

Artificial Intelligence and Benford Law as Useful Tools for Detecting Accounting Fraud

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Abstract

The article discusses the importance of using artificial intelligence (AI) to detect accounting fraud. It shows how AI can automate the analysis of financial data, identify irregular patterns and act quickly on potential fraud. Various methods, such as Benford's Law analysis, machine learning, and transactional sample analysis, are presented in detail. The ability of AI to continuously learn and adapt to new deceptive tactics is also emphasized. With a comprehensive approach that includes process automation and multi-source data analysis, AI helps to protect better organizations against financial losses and the negative consequences of accounting fraud.

Keywords: fraud, accounting, artificial intelligence, forensic accountant, accounting fraud, Benford's Law

INTRODUCTION

Detecting accounting fraud is an important area that requires expertise and experience. A forensic accountant specializing in fraud detection in the financial operations of companies can take advantage of AI to work more accurately and efficiently. When it comes to detecting fraud in finance and accounting, there are several approaches and methods used to identify potential irregularities. Some of the common techniques include analyzing financial data, verifying documentation, checking internal controls, using computer programs to detect irregularities, and working with forensic accounting experts.

Analysis of financial data is an essential method for detecting potential anomalies. The latter includes reviewing balance sheets, income and cash flow statements and looking for any unusual patterns or discrepancies. It is also vital to check documentation such as invoices, contracts and bank statements to ensure that they are correct and compliant.

Internal controls are crucial in preventing and detecting fraud. This includes the implementation of appropriate procedures and the political and regular review of their effectiveness. Computer-based anomaly detection software can help automate this process by analyzing large amounts of data and looking for unusual patterns or anomalies. In addition, working with forensic accounting experts can be helpful in investigating potential fraud. Forensic accountants have specialized knowledge and experience in detecting and investigating financial irregularities and can assist in evidence gathering and analysis. However, it should be noted that no method is 100% reliable and that it is also important to consider other factors such as ethical conduct, transparency, and good governance.

LITERATURE REVIEW AND RESEARCH QUESTIONS

A few years ago, artificial intelligence was out of reach, with robots and modern technological devices only seen in fictional films. Today, however, technological developments have made AI applications indispensable in our daily lives. (Kokoina & Davenport, 2017; Holzinger et al., 2019; Almaih, Alfaishal, et al., 2022). Modern technological machines that carry out most of our daily tasks are becoming more efficient and successful over time using modern artificial intelligence techniques (Askary et al., 2018; Almaiah, Alfaisal et al., 2022). Also, modern accounting applications have developed thanks to artificial intelligence, which has a positive impact on accountants, saving them time and making calculations in a short period. (Zhang et al., 2023; Alkan, 2022; Faccia et al., 2019; Mohammed et al., 2020). In addition, AI in accounting aims to increase the efficiency of computer operations in ways that help make the best decisions (Almaiah, Ayouni et al., 2022; Khassawhen, 2014), as AI can extract information and data with high accuracy at the click of a button, which is something that could take an accountant days to do, not to mention that human error also needs to be taken into account (Faccia et al., 2019). Artificial intelligence organizes and analyzes accounting information, making it easier for accountants to provide the most accurate financial information (Damerji & Salimi, 2021; Raisch & Krakowski, 2021; Zaitoun & Alqudah, 2020).

Studies on the use of AI in auditing show a positive impact on the effectiveness of the audit process. Dunn and Hollander (2017) focus on the impact of AI on auditing by reviewing the development of AI systems in auditing based on the identified strengths and limitations. This research explores the impact of AI on improving the efficiency and quality of the audit process. The results suggest that large audit firms will continue to invest in specialized expert systems and industry-specific neural networks, as well

as specific audit tasks, to mitigate their audit risks (Bogdan et al., 2023). Similar results are found in the study by Li et al. (2018). This study reveals that accountants and auditors are using AI technology to automate the audit process, reduce repetitive work, and improve data analysis. AI technology equips them to process large datasets that identify unusual transactions and analyze risks (Dinca et al., 2024). Davis and Fisher (2020) studied the use of AI technology in auditing. Their study shows that auditors can use AI technology to analyze audit data, identify non-compliant transactions, and detect errors. AI technology provides auditors with powerful tools to improve the accuracy and efficiency of the audit process.

In a study by Chen et al. (2019), the authors investigated the use of artificial intelligence in accounting work. Their research shows that accountants are using AI technology to automate classification, analysis, and financial reporting tasks. AI technology helps them save time and effort in processing complex financial data while providing critical information to support decision-making.

This study aims to answer the following research questions:

1. What accounting frauds can occur in accounting?
2. What is the role of AI in detecting accounting fraud?
3. What problems/challenges can AI solve/eliminate in accounting?
4. Is artificial intelligence useful in detecting accounting fraud?

ACCOUNTING FRAUD

Accounting fraud is the manipulation of financial statements and accounting records in order to mislead or conceal irregularities or illegal activities in the company's accounting and financial reports. These frauds involve a variety of unethical and illegal practices that can distort a company's actual financial situation. Some common forms of accounting fraud include:

- **Double entry:** this is a basic form of accounting fraud in which transactions are recorded in accounting records in a way that does not reflect actual events. For example, assets may be overstated or costs reduced to increase profits.
- **Artificial revenue inflation:** a company can increase revenue by selling products or services that it has not yet delivered or by using speculative customer accounts.
- **Hidden costs:** Costs may be hidden to maximize profits. The latter includes misleading cost accounting entries or inappropriate increases in the value of assets.
- **Inventory violations:** under or over-statement of inventory quantities in the inventory, which affects the value of assets and profits.
- **Concealment of liabilities:** liabilities to suppliers, loans or tax liabilities may be concealed or withheld in order to improve the liquidity of the company.
- **Speculative accounting:** a company may pursue risky investment strategies and then portray these investments as safe or profitable.
- **Fake customer transactions:** a company may create fake customers and transactions to inflate revenues and profits.
- **Cash flow manipulation:** cash flows can be manipulated to show better financial stability than actually exists.

- **Depreciation and write-off irregularities:** assets may be wrongly depreciated or written off, affecting their balance sheet value.

Accounting fraud poses a serious risk to businesses, investors, and the economy as a whole. Therefore, strict legislation and standards for financial statements and internal controls are in place to prevent and detect these frauds. Organisations must also continuously carry out checks, controls and investigations to ensure the integrity and transparency of their financial activities.

BENFORD'S LAW

One example of the use of artificial intelligence in detecting accounting fraud is the use of Benford's Law. Benford's law is based on the observation that in nature and numerical data, the first digits occur in a significant order. This law can be used to verify the authenticity of financial data.

The story of the first digit began in 1881 when Simon Newcomb noticed that the logarithmic tables were more worn out at the beginning than at the end. He concluded that users of tables more often need decimal logarithms of numbers starting with a lower digit. He even hypothesized that the first significant digit c often occurs according to the logarithmic law, i.e., with probability $P(c = n) = \log(n + 1) - \log n = \log(1 + 1/n)$, $n = 1, 2, 3, \dots, 9$ (Hladnik, 2002, p. 140).

Newcomb's discovery was forgotten for a long time but remembered again more than fifty years later. In 1938, Frank Benford, a physicist employed by an electricity distribution company, revisited the phenomenon (Hladnik, 2002, p. 141).

Initially, Benford's law applied only to mathematical and physical constants and to geographic data. Hal Varian stated in 1972 that the law could be used to check numbers in public planning decisions (Ramaswamy, Leavins, 2007, p. 28).

Nigrini proved in 1994 that Benford's Law could be used to detect fraud. His research is based on the fact that individuals create fraudulent numbers due to psychological and mentioned situations (Özer, Babacan, 2013, p. 31). He is also believed to be the first researcher to have extensively implemented and tested Benford's Law in the field of financial statements, with the aim of detecting potential fraud in them (Durtschi, Pacini, 2004, p. 22).

Benford's law states that the probability of digits appearing in different places in a number logarithmically decreases as the value of the digit increases. This is in contrast to intuition, which states that the digits are evenly distributed. Therefore, Benford's law is mainly used as a means of identifying falsified data (Tolle, LaViolette, 2000, p. 331). It is also used as a forensic tool to compare the actual frequency of digits with the expected frequencies (Moore, Benjamin, 2004, p. 5).

The formulas for the digit frequency of Benford's law are shown by D_1 for the first digit, D_2 for the second digit, and D_1D_2 for the first two digits. The probabilities of occurrence of the first digit are obtained using the mathematical formula (Nigrini, 2012, p. 5):

$$P(D_1 = d_1) = \log\left(1 + \frac{1}{d_1}\right); d_1 \in \{1, 2, \dots, 9\}.$$

The probabilities of occurrence of the second digit are obtained using the mathematical formula (Nigrini, 2012, p. 5):

$$P(D_2 = d_2) = \sum_{d_1}^9 \log\left(1 + \frac{1}{d_1 d_2}\right); d_2 \in \{0, 1, \dots, 9\}.$$

Nigrini (2012, p. 5) states that the probability of occurrence of the first two digits in a number is obtained by using the mathematical formula:

$$P(D_1 D_2 = d_1 d_2) = \log\left(1 + \frac{1}{d_1 d_2}\right); d_1 d_2 \in \{10, 11, \dots, 99\}.$$

Benford's Law analysis using artificial intelligence algorithms enables automated verification of large amounts of data, increasing efficiency and accuracy in detecting potential irregularities. This can enable organizations to detect any accounting irregularities or manipulations more efficiently and quickly, thereby reducing the risk of financial losses or reputational damage.

USING ARTIFICIAL INTELLIGENCE TO DETECT ACCOUNTING FRAUD

Artificial intelligence enables automation and increases the scope of financial data analysis. Using advanced algorithms and machine learning, AI can quickly identify anomalies and suspicious patterns in large amounts of data. The latter allows the forensic accountant to focus on the most important aspects of the investigation, leading to more effective fraud detection.

Detecting accounting fraud is critical to maintaining the integrity of financial markets and businesses. There are several ways to detect accounting fraud:

- **Regular reviews and audits:** regular reviews and audits of financial statements by external auditors or internal auditors are a common way of detecting fraud. The auditors review the financial statements and other relevant documents and look for irregularities.
- **Analysis of financial indicators:** monitoring of financial indicators and comparison with industry standards and historical data may reveal unusual patterns that could indicate fraud.
- **Determining bookkeeping irregularities:** a detailed analysis of bookkeeping records and transactions can help detect irregularities such as false entries or unjustified costs.
- **Use of analytical tools:** artificial intelligence and analytical tools can analyze large amounts of data to detect unusual patterns and anomalies. This includes using machine learning to identify anomalies.
- **Cooperation with internal investigators:** internal investigators in the company can focus on investigating suspicious activities and cooperate with other departments to detect possible fraud.
- **Examples of whistleblowing:** reports of suspicious activity by employees or other stakeholders can lead to investigations and the discovery of fraud.
- **Verifying documentation and authorization:** verifying that all transactions are properly documented and authorized is an important step in fraud prevention.
- **Analysis of variances and cash flow tracking:** tracking variances between actual and expected cash flows and checking the use of funds can reveal irregular activities.
- **Transaction lifecycle analysis:** reviewing the entire transaction lifecycle from start to finish can help identify irregularities and fraud.

- **Improving internal controls:** putting in place effective internal controls and procedures to prevent fraud is vital to fraud prevention and detection.

It is crucial for organizations to regularly monitor and update their fraud detection and prevention processes and to train employees on the importance of ethical conduct and integrity in financial transactions. In addition, cooperation with the competent authorities and law enforcement authorities is required if serious accounting fraud is suspected.

Detecting accounting fraud using artificial intelligence (AI) has become increasingly important and effective in modern business environments. AI can help identify unusual patterns and unusual transactions. Below are some examples of how AI can detect fraud (OpenAI, 2023):

- **Big Data Analysis:** AI is excellent at analyzing large amounts of data. With the ability to analyze substantial financial databases, it can quickly identify unusual patterns and irregularities that would be difficult for a human reviewer to detect. This includes comparing current transactions with past ones and looking for deviations.
- **Predictive analytical models:** using machine learning and deep learning algorithms, AI can develop models to predict financial trends and identify anomalies. These models learn from historical data and can quickly identify discrepancies.
- **Audiovisual analysis:** AI may use audiovisual analysis to identify potential signs of fraud, such as speech analysis or facial recognition, to control access to sensitive financial information.
- **Text analysis:** by analyzing written documents, e-mails and other written communications, AI can identify keywords and patterns that indicate irregularities or participation in fraud.
- **Transaction tracking:** AI can track transactions between different accounts and entities and identify unusual and unjustified transactions that could be a sign of accounting fraud.
- **Automated risk management:** AI can develop automated risk management systems that alert about high-risk transactions or activities and take immediate action to prevent them.
- **Combination of different data sources:** AI can combine information from different sources, including transactional data, employee communication, access to systems, and others, to more comprehensively assess risk.

The role of accountants will continue to change as AI evolves, with a greater emphasis on technological skills, data analysis, and innovative thinking (Qasim, A.; Kharbat, 2020). The collaboration of accountants with AI technology provides a future in which accounting is more dynamic and data-driven (Luo, J.; Meng, Q.; CAI, 2018). AI significantly improves accounting efficiency by automating complex tasks, improving accuracy, speeding up reconciliation processes, and supporting fraud detection. Accountants can manage their time and expertise more effectively, improve the use of resources and achieve better financial results for the company.

ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE IN DETECTING ACCOUNTING FRAUD

Artificial intelligence (AI) has a number of advantages in detecting accounting fraud, allowing for better efficiency and accuracy compared to manual or traditional methods. Some of the main advantages of AI in detecting accounting fraud include (OpenAI, 2023):

- **Big data analysis:** AI can analyze huge amounts of financial data in a very short time. This allows for a more comprehensive analysis and increases the chances of detecting anomalies.
- **Accuracy:** AI can identify patterns and anomalies that forensic accountants might overlook. The latter increases accuracy in detecting accounting fraud.
- **Consistency:** AI works consistently and is not subject to human error or bias. This increases the reliability of the results.
- **Time-based monitoring:** AI can track transactions in real time and immediately alert about suspicious activity, which allows immediate action.
- **Autonomous operation:** AI can operate automatically without the need for constant supervision, allowing accounting data to be continuously monitored and verified.
- **Speed:** AI can quickly check and analyze large amounts of data in seconds or minutes, allowing for faster responses to possible anomalous activities.
- **Text anomaly detection:** with natural language processing technology, AI can analyze text documents such as e-mails and reports to detect traces of fraud.
- **Flexibility:** AI can be customized to meet the specific needs and requirements of a company and the changing patterns of fraud.
- **Reducing human burden:** AI can take on routine tasks, allowing analysts to focus on more complex and strategic aspects of fraud detection.
- **Combination with traditional approaches:** AI can be used in combination with traditional fraud detection methods, increasing the integrity and reliability of the investigation.
- **Continuous improvement:** AI can continually learn and improve its skills based on new data and experience.

Despite its many advantages, it is important to understand that AI is not perfect and cannot replace human analysis and judgment. Ideally, it should be used as a tool to support accounting professionals who can carry out further investigations and actions if any irregularities are detected. In addition, data security and privacy must be ensured when using AI to detect fraud.

Despite its many advantages, artificial intelligence (AI) also has some disadvantages when it comes to detecting accounting fraud. It is essential to be aware of these limitations and take them into account when using AI to detect fraud. Some of the main disadvantages of AI in this context include (OpenAI, 2023):

- **Pattern-based learning limitation:** AI is based on pattern-based learning, which means that it can be limited to identifying patterns that are already present in the data. It cannot detect wholly new and innovative forms of accounting fraud.
- **Need for accurate data:** AI requires high-quality and accurate input data. If the input data is incomplete or inaccurate, this may lead to incorrect conclusions.
- **Failure to take account of changing circumstances:** AI may not be able to adequately take into account changing circumstances or new laws and regulations, which may lead to incorrect conclusions.
- **High implementation and maintenance costs:** the deployment of AI for fraud detection requires significant investments in hardware, software solutions, training and maintenance, which can be financially demanding.
- **Privacy and data security:** the use of AI requires access to sensitive financial data, which increases the risk of privacy and data security breaches if not adequately protected.

- **Referral of all cases for further investigation:** AI can generate a large number of alerts and recommendations for further investigation, which can overwhelm human analysts and cause them to overlook fraud.
- **Limited ability to understand text:** despite advances in natural language processing, AI still has limited ability to understand and analyze text documents such as e-mails and reports.
- **Lack of moral responsibility:** AI has no moral responsibility and cannot take responsibility for its own actions or decisions. The responsibility for using AI to detect fraud remains with human operators.

Despite these disadvantages, AI is still a handy tool in detecting accounting fraud, mainly when used in combination with human analysis and supervision. It is important that the limitations of AI are taken into account and that it is used carefully and prudently in the verification of financial statements and the detection of irregularities.

Artificial intelligence also plays a positive role in accounting decision-making in accordance with regulatory standards (Paurav, 2023). Its innovative capabilities provide a number of benefits that help accountants and organizations make better financial decisions while complying with legal regulations (Issa et al., 2016). Artificial intelligence improves the reliability and accuracy of accounting records by analyzing and organizing data in real time, reducing the likelihood of errors in reporting and decision-making. Since AI can analyze a massive amount of data, it can also obtain valuable and necessary information to make better decisions according to market demand (Hoogendoorn, 2006). It should be emphasized that accounting decisions must follow regulatory standards where the role of AI cannot be ignored (Needles, 2010).

Compliance with fraud prevention rules is vital to maintaining trust and integrity, which is why AI is important in fraud detection and decision-making. AI-powered systems perform data validation and verification steps in an automated way, simplifying the audit process. This saves auditors' time while ensuring transparency and compliance with regulatory auditing standards and enhances the credibility and reliability of the financial data used in decision-making (Barth, M.E.; Landsman, 2010). Artificial intelligence enables accountants to handle financial data more efficiently and increases transparency in line with regulations, contributing to better financial governance and trust among stakeholders (Morais, 2020).

CONCLUSION

The role of artificial intelligence in accounting is revolutionary, simplifying accounting processes, improving accuracy, better data analysis and promotion capabilities. Accountants and businesses need to embrace AI and acquire the necessary skills to use it effectively. Despite the promising possibilities of AI in detecting accounting fraud, there are also challenges. The accuracy and reliability of the algorithms must be ensured, as false positives or negatives can cause great harm. Privacy and ethical issues must also be taken into account when using AI to monitor the financial activities of individuals and companies.

The study of Benford's Law, machine learning and the analysis of transaction patterns with artificial intelligence allows for exceptional accuracy in the identification of potential fraud. The ability of artificial intelligence to adapt to new deceptive patterns is also emphasized, which is crucial in a dynamic environment where deception tactics are constantly changing. With the technological advancement of

artificial intelligence, new perspectives are opening up in the fight against fraudulent practices, allowing organizations to operate more safely in a dynamic and complex financial environment.

Detecting accounting fraud has become more complex than ever, but with artificial intelligence, we have a powerful tool to help us better understand and control financial flows. The use of AI to combat fraud requires a deliberate approach and careful data management. Still, it can be key to maintaining the integrity of financial advice and trust in financial markets. With the correct use of AI, we can achieve a more transparent and fair financial environment for all. However, there are also great opportunities to improve the fight against accounting fraud with the help of AI. The speed, accuracy and performance that this technology brings can make a significant contribution to the detection and prevention of accounting fraud.

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