents on the topic of AI in financial statement analysis; (8) Authors or keywords that frequently appear with

Sankey plots, Thematic map, Word cloud and Treemap; (9) Main idea, research design, and review results in the study. These goals will be met using descriptive and network analysis. This paper's methodology is separated into various sections. The first portion is an introduction, while the following section contains the research questions. The approach will be the focus of the third portion, followed by the data analysis section. The paper will conclude by discussing the findings and future research prospects on AI in financial statement analysis.

2. Research Methods

This study is included in literature review research utilizing bibliometric analysis methodologies. Bibliometric analysis investigates and maps the material published in journals across many scientific areas. According to [Aria and Cuccurullo \(2017\)](#), bibliometric analysis uses statistical and mathematical methodologies to study trends in the literature that are still within the purview of one domain. Several previous studies have used bibliometric analysis to analyze AI topics in the accounting domain, such as studies conducted by [Mashayekhi et al. \(2023\)](#), namely the bibliometric analysis of the blockchain in extended audit reporting (EAR), [Lardo et al. \(2021\)](#), namely bibliometric analysis of AI in the general scope of business, management, and accounting, and [Lamboglia \(2020\)](#). The bibliometric analysis method was used for this study because it has the advantage of examining a discipline's development, trends, and publication patterns. Furthermore, the bibliometric analysis approach will describe underlying conceptual, intellectual, and social trends. The data for this bibliometric analysis is derived from journal papers published in the Scopus database. [Figure 2](#) explains how documents that constitute the foundation of bibliometric analysis are chosen.

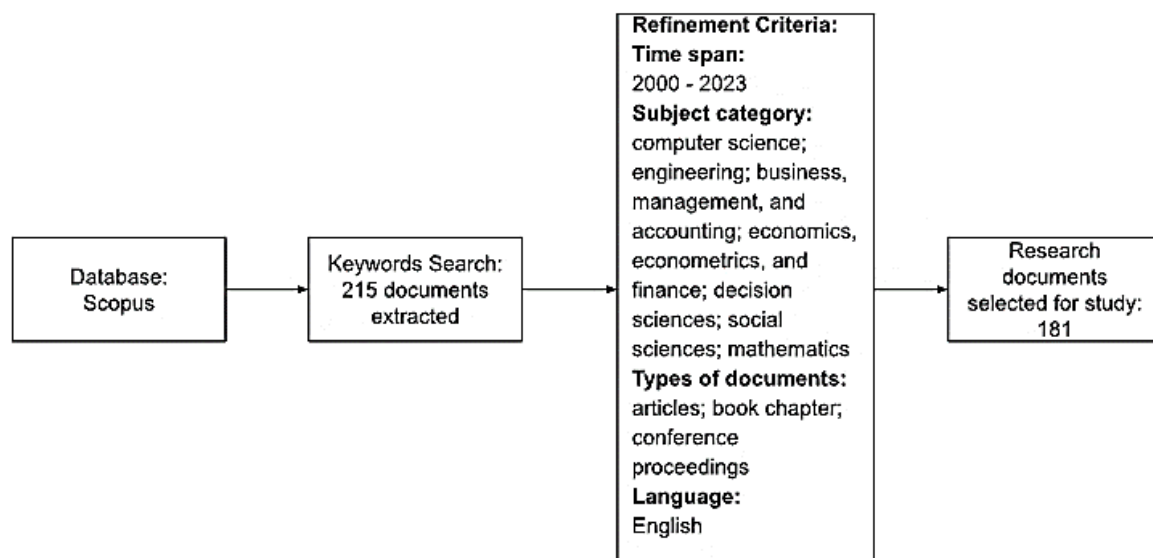


Figure 2. Flowchart of Document Selection for Bibliometric Analysis

The documents for examination were chosen by searching using the appropriate combination of keywords. The data should then be analyzed using R studio software. The initial stage was to perform a descriptive analysis of the data concerning authors, sources, nations, and documents. The following stage is to develop a network map to improve data visualization by clarifying the data's conceptual structure, intellectual organization, and social structure ([Aria & Cuccurullo, 2017](#)). Furthermore, the process from data selection to data analysis is as follows.

2.1. Database Selection

A structured description of the articles indexed in the database is required for bibliometric analysis. This research uses the Scopus database, compatible with bibliometric analysis software, such as Biblioshiny, which can be viewed in R studio.

2.2. Getting Data Ready for Analysis

The data was obtained in CSV format from the Scopus database, with the following details:

- Date of Shortlisting: August 16, 2023

- Keyword for Search strategy: the keywords "Artificial Intelligence" and "Financial Statement Analysis" were used to identify research contributions and 215 documents were extracted using keyword search criteria with strings: "(TITLE-ABS-KEY ("analysis*") AND TITLE-ABS-KEY ("financial *statement*") AND TITLE-ABS-KEY ("artificial intelligence" OR "machine learning" OR "data mining"))"
- Search Strategy: Keywords ("analysis*") AND ("financial *statement*") AND ("artificial intelligence" or "machine learning" or "data mining")
- Refined by: Scopus database categories
- Document Type: Journal Articles OR Book chapters OR Conference papers.
- Language: English
- Period: 2000-2023
- Selection of period: this period is due to the primary purpose of the research to find trends and views in the domain of AI studies in financial statement analysis. All papers from 2000 to 2023 were selected from the database because, starting from 2000, AI experienced massive development.
- Selection of subject categories: the subject categories selected are narrowed down to several topics, namely the implementation of AI in the scope of Computer Science, Engineering, Business, Economics, Decision Making, Social Science, and Mathematics; there are 181 documents extracted.
- Selection of document types: the documents used in this research include articles, book chapters, and conference proceedings.
- Language selection: the language filter "English" was used, papers were selected, and the final dataset of 355 documents was extracted. The documents' titles, authors, abstracts, and keywords were imported into Biblioshiny in ".csv" format for further processing.

2.3. Selection of Bibliometric Tool

The bibliometric tool R from [Aria and Cuccurullo \(2017\)](#) was employed in this investigation. Bibliometrics is an open-source tool that analyzes the depth of science maps. Bibliometrics is an R software package integrated with other R statistical programs. This program can assist researchers in doing a thorough bibliometric analysis, including data analysis and visualization.

2.4. Data Analysis Technique

This research employs two rounds of data analysis. Descriptive analysis was applied to bibliometric data regarding sources, authors, and documents. Second, network analysis focuses on mapping science through visualization, including co-occurrence networks, thematic maps, co-citation networks, and collaborative World Map. Both strategies are depicted graphically in [Figure 3](#).

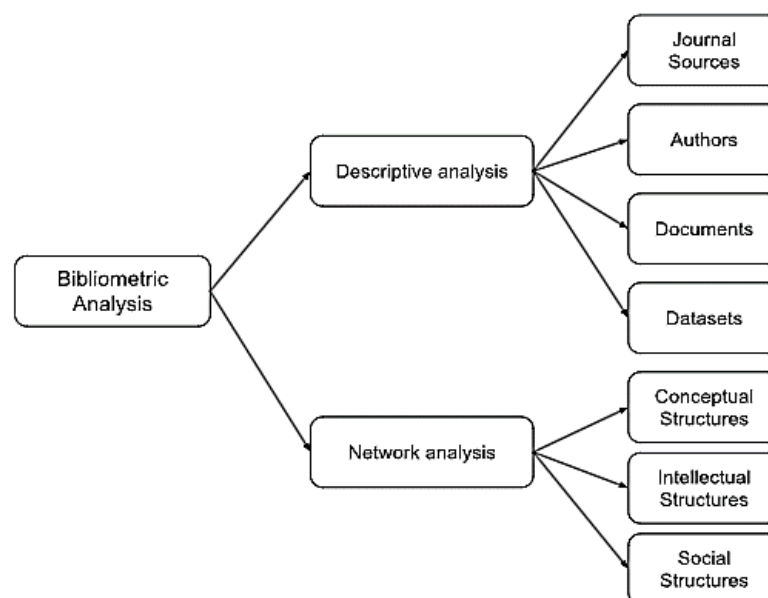


Figure 3. Levels of Bibliometric Analysis

3. Research Results and Discussion

3.1. Descriptive Analysis

Bibliometric analysis in R using Biblioshiny yields tables, pictures, and mapping results. These results explain diverse information, such as document primary information, source, title, author interaction, relevant sources, impactful resources, source dynamics, contributing countries, dominant keywords, conceptual structure, intellectual structure, and social structure.

A summary data set in Table 1 shows a birds-eye perspective of the bibliometric data frame of 181 documents selected from the Scopus database using a systematic search query. These documents were discovered in 140 sources with an average citation score of 12. This data indicates that significant research has been done with active researcher participation.

Table 1. Document Main Information

Description	Results
Timespan	2000:2023
Sources (Journal, Books, etc.)	140
Documents	181
Annual Growth Rate %	10.02
Document Average Age	5.86
Average citations per document	12
References	5254
Keywords Plus (ID)	1040
Author's Keywords (DE)	539
Authors	466
Authors of single-authored docs	29
Single-authored docs	30
Co-Authors per document	2.85
International co-authorships %	16.57
Article	85
Book chapter	4
Conference paper	92

Bibliometric analysis provides a Sankey diagram to explain the interaction between source, keywords, and author. According to Riehmman et al. (2005), a Sankey diagram is a visualization approach that allows for the display of flows using nodes (rectangles) and links in the form of arrows or arcs with widths proportional to the importance of the flow.

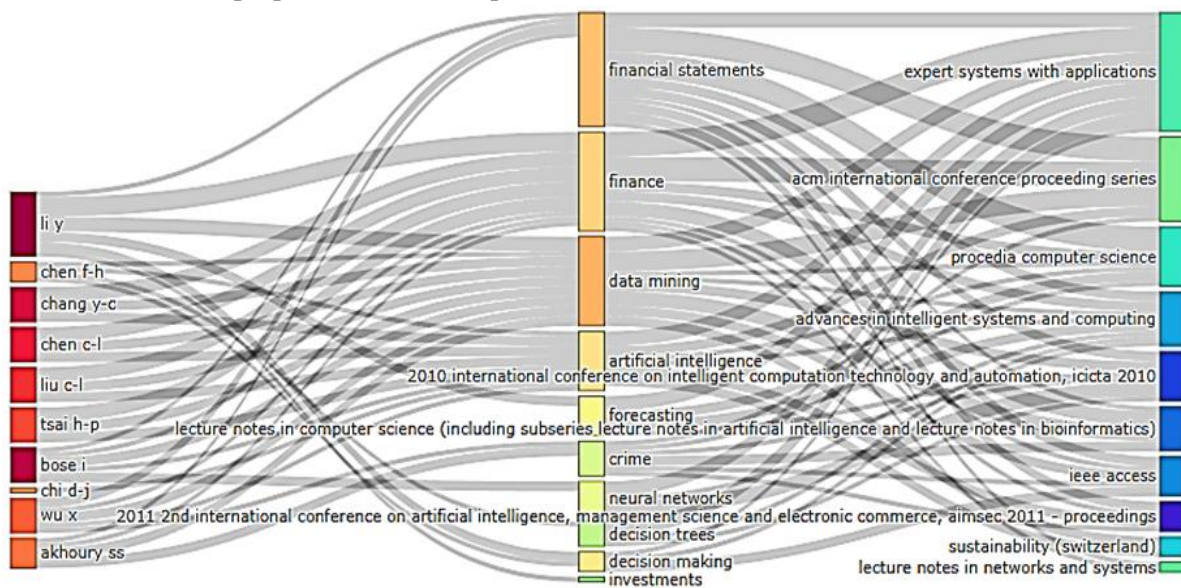


Figure 4. Sankey Diagram

In a field with three plots, the authors are shown on the left side of the Sankey Diagram, the keywords in the middle column, and the sources chosen for analysis are shown on the right. Figure 4 depicts significant keywords such as “Financial Statements,” “Finance,” “Data Mining,” “Artificial Intelligence,” and “Forecasting” with their sources and most productive authors. All ten prominent journals have included “Artificial Intelligence” and “Financial Statement,” which indicates AI is implemented in accounting areas, such as financial statement analysis. The main topics covered by these leading authors and publications were also “Finance,” “Data Mining,” “Artificial Intelligence,” and “Decision Making”.

The number of articles published indicates the evolution of topic trends in academic research. Figure 5 depicts how research trends on the use of AI in financial statement analysis fluctuate.

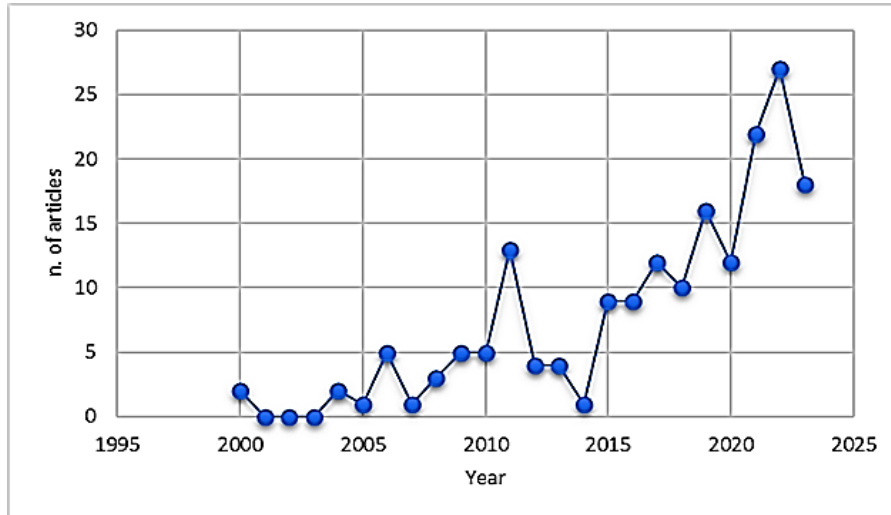


Figure 5. Number of Articles Published Year-on-Year

The rising trend began in 2020 and is expected to continue. The beginning of the increase in subject trends in 2020 was predicted to result from the COVID-19 pandemic, which triggered digital transformation in the form of widespread usage of AI in businesses. The most articles, 27 in all, were produced in 2022. There is no precise explanation for past years' ups and downs and the lack of publications from 2001 to 2003. A study topic grows in four stages: precursor, proper exponential growth, consolidation of the body of knowledge, and the decline in the number of articles (Low and Siegel, 2020). Figure 5 depicts the current information distribution stage and research on AI deployment in financial statement analysis.

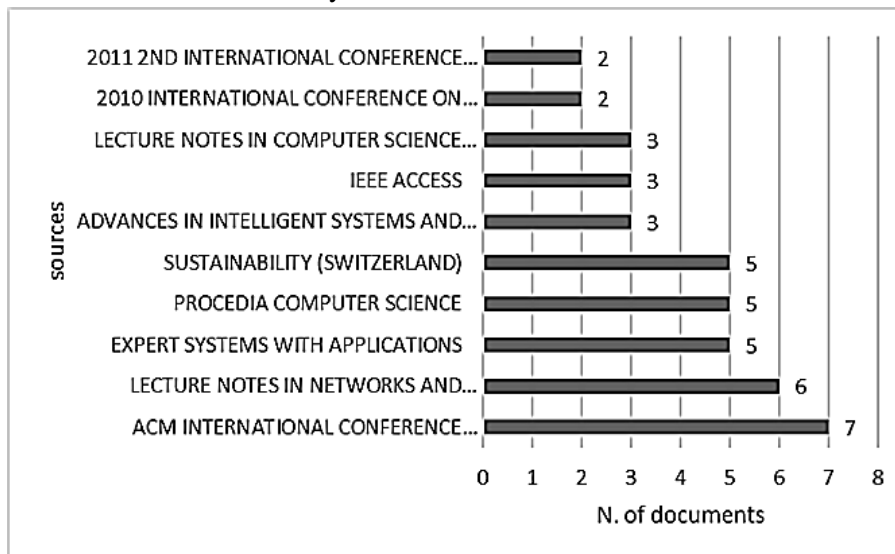


Figure 6. Most Relevant Sources

Figure 6 depicts the number of journal articles about AI implementation in financial statement analysis. The most relevant sources are found in five journals, including ACM International Conference with seven papers, Lecture Notes in Networks and Systems with six articles, and Expert Systems with Applications, Procedia Computer Science, and Sustainability (Switzerland) with five articles apiece.

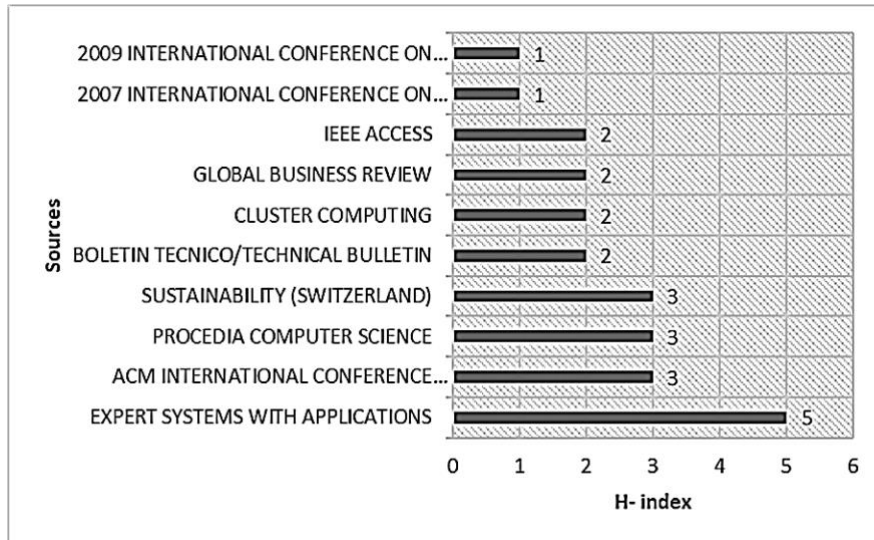


Figure 7. Top 10 Impactful Resources

The bibliometric analysis also aids in determining the extent to which a journal source influences scientific advancement. Figure 7 illustrates the ten most prominent scholarly publications in the field of research based on the h-index. The most outstanding value of the h-index is "n," where "n" is the number of journals that have published "n" articles with "n" citations. The h-index is a metric that assesses the relative quality of a journal based on its citation impact and productivity (Ingale & Paluri, 2020). Figure 7 demonstrates that the Expert Systems with Applications conference has the most clout, with an h-index of 5, followed by the ACM International Conference, Procedia Computer Science, and Sustainability (Switzerland).

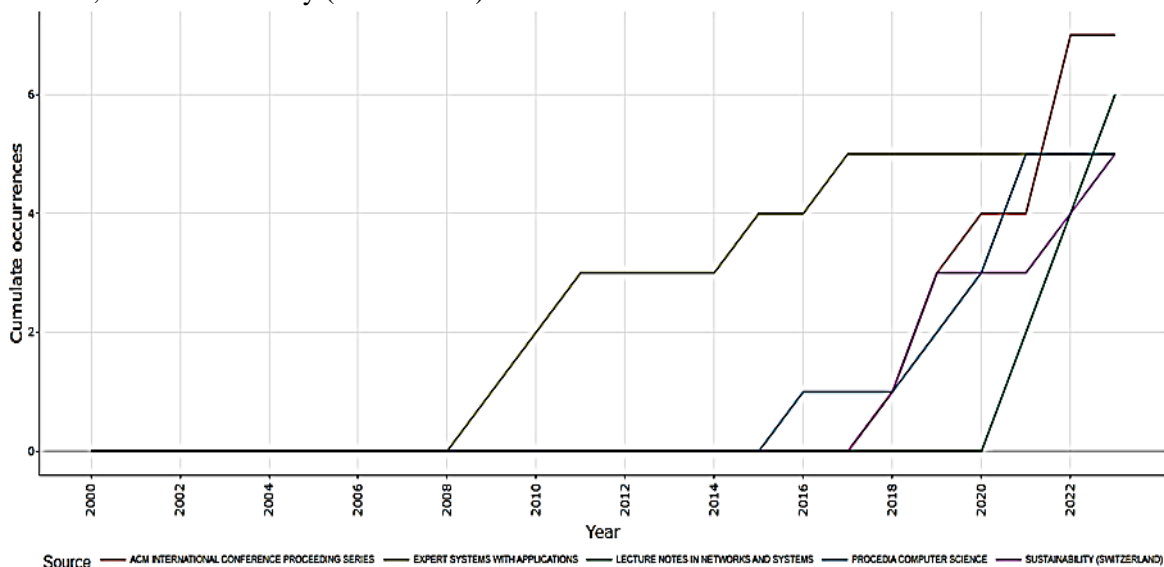


Figure 8. Sources Dynamic

From 2009 through 2023, Figure 8 depicts the cumulative incidence rise in each journal. Expert Systems with Applications was the first journal to publish significant research on the issue of AI deployment in financial statement analysis, with one publication in 2019. This journal has five papers that explore the issue of AI in financial statement analysis through 2023. Furthermore, in 2016, the

Procedia Computer Science magazine released 1 article, with growth through 2023, for five articles on AI in financial statement analysis. Sustainability and ACM International Conference Proceeding Series will begin publication in 2018, and Lecture Notes in Networks and Systems begin publication in 2021. The ACM International Conference Proceeding Series journal has the most significant cumulative number of publications linked to the issue of AI in financial statement analysis through 2023.

This research aims to collect data from countries that have contributed to research on using AI in financial statement analysis. According to a bibliometric study, China is the country that contributed the most research on the issue of AI from 2000 to 2023. This is shown by the fact that there are as many as 126 articles on the topic. China also has the most publications (802) and citations (802). India is second in contributors to AI research themes in financial statement analysis, with 38 papers and 20 citations, followed by the United States, with 33 articles and 348 citations.

The author Lam M. published in the journal Decision Support Systems in 2004 and received the most article citations on AI implementation in financial statement analysis. The article has received 257 citations. Following that is a paper written by Chen W.S. with 175 citations and published in the Expert System with Applications journal, followed by an article written by Chen M. Y. with 140 citations and published in the same journal. According to the bibliometric analysis, Li Y was the author of the most relevant publication on AI deployment in financial statement analysis between 2000 and 2023. From 2006 to 2023, Li Y was likewise the most productive author on the topic, publishing four works and being mentioned 103 times. Bose I is the second most productive author, having written three articles and being mentioned 97 times. Then, as a group, Chen C.L., Liu C.L., Chang Y.C., and Tsai H.P. authored three publications that were cited 24 times.





Figure 9. Word Cloud and TreeMap

The term "data mining" appeared 70 times in the papers, followed by "financial statement" which appeared 68 times, "finance" appeared 67 times, "artificial intelligence" appeared 37 times, "decision making" appeared 25 times, and "forecasting" appeared 24 times. Figure 9 depicts a Word Cloud and TreeMap, which is a visual depiction of the document's word frequency, with the size of the term representing its frequency. "Neural networks" and "crime" are two other keywords in the Word Cloud. This demonstrates that there has been a noticeable growth in studies on the application of AI in financial statement analysis since 2009 (see Figure 8). Furthermore, it can be deduced that the studies initially focused on data mining and artificial intelligence in financial statement analysis, which is used in corporate decision-making and future business forecasting, and gradually expanded into the dimension of neural networks, which is a branch of artificial intelligence similar to how humans work, and the dimension of crime, which in the context of accounting AI can be used in fraud detection.

3.2. Network Analysis

Data visualization using network analysis is used to assess the number of clusters that appear, the number of occurrences and relationships between different units of analysis, the overall strength of the year, and the number of citations. Network analysis will produce three types of knowledge structures: conceptual, intellectual, and social.

Co-occurrence networks that employ conceptual structures describe the interactions between themes, subjects, and trends. This analysis yields a notion or combination of words or themes in network interactions. Multiple correspondence analysis (MCA) is used in bibliometric analysis to derive conceptual structure. Greenacre and Blasius (2006) state that MCA aids in the numerical and graphical examination of multivariate data. The following network parameters in Table 2 were used to draw the co-occurrence network.

Table 2. Network Parameters for Co-occurrence Network Field

Field	Keyword Plus
Network layout	Automatic
Normalization	Association clustering algorithm
Number of Nodes	Louvain
	50

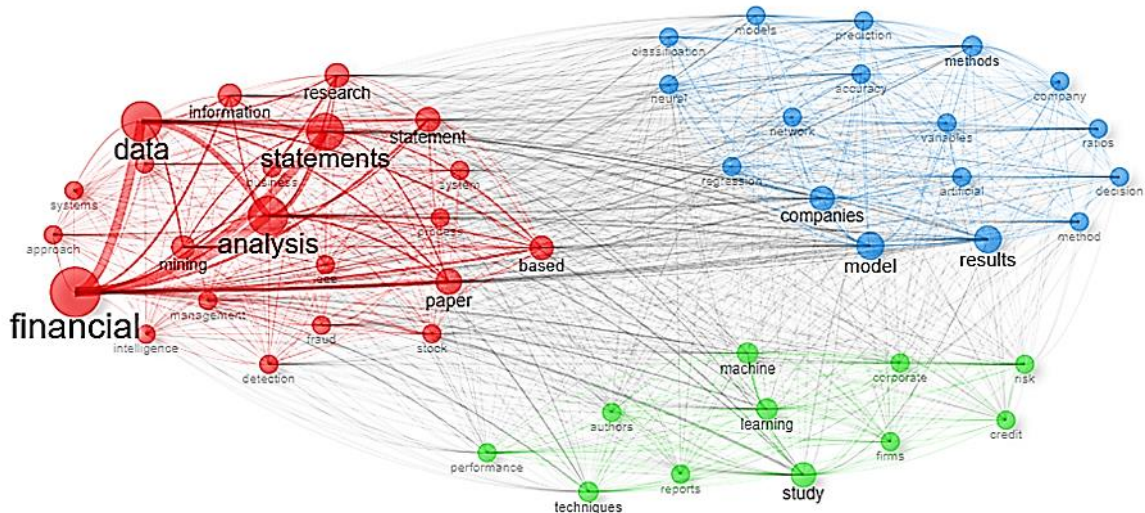


Figure 12. Co-occurrence Network on Abstract

Figure 12 depicts the abstract-based co-occurrence network. The findings of the abstract-based co-occurrence network analysis form a polarization in the red circle dominated by key phrases commonly employed in research on the issue of AI deployment in financial statement analysis. “Financial,” “statements,” “analysis,” “data,” “statement,” and “information” are examples of these words.

Thematic maps are another product of bibliometric analysis. Thematic maps are a type of centralization or emphasis that considers multiple sets of themes linked to one another in a particular framework and flow (Yu & Munoz-Justicia, 2020). There are four quadrants on the theme map. The upper left area (niche themes) has little to do with the subject, but its external connections are neglected to identify it. The connection to the theme is weak in the lower left section (developing or decreasing themes). The central theme at the top right area (motor themes) strongly connects to the theme and can be utilized as theme development material. While the bottom right (basic themes) is an essential topic with a solid tie to the theme, there has been minimal development on the theme of AI deployment in financial statement analysis. This study's thematic map analysis can be summarized as follows.

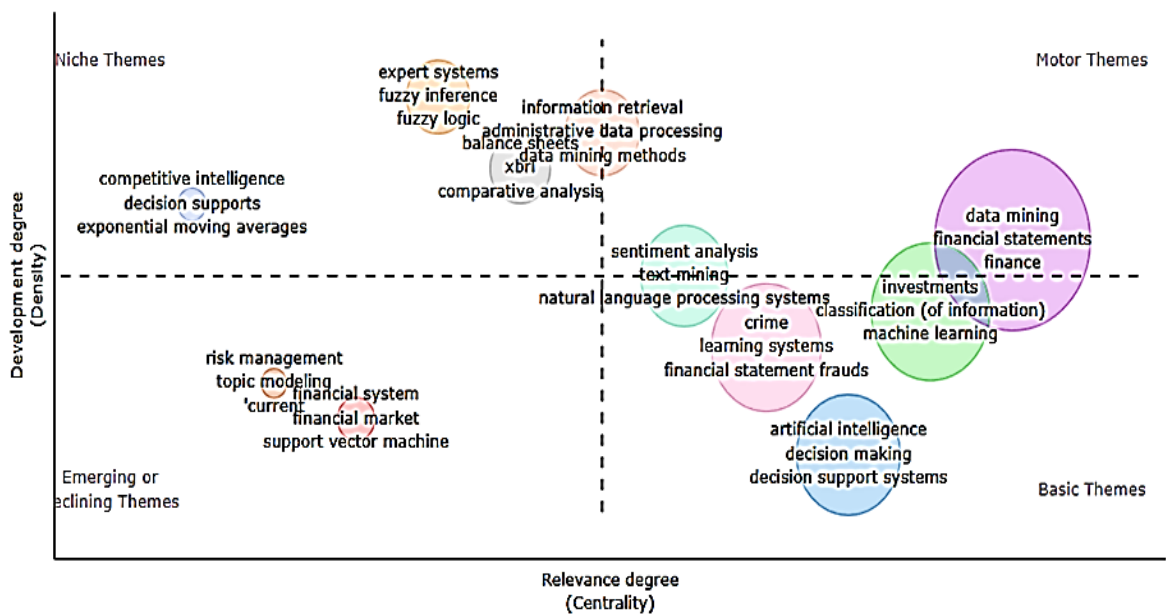


Figure 13. Thematic Map: Keyword Plus

The main themes (motor themes) in the research are data mining, financial statements, finance, and sentiment analysis (upper right quadrant), according to the thematic map created with a keyword

plus in Figure 13. The themes of text mining, natural language processing systems, crime, learning systems, financial statement frauds, investments, classification (of information), machine learning, artificial intelligence, decision making, and decision support systems have a strong relationship with AI in financial statement analysis. However, there has been little progress in these areas.

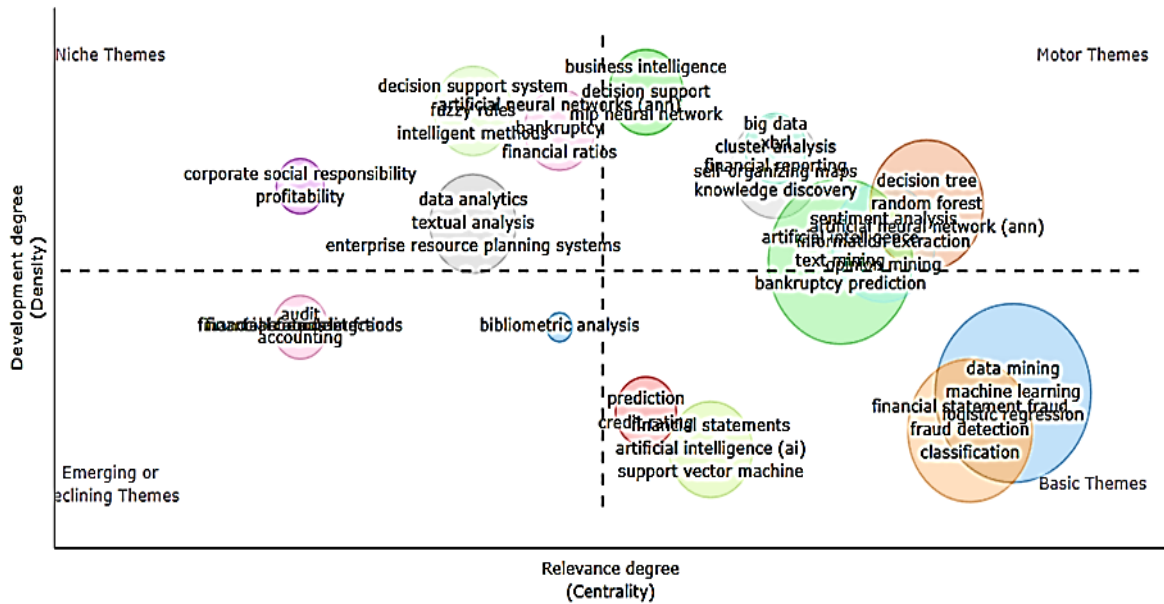


Figure 14. Thematic Map: Author’s Keyword

The thematic map in Figure 14 indicates business intelligence, decision support, neural networks, big data, cluster analysis, financial reporting, knowledge discovery, and decision trees as the motor themes (top right). The keywords bankruptcy prediction, prediction, financial statements, artificial intelligence, support vector machine, data mining, machine learning, financial statement fraud, logistic regression, fraud detection, and classification are identified as basic themes (bottom right) that have little development but a high level of connection with the theme of AI implementation in financial statement analysis.

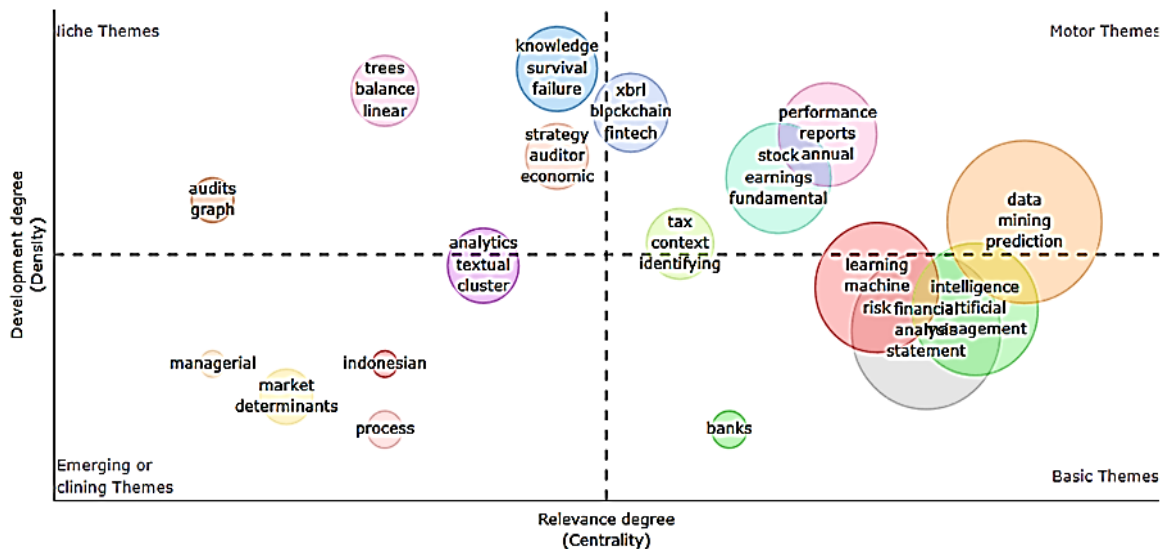


Figure 15. Thematic Map: Titles

The thematic map in Figure 15 detects the keywords xbrl blockchain fintech, performance reports yearly, and stock earnings fundamental. The main focus of the research (top right) is data mining prediction. The keywords tax context identifying, banks, learning machine risk, financial analysis statement, and artificial intelligence management are identified as the primary theme (bottom right),

which still has little development in the topic of AI implementation in financial statement analysis but has a high level of connection with the theme.

Thematic evolution is the subsequent output of biblioshiny. Thematic evolution results describe keyword groups' movement and development across time (Hernandez-Cruz, 2021). In this study, theme evolution employs unigrams with two parts: the left side representing the study's beginning development and the right side representing the study's later development.

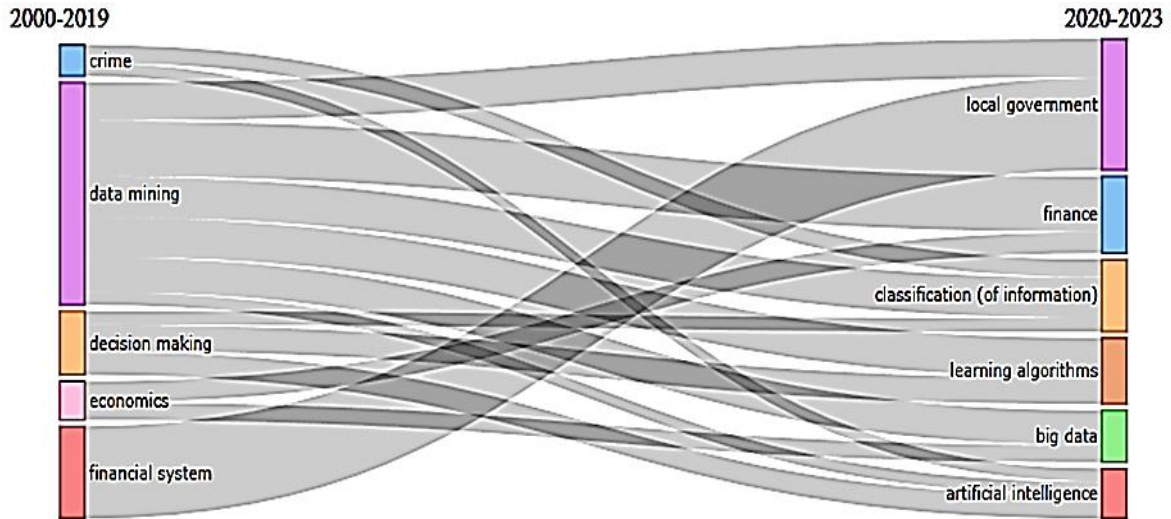


Figure 16. Thematic Evolution

Figure 16 demonstrates a significant movement in research areas. In 2020-2023, research studies on crime subjects began gravitating toward artificial intelligence, classification (of information), and finance. Topics in data mining that were hotly debated from 2000 to 2019 began to alter in 2020-2023, including artificial intelligence, big data, classification (of information), finance, and local government. The focus of decision-making shifted from 2000 to 2019 to finance and learning algorithms in 2020-2023. From 2000 to 2019, the focus was on financial systems; from 2020 to 2023, it was on local governance.

Social structure analysis uses networks and graphs to identify social structure. Nodes (such as author, country of origin, institution, or publication source) characterize the network structure, and ties or links between nodes indicate relevant interactions. As illustrated in Figure 17, writers Liu C.L., Tsai H.P., Chang Y.C., and Chen C.L. have the most connections in the social network, followed by Otomasa S., Ishibashi K., Yada K., and other author partnerships.

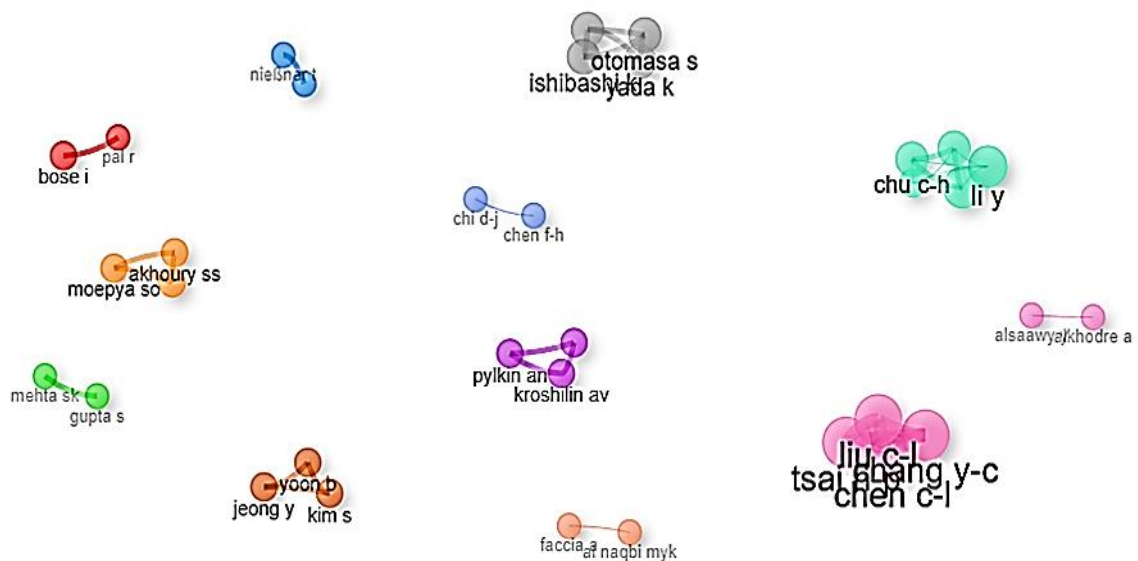


Figure 17. Authors' Collaboration Network

Figure 18 depicts an analysis of author collaboration between countries from a regional perspective. Based on the results of bibliometric analysis, it can be concluded that Chinese scholars dominate cross-national scientific collaboration by collaborating with researchers from Hong Kong, the United States, India, Saudi Arabia, Turkey, and Thailand. There are further collaborations in Germany, the Netherlands, and Egypt. Singapore then works with Australia and Canada. The United Kingdom works with Malta, Greece, the United Arab Emirates, and Spain. The United Kingdom works with Malta, Greece, the United Arab Emirates, and Spain.

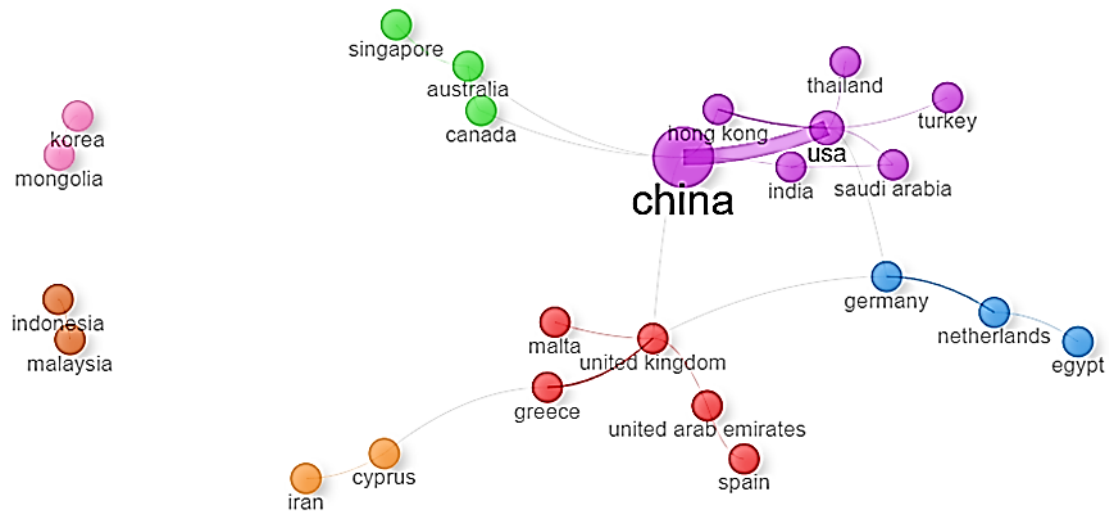


Figure 18. Geographical Collaboration Network

3.3. Literature Review of The Most Cited Articles

The previous section reviewed the results and discussion of bibliometric analysis so that the contribution of authors and journals, keywords, countries, main topics, and knowledge base structure in Scopus-indexed journal articles that discuss the implementation of AI in financial statement analysis is known. Furthermore, scholars will undertake a theoretical review of the ten most cited articles in this section. The information about the topic of the kinds of literature reviewed is shown in Table 3 below.

Table 3. A Summary of Article Information

No	Author	Year	Journal	Topic
1	Monica Lam	2004	Decision Support Systems	Financial performance prediction
2	Wei-Sen Chen, Yin-Kuan Du	2009	Expert Systems with Applications	Financial distress prediction
3	Mu-Yen Chen	2011	Expert Systems with Applications	Financial distress prediction
4	Johan Perols	2011	Auditing: A Journal of Practice & Theory	Fraud detection
5	W.L. Tung, C. Quek, P. Cheng	2004	Neural Networks	Bank failures prediction
6	Xuemin (Sterling) Yan, Lingling Zheng	2017	The Society for Financial Studies	Fundamental analysis
7	Shiguo Wang	2010	International Conference on Intelligent Computation Technology and Automation	Fraud detection
8	Chi-Chen Lin, An-An Chiu, Shaio Yan Huang, David C. Yen	2015	Knowledge-Based Systems	Fraud detection

9	Dianmin Yue, Xiaodan Wu, Yunfeng Wang, Yue Li, Chao- Hsien Chu	2007	IEEE	Fraud detection
10	Narcisa Roxana Mosteanu, Alessio Faccia	2020	Journal of Management Systems – Quality Access to Success	Financial management

Based on Table 3 above, the ten journal articles that will be reviewed have several topics.

3.3.1. Financial Performance Prediction

Lam (2004) investigated financial performance in the article "Neural Network Techniques for Financial Performance Prediction Integrating Fundamental and Technical Analysis." The capacity of neural networks, namely the backpropagation algorithm, to integrate fundamental and technical analyses to predict financial performance is investigated in this study. This study employs 16 financial statements as independent variables, 11 macroeconomic indicators as dependent variables, and return on common shareholders' equity as the dependent variable. Researchers developed tests to assess the prediction capacity of neural networks on financial performance in this study. The experimental results confirm neural networks' ability to outperform minimum indicators in a highly diversified investing strategy. Furthermore, adding earlier years' financial data in the neural network training input vector can significantly boost the rate of return. This highlights the advantages of combining fundamental and technical analysis with neural network training.

3.3.2. Financial Distress Prediction

In their article "Using Neural Networks and Data Mining Techniques for The Financial Distress Prediction Model," Chen and Du (2009) address efforts to improve the model's ability to predict financial distress. This study is inspired by the idea that company executives can purposefully bundle financial data to conceal the situation of organizations in financial distress or on the approach of bankruptcy. Chen and Du adopted the Taiwan Stock Exchange Corporation (TSEC) operating guidelines that corporations broke, resulting in termination and suspension. The study also used financial, non-financial, and factor analysis to extract variables. Data mining and artificial neural network techniques created a financial distress prediction model. The findings of this study suggest that the AI technique may be a better tool than classical statistics for predicting the possibility of financial distress in businesses.

Chen (2011) discusses financial hardship in his article "Predicting Corporate Financial Distress Based on Integration of Decision Tree Classification and Logistic Regression." This study has nearly the same research motivation as Chen and Du (2009), which is worried about companies that conceal financial issues. This study, like Chen and Du (2009), uses TSEC operational restrictions to increase the accuracy of the financial distress prediction model. The difference is that Chen used principal component analysis (PCA) and decision tree (DT) classification methods in this investigation. The findings of this study suggest that the AI technique can be a better and more appropriate strategy for predicting than classical statistics.

3.3.3. Fraud Detection

Perols (2011) evaluates the performance of six statistics and machine learning algorithms for financial statement fraud detection in his work "Financial Statement Fraud Detection: An Analysis of Statistical and Machine Learning Algorithms." The results reveal that logistic regression and vector support machines outperform artificial neural networks. Lin et al. (2015) attempt to test all aspects of the fraud triangle using data mining techniques and using available information and public information as proxy variables to evaluate attributes such as pressure/incentive, opportunity, and attitude/rationalization in a paper titled "Detecting the Financial Statement Fraud: The Analysis of The Differences Between Data Mining Techniques and Experts' Judgments." Logistic regression, decision trees, and artificial neural networks are the data mining techniques employed.

Yue et al. (2007) did research titled "A Review of Data Mining-based Financial Fraud Detection Research," which provides an overview in the form of a complete study of the financial fraud detection process using data mining-based methodologies. This study developed a financial fraud detection framework for comprehending and classifying diverse combinations of fraud detection approaches and data mining algorithms. This framework allows one to evaluate various features of fraud detection algorithms based on multiple assessment criteria. Wang (2010) also reviews research on data mining in financial fraud detection. Wang considers data mining an advanced analysis

software to support auditors' decision-making in detecting fraud in a study titled "A Comprehensive Survey of Data Mining-based Accounting-Fraud Detection Research."

3.3.4. Bank Failures Prediction

Tung, Quek, and Cheng (2003) investigate the dangers that can develop when a bank collapses, such as substantial bailout costs and investor and depositor loss of confidence. Based on financial distress symptoms, an early warning system is required to identify possible bank failures or high-risk banks. Tung et al. proposed using neural fuzzy systems to predict bank failures in their paper "GenSo-EWS: A Novel Neural-Fuzzy Based Early Warning System for Predicting Bank Failures." The system development results reveal that GenSo-EWS performs well as an alternative to predicting bank failures.

3.3.5. Fundamental Analysis

According to Yan and Zheng (2017), in their article "Fundamental Analysis and the Cross-Section of Stock Returns: A Data-Mining Approach," researchers created a system comprised of more than 18,000 essential signals from financial statements. To assess the impact of data mining on fundamental-based abnormalities, researchers utilized a bootstrap approach. Even after accounting for data mining, the study discovered numerous essential signals are essential predictors of cross-sectional stock returns. This forecasting capacity is especially prominent after high-sentiment periods and among equities with higher arbitrage restrictions.

3.3.6. Financial Management

Financial management is critical in all economies and must now be digitally flexible. Mosteanu and Faccia (2020) did research titled "Digital System and New Challenges of Financial Management - FinTech, XBRL, Blockchain, and Cryptocurrencies" that highlighted the management of financial reporting through AI using XBRL and blockchain. Extensible Business Reporting (XBRL) enables a company to create the necessary reporting data directly from its financial data. Meanwhile, blockchain can reduce the risk of errors, particularly human errors, lower the danger of fraud, enable system automation, boost efficiency, and improve financial report reliability.

4. Conclusion

This study examines 181 Scopus-indexed journal papers from 2000 to 2023 that focus on the deployment of AI in financial statement analysis. The research also thoroughly examines the conceptual framework, intellectual structure, and social structure of the writings on the subject. This study highlights relevant publications, sources, and authors focusing on AI research in financial statement analysis. Biblioshiny, a bibliometric analysis tool from the Bibliometrix R-Package, was employed in this study. According to the bibliometric analysis results, the most relevant journals for applying AI in financial statement analysis are the ACM International Conference, Lecture Notes in Networks and Systems, Expert Systems with Applications, Procedia Computer Science, and Sustainability. Between 2000 and 2023, Li Y was the most prolific author. China, India, and the United States are the countries that are most interested in using AI in financial statement analysis.

From 2000 to 2023, the most significant trends of themes relating to AI's deployment in financial statement analysis include publications on data mining, financial statements, finance, artificial intelligence, decision-making, and forecasting. An examination of thematic evolution reveals a considerable shift in research areas. Between 2020 and 2023, research on crime themes shifted toward artificial intelligence, information classification, and finance. Hotly disputed data mining topics between 2000 and 2019 began to shift in 2020-2023, including artificial intelligence, big data, information classification, finance, and local government. From 2000 to 2019, the focus of decision-making changed to finance, followed by learning algorithms in 2020-2023. The emphasis was on financial systems from 2000 to 2019 and local government from 2020 to 2023. Natural language processing systems, criminality, learning systems, financial statement frauds, machine learning, decision-making, and decision support systems were identified as essential topics with limited development in the thematic map study. As a result, future research directions relating to AI themes are still highly relevant. A solid research recommendation is to conduct a study on the application of AI in fraud detection and AI in financial crime prevention.

This work contributes to highlighting the use of AI in financial statement analysis from the standpoint of research topic trends and suggesting potential themes for future researchers. This study provides future scholars with information about this field's issues, context, and collaboration prospects. Aside from that, the research has academic and policy implications. Academically, the findings provide useful information to scholars and researchers interested in the convergence of AI

and financial statement analysis. The study serves as a road map for further exploration and academic inquiry in this domain by emphasizing research subject trends and suggesting potential themes for further examination. Furthermore, policymakers can develop informed policies to address the ethical and regulatory concerns associated with AI technologies by understanding the emerging trends and potential implications of AI in financial statement analysis, as detailed in this research. This study collected articles for analysis from the Scopus database. Other databases, such as Web of Science, Google Scholar, Crossref, and others, should be included in future studies to extract additional data and broaden the analysis.

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