

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

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**ABSTRACT:** This study explores the landscape of fraud detection in the banking sector through a comprehensive bibliometric analysis. Using Bibliometrix and VOSviewer, an open-source tool for conducting bibliometric analysis, this study examined a corpus of scholarly articles from the Scopus database to identify key trends, influential publications, prominent authors, and leading research institutions in the field. The analysis focused on publication trends over time, citation patterns, and collaborative networks among researchers. Key findings highlight the predominance of machine learning and artificial intelligence techniques in recent fraud detection research, the significant contributions from researchers in China and India, and the growing importance of interdisciplinary collaboration. The study provides a detailed visualization of the intellectual structure of fraud detection research, offering insights into emerging trends and potential areas for future study. By mapping the existing body of knowledge, this study aims to guide researchers, practitioners, and policymakers in developing effective strategies to combat fraud in the banking sector.

**KEYWORDS:** fraud in banking sector, detection, bibliometric analysis, machine learning, artificial intelligence techniques

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### I. INTRODUCTION

A bank is a business entity that collects and manages funds from third parties (Bank Indonesia, 2024). These third parties, referred to as customers, entrust the bank to manage their funds, whether through credit distribution activities or other investment activities. As an institution that manages customer trust, the bank has the responsibility and obligation to ensure the security and safety of the funds deposited (Cuccia & Capstone, 2023). On the other hand, deposited funds are attractive targets for fraud perpetrators. According to a survey by ACFE, the banking industry ranks at the top as the organization most frequently victimized by fraud, with 351 cases and a median loss of \$100,000 (ACFE, 2022). Fraud, both internal and external (singleton, 2010), poses a significant challenge as it directly impact the financial stability and reputation of banking institutions. Banks now must compete with over 46 types of fraud, ranging from identity theft and check washing to more sophisticated schemes such as coordinated cyber-attacks (Aebi et al., 2021). Managing these risks requires banks to implement stringent internal controls, conduct regular audits, and utilize advanced fraud detection technologies.

Recent cases in Indonesia show that fraud in banking institutions often involves employees. For instance, in the case of BTN, a bank employee committed fraud by offering high-interest deposit products. Victimized customers invested their funds in this scheme, and the bank employee forged documents to create fake deposit accounts (Kompas, 2024). Another case that attracted public attention involved the theft of customer data to apply for fictitious credit, resulting losses to 9 billion rupiah (Solopos, 2024). Bank employees had access to customers' accounts and passwords, allowing them to conduct financial transactions freely. Another case occur in state-own Bank in Southern Sumatera where the employee make duplication of customer mobile banking application and use it to gain cash (idntimes, 2024). One thing in common among that case is, the employee as a perpetrator has perform their fraudulent activity for several years undetected. While the victimized organization is the Bank which already had an anti-fraud control design including fraud detection technique. The phenomena has brought us to questioning the ability of the Bank to detect fraud earlier.

This study aim to identify emerging fraud detection techniques in the banking sector through a systematic literature review. This study conduct a bibliometric analysis of the literature on Fraud detection in banking sector, utilizing Scopus database. Therefore, this study attempts to address three research questions in this analysis. First (RQ1), what are the primary academic interest on fraud detection in banking sector considering authors, journals, and countries of the publication. Second (RQ2), what fraud detection technique that emerge in recent academic research, and the third (RQ3) what subject area can be explored for

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

the future research in these theme. The study has useful implication for academicians and bankers to promote an effective fraud detection technique in banking sector.

### II. THEORETICAL BACKGROUND

(Handling human resources in a company is an art. Not only thinking about their welfare, but also preventing employee fraud (Suryandari et al, 2023). This study uses an opportunistic perspective in positive accounting theory and rational choice theory to explain the employee fraud occurrence. The opportunistic perspective is often referred to as an *ex post* perspective – *ex post* meaning after the fact – because it considers opportunistic actions that could be undertaken once various contractual arrangements have been put in place (Deegan, 2013). Although employees received the amount of bonus from the interest revenue made from the contractual arrangement between customer and Bank, they still wanted to gain the advantage from the deposited fund. On the other hand, the Rational Choice Theory (RCT) developed by Gary Becker tries to explain why people committed to crime. Becker's economic approach to crime suggests that individuals engage in criminal activities if the expected benefits outweigh the expected costs, including the probability of being caught and punished (Becker, 1968). To explain the above case, Bank employees committed to fraud because they assess the risk of being caught is low due to the inability of the Bank to detect the fraud scheme. Hence, the need for conducting anti-fraud control through an effective fraud detection technique is inevitable.

In 2002, Bolton and Hand published a review on fraud detection techniques. Detailing the tools available for statistical fraud detection and identifying the most commonly used technologies in four areas: credit card fraud, money laundering, telecommunication fraud, and computer intrusion. Similarly, Kou et al. (2004) conducted a survey on techniques for detecting the same types of fraud covered by Bolton and Hand (2002). They categorized the techniques based on different types of fraud detection. Some of the techniques they described include outlier detection, neural networks, expert systems, model-based reasoning, data mining, state transition analysis, and information visualization.

For internal fraud detection, previous studies have been conducted. Eberle and Holder (2009) present a graph representation approach to detect anomalies in business transactions and processes. Three algorithms are used in the pre-processing phase to aid the identification of anomalies. These assembly techniques successfully discover irregularity in data from different sizes with minimal to no false-positives. Luell (2010) proposes a decision framework to aid fraud detection approaches. The system is constructed by a detection component and visualization. They demonstrate the potential of the proposed solution by three case studies. Argyriou et al. (2013) propose an internal fraud detection solution. Despite being developed to detect frauds in internal systems, the proposed solution should work in any system that involves relationships of two different entities, for example, client and employee.

Later in 2015, Carminati et al (2015) introduced BankSealer as a decision support system for online banking fraud analysis and investigation. This system uses a temporal threshold system that measures the anomaly of the current spending pattern of each customer. In the same year Chen J et al (2015) from Alibaba presented a big data based fraud prevention product called AntBuckler. By combining large amounts of data of Alibaba and customers', AntBuckler uses the RAIN score engine to quantify risk levels of users or transactions for fraud prevention. Carminati et al (2018) complemented their work on BankSealer by designing a proof-of-concept attack tool that performs mimicry attacks, emulating a sophisticated attacker that cloaks frauds to avoid detection.

This study will contribute in describing the emerging of fraud detection techniques in order to motivate future research in this theme. Moreover, this study will provide information for Indonesian Bank analysts, and internal auditors to consider the possible techniques applied in their company.

### III. MATERIALS AND METHOD

This research utilized the Scopus database due to its higher quality of articles and broader range of publications. There were no time limitations on the scientific articles, allowing for a comprehensive review of all relevant items to the research topic. The initial step in searching the database and selecting items was to identify keywords pertinent to the research topic. These keywords include banking sector and four terms related to fraud: anti-fraud strategy, fraud detection, fraud prevention, and internal fraud. 681 articles were identified from the search area "Article title, abstract, keywords". The subject area is narrowed down to "computer science", "business, management and accounting", and "economics, econometrics and finance". Document types selected to "articles" and publication stage selection is "final". At the end, data was curated into 101 articles for bibliometric analysis.

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

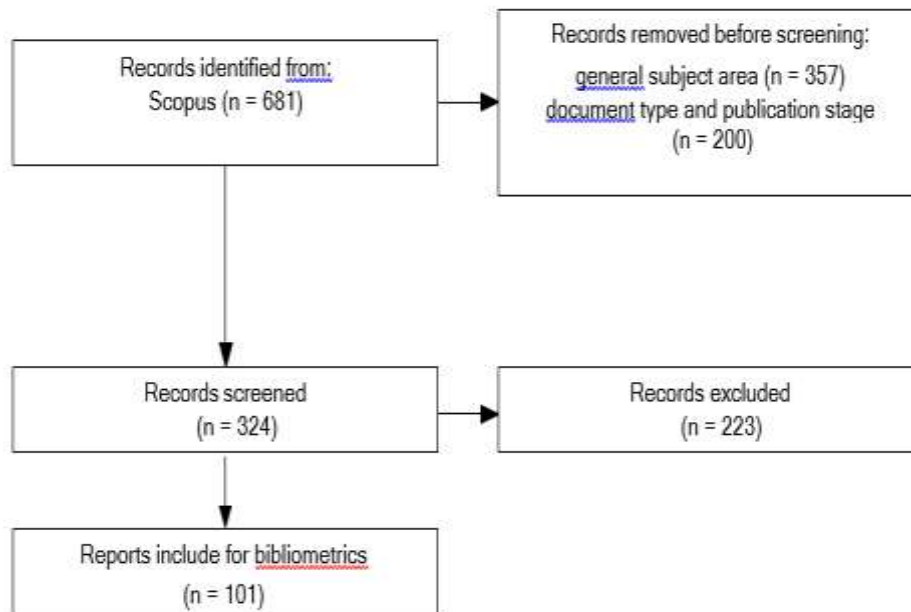


Figure 1. PRISMA Flowchart for The Study

After the final sample was selected, a bibliometric and descriptive analysis of the SLR was performed. This analysis considered key verification criteria such as publication trends over a specific period, types of publications, top journals, authors, affiliations, and the countries of origin of the publications. The citation rate of the publications was also examined to gauge their impact. To identify the most significant publications, a Scopus database tool was employed to rank the most frequently cited works in the final analysis. This process helps highlight publications that are crucial and frequently referenced by other researchers in the same field. Data was directly extracted from Scopus, encompassing necessary details like author, title, abstract, keywords, year of publication, and affiliation, which were then imported into VOSviewer for bibliometric visualization. The final component of this research involved a deeper content analysis using the network visualization matrix.

### IV. RESULT AND FINDINGS

The bibliometric analysis includes 101 publications and examines by the year of publication, journal, author, country, and keywords. This study presents the research interests, concerns, and trends related to fraud detection in banking sector. Using the analyze tool from Scopus, Figure 1 shows the number of documents produce on this theme. The frequency of publications has tended to increase in the last five years, although it has declined in the last two years. This study is conducted in June 2024, therefore a declining line in 2024 is excluded as the later publication has not been captured.

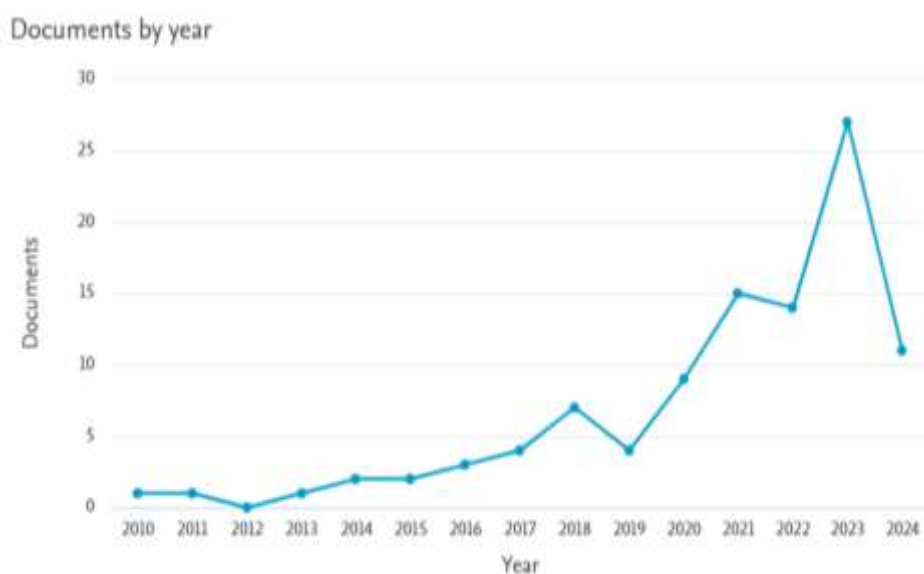


Figure 2. Trend of Publication

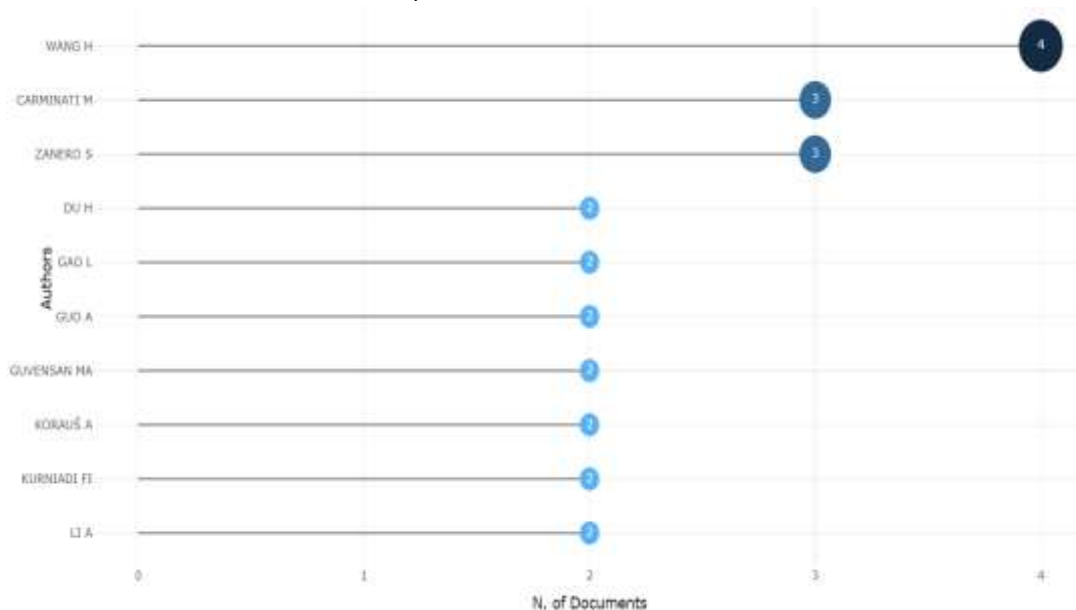
## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

The result include 76 journals, most of the relevant articles were published in the subject area of Computer science. Banking sector use technology and information system to operate and providing services. This explain why this theme is also attractive for computer and information system major. The 10 most relevant sources presented in Table 1.

**Table 1. Most relevant sources processed with R studio**

No	Sources	Articles
1	INTERNATIONAL JOURNAL OF ADVANCED COMPUTER SCIENCE AND APPLICATIONS (IJACSA)	8
2	BANKS AND BANK SYSTEMS	4
3	IEEE ACCESS	4
4	INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND EXPLORING ENGINEERING	3
5	ACM TRANSACTIONS ON PRIVACY AND SECURITY	2
6	COGENT BUSINESS AND MANAGEMENT	2
7	COMPUTERS, MATERIALS AND CONTINUA	2
8	ELECTRONICS (SWITZERLAND)	2
9	INTERNATIONAL JOURNAL OF ELECTRICAL AND COMPUTER ENGINEERING	2
10	INTERNATIONAL JOURNAL OF INTELLIGENT ENGINEERING AND SYSTEMS	2

From the table above, 8 articles were published in International Journal of Advanced Computer Science And Applications (IJACSA). The IJACSA is peer-reviewed academic journal that focuses on research in the field of computer science and its applications. The 10 most relevant author presented in Figure 3. Result shows Wang H as the most relevant author with 4 articles, followed by Carminati M and Zanero S with 3 articles publish in this theme.



**Figure 3. Most relevant author processed with R studio**

From corresponding author's countries, result shows China as the most publication amount with 10 articles, followed by India with 7 articles, Indonesia and South Africa with 4 articles.

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

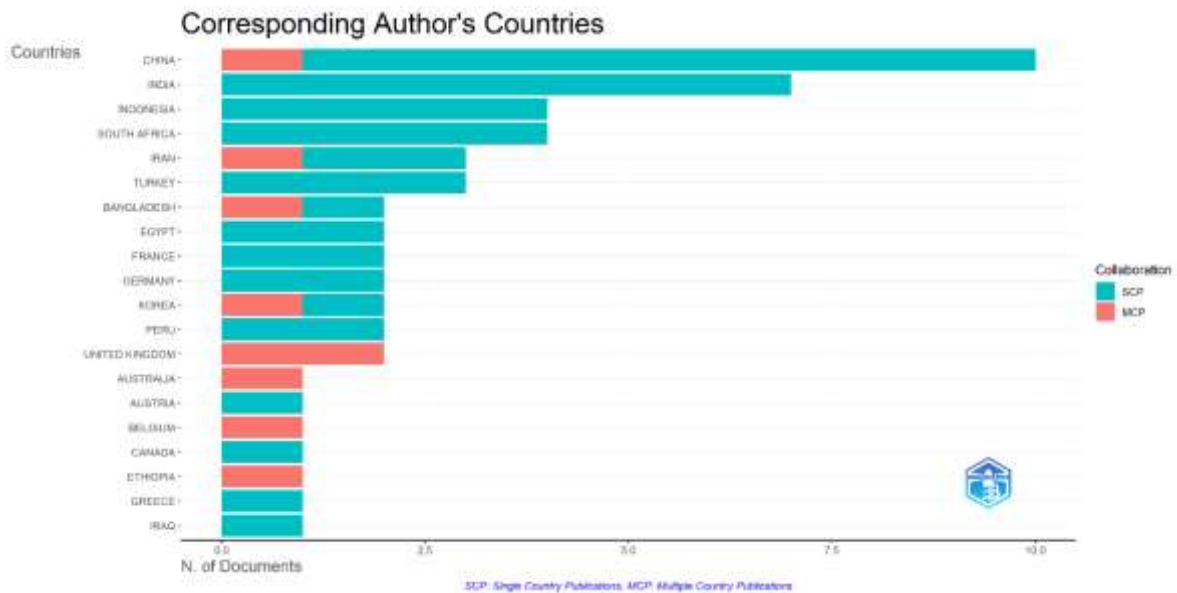


Figure 4. Corresponding author's countries processed by R Studio

Table 2 presents the most global cited document. The analysis identified 11 articles with number of citation more than 20 in global.

Author	Title	Total Citations
Zhang z, 2018	A Model Based on Convolutional Neural Network for Online Transaction Fraud Detection	93
Carminati m, 2015	BankSealer: A decision support system for online banking fraud analysis and investigation	64
Ileberi e, 2021	Performance Evaluation of Machine Learning Methods for Credit Card Fraud Detection Using SMOTE and AdaBoost	57
Chen j, 2015	Big data based fraud risk management at Alibaba	44
Leite ra, 2018	Visual analytics for event detection: Focusing on fraud	33
Suryanto t, 2016	The Shariah financial accounting standards: How they prevent fraud in islamic banking	27
Barakat a, 2014	Information asymmetry around operational risk announcements	25
Carminati m, 2018	Security evaluation of a banking fraud analysis system	25
Jayasree v, 2013	A review on data mining in banking sector	22
Daliri s, 2020	Using Harmony Search Algorithm in Neural Networks to Improve Fraud Detection in Banking System	21
Almhaithawi d, 2020	Example-dependent cost-sensitive credit cards fraud detection using SMOTE and Bayes minimum risk	21

Table 2. Most global cited document processed by R studio

Figure 4 demonstrate the network analysis keyword. The connection between keyword is analyze by counting the co-occurrence of particular words. This keyword can represent a variable or concept.

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

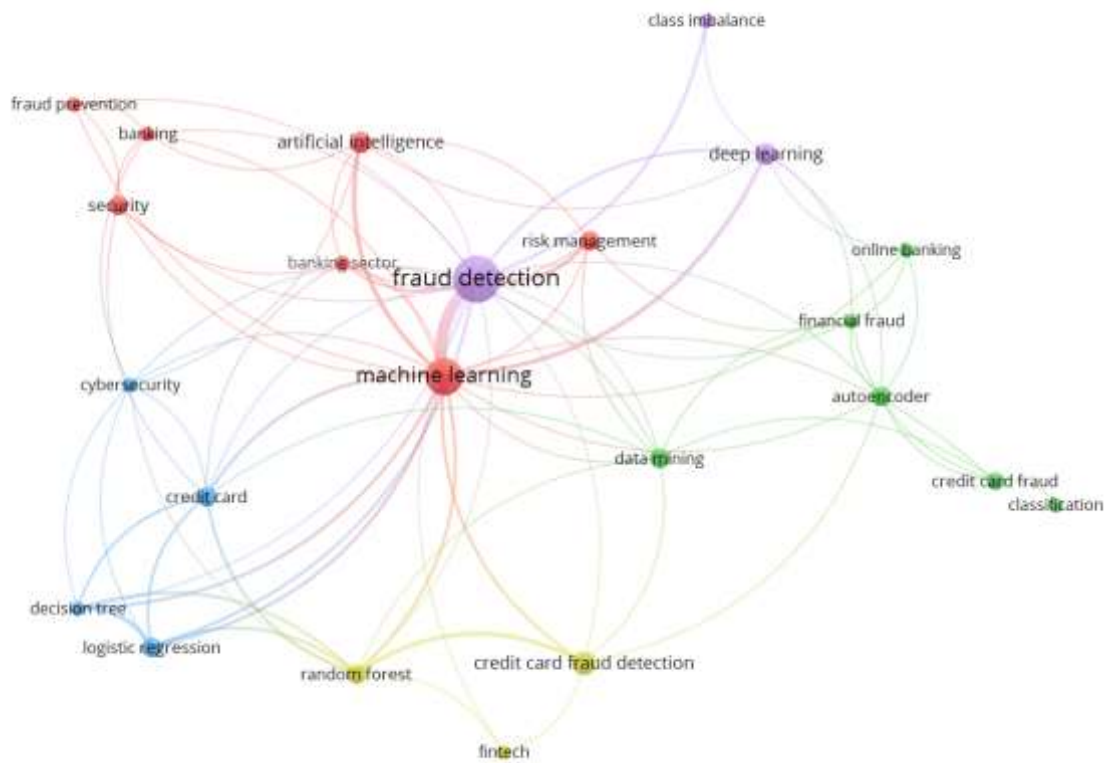


Figure 4. Network visualization processed by Vosviewer

Result shows “machine learning” and “fraud detection” had a bigger nodule among others. The strong lines and the closeness of nodule shows that “machine learning” has a strong connection with “fraud detection” concept. The color describe a several concept in the same group. “Machine learning”, “banking” and “banking sector” has the same color implies that the particular keyword are often occurred in the same theme.

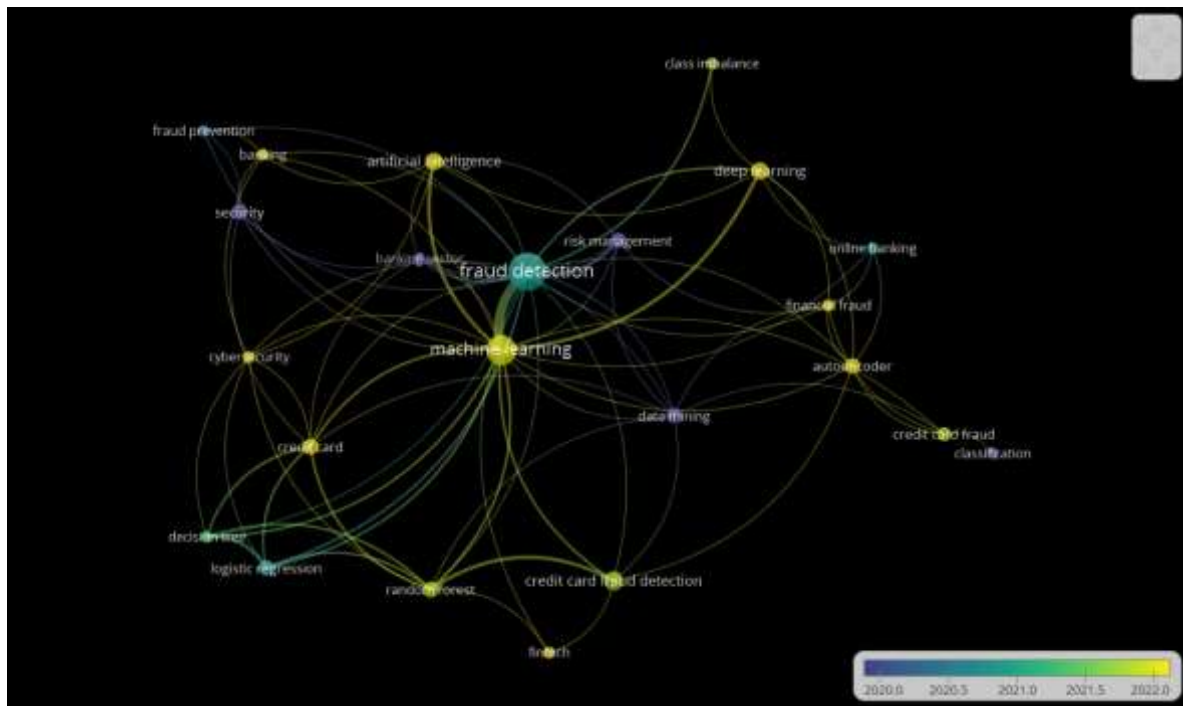


Figure 5. Overlay visualization processed by Vosviewer

## Fraud Detection in Banking Sector: A Bibliometric Analysis and Future Research

In Figure 5, the recent concept occurred in the publication is demonstrated. The color shows the occurrence of particular concept in different times. Machine learning, artificial intelligence, deep learning and random forest is several concept that much occurred in 2022 until now.

### V. DISCUSSION

#### A. Academic Interest of The Theme

The result of this study has demonstrate the academic interest of fraud detection in banking sector. Ranging from 2010 until now, academicians continue to develop fraud detection technique in banking sector. Most of it is the one who had computer and data science educational background.

#### B. Recent Technique to Detect Fraud in Banking Sector

This study shows that fraud detection techniques in the banking sector often leverage machine learning due to its ability to analyze vast amounts of data quickly and accurately, identifying patterns and anomalies that may indicate fraudulent activity. Machine learning algorithms can continuously learn and adapt from new data, improving their accuracy over time. This dynamic nature allows banks to detect emerging and sophisticated fraud tactics that static rule-based systems might miss. Additionally, machine learning models can analyze complex interactions and subtle correlations in transactional data, providing real-time alerts and reducing false positives. The scalability and efficiency of machine learning enhance the bank's ability to safeguard assets and maintain customer trust, making it an essential tool in modern fraud detection strategies.

#### C. Future Research Opportunities

The future research agenda can explore the effectiveness of machine learning in detecting fraud in banking sector. Researcher also can explore the interaction between auditor and machine learning to detect fraud. More over future research could focus on the needs of data analysis capability for the accounting profession including fraud examiner. Due to the extensive adoption of digital technologies, analysis of fraud detection in credit card and online payment is another emerging field.

### VI. CONCLUSION

The count of research papers in this domain has seen an upward trend; this clearly indicates that this research area is gaining significant importance and that there are newer dimensions in this domain. This research study has performed a thorough bibliometric analysis in this domain and emphasized machine learning as one of the fraud detection technique, which will be useful to academicians, policymakers, and Bankers who want to work together on these focus areas in the future.

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