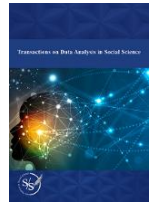




ISSN Online: 2821-1936

Transactions on Data Analysis in Social Science

Journal Homepage: <https://transoscience.ir>

Application of Artificial Intelligence and Machine Learning in Accounting and Auditing

A. Shahbazbeigi^{1,*}¹ Faculty of Accounting and Management, University of Tehran International Branch, Tehran, Iran

ARTICLE INFO	ABSTRACT
<p>Article History: Received 10 March 2024 Received in revised form 27 April 2024 Accepted 3 June 2024 Available online 5 June 2024</p>	<p>Financial accounting and auditing procedures have undergone a revolutionary transformation due to the rapid advancement of technology and innovation, presenting significant opportunities to enhance efficiency, accuracy, and transparency. In this dynamic landscape, machine learning (ML), data analytics, and artificial intelligence (AI) have emerged as indispensable tools. These technological advancements empower financial professionals to swiftly deliver precise financial information, enhance decision-making, and expedite operations. Utilizing AI and ML techniques is paramount in improving accounting and auditing procedures. By automating laborious processes such as data input and reconciliation, errors are reduced, and productivity is heightened. AI and ML systems possess the capability to swiftly and reliably identify trends, anomalies, and potential fraud by analyzing vast volumes of financial data. By harnessing real-time monitoring and predictive analytics capabilities, financial professionals can effectively manage risks and make well-informed decisions. Furthermore, incorporating AI and ML in auditing elevates the quality of audits by providing profound insights, detecting non-compliance, and strengthening fraud detection mechanisms. This engenders trust in the accounting profession and fosters more accurate financial reporting. The present study offers a comprehensive review of the literature on the utilization of AI and ML in accounting and auditing. The findings encompass the cost-reducing effect of AI-based supplier audits, the superior predictive capacity of nonlinear models in forecasting stock volatility compared to linear models, and the enhanced efficiency of accounting and auditing through the integration of AI and ML. Moreover, AI augments the auditing process and automates workflows, while ML facilitates projections of stock performance and facilitates fraud identification.</p>
<p>Keywords: Artificial intelligence (AI); Machine learning (ML); Accounting; Auditing; Finance</p>	

1. INTRODUCTIN

In the rapidly evolving corporate landscape of today, financial accounting and auditing must embrace and leverage new technologies and advancements to a significant extent [1, 2]. These advancements significantly enhance the effectiveness, accuracy, and transparency of financial reporting and analysis [3]. Artificial intelligence (AI), machine

* Corresponding Author: ah.shahbaz@yahoo.com

Faculty of Accounting and Management, University of Tehran International Branch, Tehran, Iran


<http://dx.doi.org/10.47176/TDASS.2024.92>


© 2024 by the authors. Licensee T.D.A.S, Tehran, Iran. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

learning (ML), and data analytics represent technological breakthroughs that bolster risk assessment capabilities, expedite and enhance the accuracy of financial data processing, and enable the identification of trends and anomalies [4-9]. Furthermore, state-of-the-art technologies and advanced tools streamline auditing processes and ensure adherence to regulatory compliance standards [10, 11]. By embracing these new technologies, financial professionals can effectively mitigate risks, make well-informed decisions, and deliver timely and precise financial information to stakeholders [12-15].

Given the versatility of AI and ML techniques across various scientific and commercial domains, their application in accounting and auditing can greatly enhance efficiency through the automation of laborious tasks such as data input, transaction categorization, and reconciliation [16-28]. These technologies excel in the rapid and accurate analysis of extensive volumes of financial data, enabling the identification of patterns, detection of anomalies, and prediction of future trends [29-36]. Moreover, AI-powered systems can enhance fraud detection by leveraging past trends and variances to identify questionable activities [37, 38]. ML algorithms enable auditors to conduct better risk assessments and predictive modeling, allowing them to identify areas of concern and allocate resources effectively. This enables auditors to focus their efforts where they are most needed [39, 40]. The utilization of AI and ML techniques in the realm of accounting and auditing offers several significant advantages. Notably, these advanced technologies facilitate the automation of repetitive tasks such as data input and reconciliation, resulting in a reduction in human errors and a substantial increase in productivity [41]. Moreover, these technologies enable real-time monitoring and predictive analysis, thereby enhancing risk management practices and facilitating informed financial decision-making [42-44]. Furthermore, AI and ML have the potential to enhance audit quality through the provision of deeper insights, identification of non-compliance issues, and strengthened fraud detection measures. As a result, financial reporting can be more accurate, fostering greater public confidence in the accounting profession [45-47].

The objective of the present study was to conduct a comprehensive review of the existing literature pertaining to the applications of AI and ML in the domains of accounting and auditing. The subsequent sections are organized into three categories, namely (I) applications of AI in accounting and auditing, (II) applications of ML in accounting and auditing, and (III) applications of chatbots in accounting and auditing. Table (1) provides a summary of the findings derived from the literature review conducted on the subject of AI and ML methods in accounting and auditing.

2. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN ACCOUNTING AND AUDITING

The integration of AI into accounting and auditing procedures has brought about significant transformations, encompassing cost reduction, enhanced data analysis, resolution of ethical concerns, and improved overall financial performance. A study conducted by Wang et al. (2024) explored the underlying processes and the impact of supplier AI applications on customer audit fees. To examine this relationship, the researchers analyzed data from China's non-financial listed enterprises spanning the period from 2011 to 2020, utilizing robotics data as a proxy for the extent of AI implementation. The findings revealed a substantial decrease in audit expenses for businesses that adopted supplier AI applications. The study also proposed supply chain risk and supply chain transparency as potential mechanisms influencing this relationship. Future research endeavors could investigate the long-term implications of supplier AI adoption and explore the role of other variables in the connection between audit fees and AI applications [48]. Thottoli et al. (2024) conducted a study to investigate the application of AI and information communication technology (ICT) in enhancing auditing procedures. The researchers employed quantitative and bibliometric methodologies, including surveys, interviews, and bibliometric analysis. The findings of the study revealed that while the adoption of ICT did not alter the relationship between perceived benefits of ICT and auditing methods, the extent of ICT training did have an impact. The research highlights the potential implications of AI on accounting procedures and suggests the need for improved knowledge management among auditors regarding ICT usage. To further enhance audit quality, future studies should focus on addressing implementation challenges and resolving any existing issues [49]. In their study, Zhen et al. (2023) investigated the role of the accounting information system (AIS) as a mediator in the utilization of digital technologies for strategic performance. They developed a digital accounting system incorporating AI and EC, which was found to enhance execution rate, operational efficiency, and acceleration rate. Future research endeavors could focus on examining the long-term impact of implementing the digital accounting system, assessing its influence on various corporate domains, and refining its effectiveness and adaptability [50].

Zhang et al. (2023) conducted a study utilizing stakeholder interviews to investigate the ethical implications of AI in management accounting. Through analysis of 47 interviews, the research identified common ethical challenges associated with AI implementation, including concerns related to data security, privacy, accountability, accessibility, and openness. To address these issues, the researchers underscored the importance of ethical principles in guiding AI usage. Furthermore, the study recommended that future research delve into the long-term consequences of AI adoption, explore strategies for mitigating ethical risks, and promote ethical utilization of AI in the field of management accounting [51]. In their 2023 study, Fülöp et al. sought to address ethical concerns associated with AI in the accounting domain. Employing a deductive methodology, the researchers conducted empirical research through interviews. The findings revealed that while most accountants possessed a basic awareness of AI, only a few had a comprehensive understanding of the technology. However, all panelists acknowledged the importance of AI ethics and recognized the role of regulatory organizations in ensuring ethical practices. The results of the study provide a current overview of the topic and indicate potential applications. Considering the dynamic nature of the AI field, future research endeavors should delve into the ethical implications of AI in accounting in greater detail, allowing for a more comprehensive understanding of the subject matter [52]. Shiyab et al. examined the utilization of AI in Jordanian banks and its impact on financial performance. Through a content analysis of 115 annual reports, the researchers observed a consistent increase in the disclosure of AI since 2014. While AI implementation had a negative effect on overall expenditures, the disclosure of AI positively influenced accounting performance measures such as return on assets (ROA) and return on equity (ROE). The study emphasized the importance of ethical AI practices and the development of disclosure guidelines. Furthermore, it provided recommendations for future research, including exploring the relationship between AI and bank performance in greater depth and establishing global reporting guidelines for AI disclosure [53].

Shankar et al. (2024) conducted a mixed-method research to examine the factors influencing the adoption of AI-enabled drones for manufacturing process audits. The study identified vulnerability and sunk cost obstacles as hindrances to adoption intention, while factors such as function, environmental considerations, and epistemic values acted as facilitators. The research also highlighted the mediating role of inertia and trust, as well as the moderating effect of technical innovation. Survey results indicated that audit service providers should focus on addressing obstacles and promoting the adoption of AI-enabled drones. Future studies could explore issues related to security and privacy, as well as the impact of AI-enabled drones on industrial output [54]. The aim of Rodgers et al. (2023) was to explore the utilization of AI in accounting research and automate protocol analysis. The researchers conducted a study focusing on the application of accounting standards in Iraq, employing think-aloud protocols and thematic analysis. The findings revealed that conflicts within legislation, lack of awareness regarding International Financial Reporting Standards (IFRS), and the absence of an AI framework could hinder the effective implementation of accounting standards. The study emphasized the potential of AI-assisted protocol analysis and suggested the need for further investigation in cognitive psychology, design elements, and decision-making processes within the field of accounting [55]. Qasim et al. (2023) introduced a theoretical model that incorporated AI-enabled drone technology for long-term contract cash flow management, as depicted in Figure (1). Drones were suggested as an additional tool to enhance data quality, time and cost efficiency, as well as safety during inspections of distant project sites. The research primarily focused on the application of the percentage of completion approach for revenue recognition. Future studies could explore the utility of drones in accounting and auditing further, examining their usefulness in other areas and exploring additional potential applications [56].

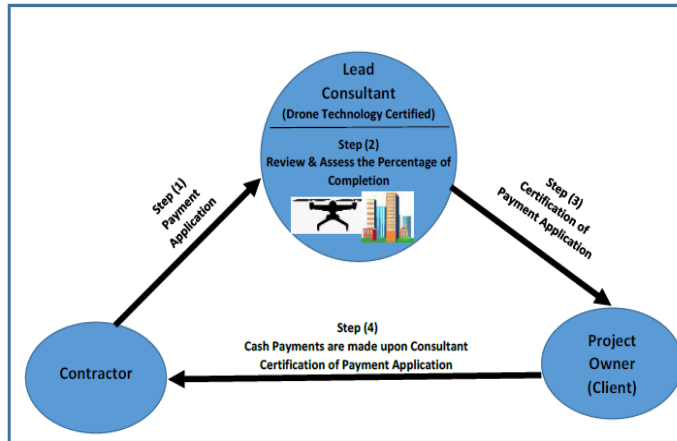


Fig. 1. An illustration of a model of AI-enabled drone cash flow management proposed in [56].

In their 2023 analysis, Marques et al. explored the impact of intelligent systems such as AI, Big Data, and IoT on management accounting. Through a comprehensive review of the literature, the researchers found evidence suggesting that these technologies have the potential to enhance competitiveness, streamline activities, and improve decision-making processes. However, to further advance understanding in this area, future investigations should focus on the practical application of these technologies and examine their long-term effects on organizational strategies and overall efficacy [57]. Lambert et al. (2023) reaffirmed Mises' assertion that economic computation is unattainable within a socialist framework and extended its applicability to the domains of big data and AI. Their study concluded that Mises' argument remains robust, underscoring the significance of private property rights and monetary exchange. The research primarily focused on theoretical considerations rather than empirical data. Future investigations could explore the utility of economic computation in diverse economic systems and examine the potential of big data and AI in improving decision-making processes [58]. Hu et al. (2023) conducted a study on the governance of AI applications in corporate audits. They devised a fusion fuzzy multiple rule-based decision-making model to identify the most crucial variables and rank the optimal approaches for implementing AI. The research underscored the importance of data infrastructure and quality, the human element, AI governance, and AI application strategy. The findings emphasized the necessity of internal audit frameworks driven by AI and their alignment with the requirements of the big data era. Future research endeavors could explore the interrelationships among different aspects and standards, as well as the development of efficient AI-based models for company audits [59]. Goto (2023) conducted a case study investigating the utilization of service research and development (R&D) by professional service companies (PSFs) to adapt their offerings in response to AI-related challenges. The research specifically examined how Japan's Big Four audit firms incorporated AI into their external audit services. The study revealed a three-phase model, highlighting the significant role of service R&D in driving innovation beyond existing knowledge boundaries. Future research could explore the adoption of AI in diverse professional service contexts and examine the long-term effects of service R&D on firms' competitiveness and performance [60].

3. APPLICATIONS OF MACHINE LEARNING IN ACCOUNTING AND AUDITING

Machine learning (ML) has gained widespread adoption in the fields of accounting and auditing, offering improved accuracy and efficiency in financial analysis and decision-making processes. ML techniques are utilized for various purposes, including fraud identification, volatility prediction, procedure optimization, textual material evaluation, and task automation. Ramzan et al. (2024) conducted a comprehensive literature review to explore the application of ML specifically in the investigation of financial statement fraud (FSF). The study revealed that ML methods are increasingly replacing traditional statistical approaches for FSF detection and prediction. The research primarily focused on identifying shortcomings in audit processes and examining the influence of both macro and micro factors on FSF occurrences. Additionally, the study provided recommendations for enhancing fraud detection algorithms and highlighted the challenge of publishing ML-based fraud studies in prestigious accounting journals,

suggesting the need for further investigation into this matter [61]. In their study, Liao et al. (2024) investigated the association between stock return volatility and company fundamental risk in the Chinese market. The researchers employed machine learning (ML) techniques to develop aggregate fundamental risk signals (FRSs) based on multiple features. The findings demonstrated that FRSs, particularly those generated by neural networks, exhibited strong predictive power for future volatility. The study emphasized the significance of considering nonlinearity in volatility forecasting and underscored the importance of fundamental risk in this context. The research also suggested that future studies could explore additional features and expand the application of ML in risk management across diverse industries [62]. In their study, Yang et al. (2024) introduced the distributed deep learning with data offloading (DDLO) approach as a means to enhance accounting informatization through the utilization of hybrid machine learning (ML) models. This approach aimed to reduce computation time and costs by dynamically allocating computer resources and offloading data to the cloud. The research highlighted the need for further investigations to enhance the algorithm, explore its potential applications, and address security and communication challenges in distributed computing environments. Future studies could focus on refining the DDLO approach, expanding its scope, and developing solutions to overcome obstacles related to security and communication in distributed computing settings [63].

Subedi et al. (2023) conducted a study exploring the feasibility of issuing a going concern opinion and the relationship between audit fees and principles-based accounting standards, employing sophisticated machine learning (ML) and regression models. The research findings indicated a reduced perceived risk, as auditors charged lower fees to clients whose financial statements were prepared based on principles-based standards. Furthermore, there was a diminished likelihood of receiving a going concern opinion when companies relied more heavily on standards grounded in principles. Future investigations could further investigate the impact of principles-based standards in diverse contexts and assess their long-term implications [64]. Rahman et al. (2023) conducted a study utilizing unbalanced ensemble learning algorithms to detect accounting fraud in Chinese family businesses. The findings revealed that the CUSBoost classifier exhibited the highest accuracy in identifying instances of fraud, surpassing the performance of the logistic regression technique. This research contributes to the field by demonstrating the superiority of unbalanced ensemble learning algorithms and emphasizing the significance of employing machine learning (ML) for fraud detection in family businesses. Future trajectories in this domain may involve investigating predictive modeling techniques and addressing data imbalances inherent in fraudulent datasets [65]. Bochkay et al. (2023) conducted a comprehensive survey of prominent accounting publications to evaluate the extent of textual analysis in accounting research. The study highlighted various applications of textual analysis, including the identification of forward-looking information and the assessment of sentiment in disclosures. The findings indicated a growing prevalence of textual analysis in the field, with scholars being encouraged to incorporate machine learning (ML), specifically deep learning, into their investigations. The authors provided practical guidance and emphasized the importance of establishing construct validity. They further recommended that future studies focus on exploring potential advancements in accounting textual analysis [66].

4. APPLICATIONS OF CHATBOTS IN ACCOUNTING AND AUDITING

The accounting and auditing industries are currently experiencing a transformative shift due to the increasing adoption of chatbots, which offer automation of processes, precise responses to inquiries, and enhanced customer relations. Zhao et al. (2023) conducted a study to explore the potential applications and challenges of ChatGPT in the accounting field. The researchers highlighted the technology's capacity to streamline customer interactions, improve auditing and tax processes, enhance financial analysis, and automate various tasks. However, the study emphasized the necessity for further investigation to fully comprehend the impact of ChatGPT on the accounting industry. The research also provided valuable insights on leveraging this technology to revolutionize the industry. Future prospects for this study involve exploring new applications, resolving existing challenges, and ensuring the ethical use of artificial intelligence (AI) and natural language processing (NLP) methods in the field of accounting [67]. Wood et al. (2023) conducted an evaluation of the AI chatbot ChatGPT's ability to respond to inquiries pertaining to accounting assessments. The researchers employed a quantitative methodology to assess the chatbot's responses and found that it demonstrated effectiveness by providing precise and relevant answers. However, certain aspects of the chatbot's performance were identified as areas for improvement, including its comprehension of complex inquiries and occasional errors in its responses. To enhance its performance and evaluate its effectiveness

in real-world accounting scenarios, further research should focus on investigating advanced natural language processing (NLP) techniques [68]. Bavaresco et al. (2023) conducted a study examining users' opinions of an ML-enabled service designed for accounting management automation of tasks. The research involved the participation of ten Dell employees who expressed their views on the service. Overall, the participants found the service to be user-friendly and recognized its potential to reduce manual labor, with a majority of them in agreement. However, concerns were raised regarding the integration of process-specific requirements and the long-term utility of the service. The study provided valuable insights and recommended ten lessons based on the participants' perceptions. Future investigations should focus on gathering feedback from staff members, addressing any limitations of the service, and refining the development and implementation of ML-based applications within corporate environments [69].

Table 1. Summary of the review of literature in the field of applications of AI and ML in accounting and auditing.

Objectives	AI/ML Method	Results	Future Recommendations	Ref.
Optimization of accounting informatization through simultaneous multi-tasking across edge and cloud devices.	Hybrid ML models, DDLO algorithm.	Enhanced data processing efficiency, improved operational efficiency in accounting	Further research on data security, resource allocation, and scalability.	[63]
Examining the impact of supplier AI applications on customer audit fees.	---	Supplier AI applications significantly reduce firms' audit fees. Supply chain risk and supply chain transparency are potential mechanisms. Spillover effects are more pronounced with stronger diffusion capability and absorptive capacity.	Further research on AI's impact on audit pricing.	[48]
Investigate auditing practices leveraging ICT and AI. Examine the effectiveness of auditing procedures integrating ICT and AI.	---	ICT perceived benefits have no direct effect on auditing practices. ICT training has a mediating effect on the relationship between ICT perceived benefits and auditing practices. ICT adoption has no moderating effect on the relationship between ICT training and auditing practices.	Upgrade auditing practices by incorporating AI and ICT determinants. Improve auditors' knowledge management regarding ICT adoption and training. Foster the incorporation of AI and ICTs in auditing practice.	[49]
Investigate the relationship between firm fundamental risk and stock return volatility.	Nonlinear models, including neural networks, random forests, and partial least squares.	Aggregate fundamental risk predicts stock return volatility. Nonlinear models outperform linear methods. Profitability-related characteristics are dominant predictive indicators. Volatility-managed market portfolios through ML improve economic profits.	Use ML techniques to manage stock risk in China. Further research on the economic interpretation of ML aggregate signals. Explore the importance of characteristics in predicting stock return volatility.	[62]
Analyze the use of digital technologies for strategic performance and AIS	AI Edge computing (EC)	Improved acceleration rate, operational efficiency, and execution rate	Develop cost-effective solutions for accounting data processing	[50]

Objectives	AI/ML Method	Results	Future Recommendations	Ref.
Explore moderation of DT and strategic performance linkage.	Reinforcement learning (RL)	Improved data processing with EC for AIS	Empower businesses with tools for effective accounting processes	
Explore potential applications of ChatGPT in accounting. Evaluate the benefits and challenges of ChatGPT integration.	ChatGPT-advanced natural language processing (NLP) model based on GPT-4 architecture.	ChatGPT has the potential to automate tasks, enhance reporting and analysis, improve auditing and tax practices, and simplify client interactions in accounting. Real-world examples and existing research provide insights into how ChatGPT can enhance accounting practices.	Further research on ChatGPT's facilitation in accounting. Understanding potential benefits and challenges of utilizing ChatGPT. Leveraging ChatGPT to reshape the accounting profession.	[67]
Ethical impact of AI in managerial accounting	---	Ethical concerns in the development and use of AI in managerial accounting	Assess and alleviate ethical concerns and promote transparency and trust.	[51]
Assessment of ChatGPT's performance in answering accounting questions.	Chatbot utilizing AI and ML algorithms	Evaluation of ChatGPT's effectiveness in answering accounting assessment questions.	Improve ChatGPT's performance and expand its applications in accounting education.	[68]
Ethical concerns of AI in the accounting profession	---	Accountants have basic knowledge but a limited understanding of AI ethics.	Involvement of regulatory bodies, practical and managerial implications, and ethical governance.	[52]
Investigate auditors' perception of principles-based accounting standards. Explore the association between principles-based accounting standards and audit pricing. Examine the association between principles-based accounting standards and the likelihood of receiving a going concern opinion.	Advanced ML approach	Auditors charge lower audit fees for principles-based financial statements. The probability of receiving a going-concern opinion decreases with reliance on principles-based standards. Principles-based standards negatively impact accounting conservatism and financial statement misstatement.	Pursue high-quality, globally accepted accounting standards. Recognize public policy implications and the importance of principles-based standards. Address sustainability concerns, including emerging risks like climate change.	[64]
Determine the extent of AI adoption in Jordanian banks. Examine the impact of AI-related disclosure on financial performance.	Content analysis Regression analysis	Increase in AI-related terms disclosure since 2014 Weak AI-related disclosure in some banks Positive impact of AI on accounting performance (ROA, ROE) Negative impact on total expenses	Address AI disclosure issues Provide disclosure guidance requirements. Promote more AI disclosure in the banking sector. Support informed decision-making in financial institutions.	[53]
Modernization of national accounting and auditing system using digital transformation tools.	---	Optimal digital transformation tools for national accounting policy identified.	Implement modernization concept aligned with the Accounting 4.0 paradigm.	[70]
Explore enablers and inhibitors of AI-enabled	---	Function, environmental, and epistemic values are enablers.	Design strategies to enhance AI-enabled drone adoption for process audits.	[54]

Objectives	AI/ML Method	Results	Future Recommendations	Ref.
drones for manufacturing process audits.		Vulnerability and sunk cost barriers are inhibitors. Initial trust and inertia are crucial mediators. Technological innovativeness moderates adoption intention.		
Investigating the use of AI in protocol analysis.	Protocol analysis combined with qualitative accounting research. Application of NLP in qualitative data analysis.	Lack of AI framework, IFRS knowledge, and legislation conflict may negatively impact standard implementation. Protocol analysis can benefit from AI support and provide design features.	Further exploration of protocol analysis and AI integration in cognitive psychology. Gradual adoption of AI-based research tools in business research.	[55]
Accounting fraud detection in family firms using ML.	Imbalanced ensemble learning algorithms.	Ensemble learning models outperform logistic regression in detecting accounting fraud.	Shift focus from regression to ML, address data imbalance	[65]
Integration of drone technology in accounting for long-term contracts.	---	Proposed theoretical framework for utilizing drones in cash flow management.	Further exploration of drone technology in accounting and auditing tasks.	[56]
Management accounting impact of intelligent systems (AI, Big Data, IoT)	Deep Learning	Simplification of daily tasks for management accountants Improved speed and quality of decision-making Shifts in the management accounting profession	Adaptation, combining human and intelligent systems, simplify management accounting tasks.	[57]
Governance of AI applications in a business audit	Fusion fuzzy multiple rule-based decision-making model	Order of priority in improvement based on impact magnitude	Enhance AI-driven internal audit framework, respond to big data environment.	[59]
Trend and current state of textual analysis in accounting research Organize available methods in a unified framework. Explain current and potential applications in accounting. Emphasize the importance of construct validity. Provide implementation guidance	NLP ML Deep Learning	Growth of textual analysis as an important research method Increased use of ML, especially deep learning, in textual analysis	Increase knowledge and use of ML, especially deep learning. Conduct further research in the field of textual analysis in accounting.	[66]
Understand users' perceptions of ML-enabled automation services. Assess the impact of ML-based automation on employees' behavior.	Robotic Process Automation (RPA) NLP Chatbot interface	10 out of 10 users found the service easy to use. 8 out of 10 users agreed that the service reduced manual labor. Users questioned the long-term usefulness and incorporation of process particularities.	Careful design of automation services and interfaces to avoid productivity hindrances. Proper training and awareness for employees to fully utilize the technology.	[69]

Objectives	AI/ML Method	Results	Future Recommendations	Ref.
Evaluate the usability and ease of use of the automation service.			Guidelines for introducing ML-based applications into business teams.	
Financial account audit early warning using fuzzy comprehensive evaluation and random forest model.	Fuzzy comprehensive evaluation, random forest algorithm.	The proposed model is beneficial for financial crisis control and early warning.	Apply the model to real enterprise financial data, further validation and improvement.	[71]
Financial accounting transformation using ML and unstructured text data.	Advanced AI model based on ML.	Improved KMP algorithm, data crawling technology, association rules mining, and financial analysis.	Further integration of ML and unstructured text technology in financial accounting.	[72]
Assessing AI technology acceptance in managerial accounting	Structural equation modeling (SEM)	Implementing AI in managerial accounting offers multiple options to managers.	Integrate new emerging technologies into managerial accounting; develop competency frameworks.	[73]
Assessing the Impact of AI Solutions' Ethical Issues on Performance in Managerial Accounting	SEM	Ethical issues (autonomy, responsibility, trust) significantly influence the perceived usefulness and performance of AI solutions in managerial accounting. AI solutions solve ethical issues but may create new ones.	Address ethical issues in the design and application of AI solutions. Further research on the impact of AI on managerial accounting	[74]
Explore the impact of ML on management accounting. Identify the role of ML in research and education for management accountants.	Exploratory data analysis (EDA) Unsupervised ML	Limited examples of ML usage in management accounting articles. Need for discussion on incorporating big data and AI/ML concepts. Necessity of including EDA and unsupervised ML in management accounting.	Incorporate ML in research and education for management accountants. Bridge gaps in both education and research to make the profession future-proof. Embrace the integration of data, data science, and technology. Focus on digitalization, big data, and clustering techniques in management control systems. Develop a deep understanding of how AI can solve accounting and business problems.	[75]
Accounting literature, the impact of annual report narratives on cost of capital.	Model-based (MOB) recursive partitioning.	Readability has an insignificant impact. The quantity of narrative disclosure lowers the cost of capital.	Further analysis of different countries and corporate profitability.	[76]
Knowledge recognition algorithm in cost accounting using rough set theory.	Rough set theory, fuzzy rough sets.	Effectiveness of the proposed knowledge recognition algorithm (87.6%, 84.4%, 94.97%, and 96.34%).	Further research on rough set theory applications, larger sample sizes, and public recognition.	[77]
Ethical challenges of AI-based decision-making in accounting and auditing.	---	Five major ethical challenges were identified: objectivity, privacy, transparency, accountability, and trustworthiness.	Adapt governance and auditing processes for ethical AI-based decision-making.	[78]

Objectives	AI/ML Method	Results	Future Recommendations	Ref.
Prediction modeling in accounting research for discrete outcomes.	Logistic regression, tree-based models, neural networks, and support vector machines.	Provides guidance and examples for predicting investigations by SEC.	Improve model accuracy, accessible presentation of results, and explore other ML methods.	[79]
Fundamental analysis, market efficiency, stock return, ML	Linear regression, tree-based ML, random forest, gradient boosting	Heterogeneity in predictor importance, ML strategies outperform LR counterparts, nonlinearities and interactions in fundamental analysis, market inefficiencies in European stock markets.	Further exploration of fundamental valuation, improvement of ML methods, and asset pricing in European markets	[80]
Predicting future earnings changes	ML Methods (Random Forests and Stochastic Gradient Boosting)	Significantly higher predictive power compared to conventional models and analysts' forecasts Annual size-adjusted returns range from 5.02% to 9.74%	Further research on leveraging ML for direct return predictions	[81]
Analyzing the influence of Big Data and AI in accounting and auditing.	---	Identified research fronts and publication activity related to the topic. Revealed the most representative authors and journals in the field.	Incorporating AI and BD into accounting and auditing syllabus and research agenda.	[82]
Fraud detection in tax audits using ML.	Gradient boosting machines.	Improved tax audit efficiency and important fraud predictors were identified.	Utilize network data, adapt the model, and expand data sources.	[47]

5. DISCUSSION AND FUTURE RESEARCH DIRECTIONS

The utilization of cutting-edge technology and advancements in financial accounting and auditing plays a pivotal role in navigating the dynamic corporate landscape of today. These developments, which encompass machine learning (ML), artificial intelligence (AI), and data analytics, offer numerous benefits such as heightened efficiency, accuracy, and transparency in financial reporting and analysis. AI and ML techniques enable the automation of labor-intensive tasks, the swift and reliable analysis of vast volumes of financial data, as well as enhanced fraud detection and risk assessment capabilities. These tools contribute to elevated audit quality, reduced human error, streamlined procedures, and the generation of insightful data. Embracing AI and ML empowers financial professionals to mitigate risks, make well-informed judgments, and deliver timely and accurate financial information, ultimately bolstering public confidence in the accounting industry.

The research findings shed light on the potential benefits and impacts of technologies such as artificial intelligence (AI), machine learning (ML), and data analytics on various accounting processes. The study highlights improvements in data processing efficiency and enhanced operational effectiveness as significant outcomes resulting from the integration of AI and ML in accounting practices. These advancements offer the potential for streamlining accounting procedures and achieving higher levels of efficiency in handling financial data [63]. It has been shown that suppliers using AI applications may drastically lower audit expenses for businesses [48, 64]. With these tools, supply chain risk and transparency may be handled [48]. The association between the perceived advantages of ICT and auditing methods is mediated by ICT training [49]. Nonlinear models have been discovered to perform better in financial analysis than linear ones, and traits associated with profitability have become the most important predictive markers [62]. Economic gains have increased when ML methods are used for volatility-managed market portfolios [62]. An AI-based chatbot called ChatGPT has the ability to improve reporting and analysis, streamline client communications in accounting, and automate processes [67]. The development and use of AI in management accounting raises ethical questions, which are addressed together with the effects of AI on accounting costs and performance [51]. The findings also include the use of AI in standard-setting, fraud detection, cash flow management, and management accounting decision-making [47, 56, 57, 65].

The recommendations highlight the need for further study on the effects of AI on audit pricing as well as data protection, resource allocation, and scalability [48, 63]. It is recommended that auditors' knowledge management on ICT adoption and training be improved and auditing processes be modernized by integrating AI and ICT determinants [49]. It is also advised to encourage the use of AI and ICTs in auditing procedures, to use ML strategies for stock risk management, and to investigate the economic interpretation of ML aggregate signals. [49, 62, 81]. Furthermore, there is a need to create affordable solutions for processing accounting data, comprehend the role and effects of ChatGPT in accounting, and tackle ethical issues while fostering transparency and trust [50, 67]. The guidelines also highlight the significance of regulatory engagement, international accounting standards, sustainability factors, AI disclosure, and the use of cutting-edge technology across a range of accounting fields [52, 53, 64, 75].

6. CONCLUSION

The dynamic nature of the contemporary business landscape necessitates the swift integration of cutting-edge technologies and advancements in financial accounting and auditing. Leveraging artificial intelligence (AI), machine learning (ML), and data analytics offers substantial benefits in terms of enhanced efficiency, accuracy, and transparency in financial reporting and analysis. These advancements enable streamlined processes, mitigate human errors, and yield valuable insights from voluminous financial data, thereby elevating audit quality and fostering trust in the accounting profession. The findings presented in this review underscore the potential advantages and impacts of AI, ML, and data analytics on various accounting processes, including improved supply chain risk management, reduced audit costs, and enhanced financial analysis and decision-making. However, it is imperative to address ethical considerations, prioritize data security, and engage regulatory bodies to ensure transparency and trust in the utilization of these technologies. Further research is needed to delve into areas such as resource allocation, scalability, and the economic interpretation of ML aggregate signals. Moreover, cost-effective solutions should be developed, and the integration of emerging technologies in accounting domains should be encouraged. By fully embracing these advancements and implementing the recommended measures, the accounting profession can unlock the full potential of AI and ML, leading to transformative practices, overcoming challenges, and driving positive change in the field.

Declaration

We acknowledge that we used ChatGPT to enhance the academic writing of our manuscript while ensuring the originality and integrity of our work.

Transparency Statement

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

Acknowledgments

We would like to express our gratitude to all individuals who contributed to this project.

Declaration of Interest

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

REFERENCES

- [1] Kroon, N., M. d. C. Alves, and I. Martins. (2021). The Impacts of Emerging Technologies on Accountants' Role and Skills: Connecting to Open Innovation-A Systematic Literature Review. *Journal of Open Innovation:*

Technology, Market, and Complexity, 7(3), 163. <https://doi.org/10.3390/joitmc7030163>

- [2] Imoniana, J. O., et al. (2023). Impact of technological advancements on auditing of financial statements.
- [3] Ahmad, A., et al. (2024). Assessment of effects in advances of accounting technologies on quality financial reports in Jordanian public sector. *Uncertain Supply Chain Management*, 12(1), 133-142. <https://doi.org/10.5267/j.uscm.2023.10.011>
- [4] Schmitt, M. (2020). Artificial intelligence in business analytics, capturing value with machine learning applications in financial services.
- [5] Nguyen, D. K., G. Sermpinis, and C. Stasinakis. (2023). Big data, artificial intelligence and machine learning: A transformative symbiosis in favour of financial technology. *European Financial Management*, 29(2), 517-548. <https://doi.org/10.1111/eufm.12365>
- [6] Al-amri, R., et al. (2021). A Review of Machine Learning and Deep Learning Techniques for Anomaly Detection in IoT Data. *Applied Sciences*, 11(12), 5320. <https://doi.org/10.3390/app11125320>
- [7] Nassif, A. B., et al. (2021). Machine Learning for Anomaly Detection: A Systematic Review. *IEEE Access*, 9, 78658-78700. <https://doi.org/10.1109/ACCESS.2021.3083060>
- [8] Milojević, N. and S. Redzepagic. (2021). Prospects of artificial intelligence and machine learning application in banking risk management. *Journal of Central Banking Theory and Practice*, 10(3), 41-57. <https://doi.org/10.2478/jcbtp-2021-0023>
- [9] Mhlanga, D. (2021). Financial Inclusion in Emerging Economies: The Application of Machine Learning and Artificial Intelligence in Credit Risk Assessment. *International Journal of Financial Studies*, 9(3), 39. <https://doi.org/10.3390/ijfs9030039>
- [10] Dzurandin, A. C. and I. Mălăescu. (2016). The current state and future direction of IT audit: Challenges and opportunities. *Journal of Information Systems*, 30(1), 7-20. <https://doi.org/10.2308/isys-51315>
- [11] Thakker, P. and G. Japee. (2023). Emerging technologies in accountancy and finance: A comprehensive review. *European Economic Letters (EEL)*, 13(3), 993-1011.
- [12] Druzhynina, V., et al. (2020). Innovative technology in terms of socio-economic value diffusion: Accounting and analytical support. *European Journal of Sustainable Development*, 9(3), 476-476. <https://doi.org/10.14207/ejsd.2020.v9n3p476>
- [13] Mancini, D., R. Lombardi, and M. Tavana. (2021). Four research pathways for understanding the role of smart technologies in accounting. *Meditari Accountancy Research*, 29(5), 1041-1062. <https://doi.org/10.1108/MEDAR-03-2021-1258>
- [14] Ibrahim, A. E. A., A. A. Elamer, and A. N. Ezat. (2021). The convergence of big data and accounting: innovative research opportunities. *Technological Forecasting and Social Change*, 173, 121171. <https://doi.org/10.1016/j.techfore.2021.121171>
- [15] Taipaleenmäki, J. and S. Ikäheimo. (2013). On the convergence of management accounting and financial accounting - the role of information technology in accounting change. *International Journal of Accounting Information Systems*, 14(4), 321-348. <https://doi.org/10.1016/j.accinf.2013.09.003>
- [16] Munoko, I., H. L. Brown-Liburd, and M. Vasarhelyi. (2020). The Ethical Implications of Using Artificial Intelligence in Auditing. *Journal of Business Ethics*, 167(2), 209-234. <https://doi.org/10.1007/s10551-019-04407-1>

- [17] Hasan, A. R. (2021). Artificial Intelligence (AI) in accounting & auditing: A Literature review. *Open Journal of Business and Management*, 10(1), 440-465. <https://doi.org/10.4236/ojbm.2022.101026>
- [18] Maleki, S. and Y. Z. Mehrjerdi. (2022). Diagnosis of coronary artery disease by bat and Harris hawk meta-heuristic optimization algorithms and machine learning methods. <https://doi.org/10.52547/jha.25.1.57>
- [19] Sahbafar, H., et al. (2023). Prepared Plasmonic Glass Substrates via Electrodeposition for Detecting Trace Glucose: SERS, DFT, and FDTD Investigations. *Plasmonics*. <https://doi.org/10.1007/s11468-023-02126-y>
- [20] Basiri, R., M. R. Popovic, and S. S. Khan. (2022). Domain-Specific Deep Learning Feature Extractor for Diabetic Foot Ulcer Detection. In 2022 IEEE International Conference on Data Mining Workshops (ICDMW). <https://doi.org/10.1109/ICDMW58026.2022.00041>
- [21] Maleki, S., et al. (2022). Predicting coronary artery diseases using effective features selected by Harris Hawks optimization algorithm and support vector machine. *Journal of Industrial and Systems Engineering*, 14(Special issue: 18th International Industrial Engineering Conference), 40-47.
- [22] Sahbafar, H., et al. (2023). Surface-Enhanced Raman Scattering (SERS) and Finite Difference Time Domain (FDTD) Investigations of Plasmonic and Flexible Filter Papers for the Detection of the Molecular Vibrations of Amoxicillin. *Plasmonics*. <https://doi.org/10.1007/s11468-023-02106-2>
- [23] Basiri, R., et al. (2024). Protocol for metadata and image collection at diabetic foot ulcer clinics: enabling research in wound analytics and deep learning. *BioMedical Engineering OnLine*, 23(1), 12. <https://doi.org/10.1186/s12938-024-01210-6>
- [24] Noroozi, R., et al. (2023). 3D and 4D Bioprinting Technologies: A Game Changer for the Biomedical Sector? *Annals of Biomedical Engineering*, 51(8), 1683-1712. <https://doi.org/10.1007/s10439-023-03243-9>
- [25] Dehghan Rouzi, M., et al. (2023). Breast Cancer Detection with an Ensemble of Deep Learning Networks Using a Consensus-Adaptive Weighting Method. *Journal of Imaging*, 9(11), 247. <https://doi.org/10.3390/jimaging9110247>
- [26] Bagheri, A.B., et al. (2023). Potential applications of artificial intelligence and machine learning on diagnosis, treatment, and outcome prediction to address health care disparities of chronic limb-threatening ischemia. *Seminars in Vascular Surgery*, 36(3), 454-459. <https://doi.org/10.1053/j.semvascsurg.2023.06.003>
- [27] Park, C., et al. (2023). Machine Learning-Based Aggression Detection in Children with ADHD Using Sensor-Based Physical Activity Monitoring. *Sensors*, 23(10), 4949. <https://doi.org/10.3390/s23104949>
- [28] Mohsennezhad, A., et al. (2024). Simply Developed Surface-Enhanced Raman Scattering (SERS) Sensors for Ultra-Sensitive Detection of Lindane Pesticide. *Plasmonics*. <https://doi.org/10.1007/s11468-024-02254-z>
- [29] Hariri, R.H., Fredericks, E.M., & Bowers, K.M. (2019). Uncertainty in big data analytics: survey, opportunities, and challenges. *Journal of Big Data*, 6(1), 44. <https://doi.org/10.1186/s40537-019-0206-3>
- [30] Sohagir, S., et al. (2018). Big Data: Deep Learning for financial sentiment analysis. *Journal of Big Data*, 5(1), 3. <https://doi.org/10.1186/s40537-017-0111-6>
- [31] Goodell, J.W., et al. (2021). Artificial intelligence and machine learning in finance: Identifying foundations, themes, and research clusters from bibliometric analysis. *Journal of Behavioral and Experimental Finance*, 32, 100577. <https://doi.org/10.1016/j.jbef.2021.100577>
- [32] Ahmed, S., et al. (2022). Artificial intelligence and machine learning in finance: A bibliometric review. *Research in International Business and Finance*, 61, 101646. <https://doi.org/10.1016/j.ribaf.2022.101646>

- [33] Hunt, E.B. (2014). Artificial intelligence. Academic Press.
- [34] Kaul, V., Enslin, S., & Gross, S.A. (2020). History of artificial intelligence in medicine. *Gastrointestinal Endoscopy*, 92(4), 807-812. <https://doi.org/10.1016/j.gie.2020.06.040>
- [35] Chowdhary, K. (2020). Fundamentals of artificial intelligence. Springer. <https://doi.org/10.1007/978-81-322-3972-7>
- [36] Ahmed, I., Jeon, G., & Piccialli, F. (2022). From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where. *IEEE Transactions on Industrial Informatics*, 18(8), 5031-5042. <https://doi.org/10.1109/TII.2022.3146552>
- [37] Hassan, M., Aziz, L.A.-R., & Andriansyah, Y. (2023). The role artificial intelligence in modern banking: an exploration of AI-driven approaches for enhanced fraud prevention, risk management, and regulatory compliance. *Reviews of Contemporary Business Analytics*, 6(1), 110-132.
- [38] Ahmadi, S. (2023). Open AI and its Impact on Fraud Detection in Financial Industry. *Journal of Knowledge Learning and Science Technology ISSN*, 2959-6386. <https://doi.org/10.31219/osf.io/myg6r>
- [39] Cho, S., et al. (2020). Learning from machine learning in accounting and assurance (pp. 1-10). American Accounting Association. <https://doi.org/10.2308/jeta-10718>
- [40] Calderon, T.G., & Cheh, J.J. (2002). A roadmap for future neural networks research in auditing and risk assessment. *International Journal of Accounting Information Systems*, 3(4), 203-236. [https://doi.org/10.1016/S1467-0895\(02\)00068-4](https://doi.org/10.1016/S1467-0895(02)00068-4)
- [41] Soori, M., Arezoo, B., & Dastres, R. (2023). Artificial intelligence, machine learning and deep learning in advanced robotics, a review. *Cognitive Robotics*, 3, 54-70. <https://doi.org/10.1016/j.cogr.2023.04.001>
- [42] Aziz, S., & Dowling, M. (2019). Machine learning and AI for risk management. Springer International Publishing. https://doi.org/10.1007/978-3-030-02330-0_3
- [43] Aljohani, A. (2023). Predictive Analytics and Machine Learning for Real-Time Supply Chain Risk Mitigation and Agility. *Sustainability*, 15(20), 15088. <https://doi.org/10.3390/su152015088>
- [44] Tien, J.M. (2017). Internet of Things, Real-Time Decision Making, and Artificial Intelligence. *Annals of Data Science*, 4(2), 149-178. <https://doi.org/10.1007/s40745-017-0112-5>
- [45] Albawwat, I., & Frijat, Y. (2021). An analysis of auditors' perceptions towards artificial intelligence and its contribution to audit quality. *Accounting*, 7(4), 755-762. <https://doi.org/10.5267/j.ac.2021.2.009>
- [46] Al-Shabandar, R., et al. (2019). The application of artificial intelligence in financial compliance management. In *Proceedings of the 2019 International Conference on Artificial Intelligence and Advanced Manufacturing*. <https://doi.org/10.1145/3358331.3358339>
- [47] Baghdasaryan, V., et al. (2022). Improving Tax Audit Efficiency Using Machine Learning: The Role of Taxpayer's Network Data in Fraud Detection. *Applied Artificial Intelligence*, 36(1), 2012002. <https://doi.org/10.1080/08839514.2021.2012002>
- [48] Wang, J., et al. (2024). Supply chain diffusion mechanisms for AI applications: A perspective on audit pricing. *International Review of Financial Analysis*, 93, 103113. <https://doi.org/10.1016/j.irfa.2024.103113>
- [49] Thottoli, M.M. (2024). Leveraging information communication technology (ICT) and artificial intelligence (AI) to enhance auditing practices. *Accounting Research Journal*, ahead-of-print(ahead-of-print).

<https://doi.org/10.1108/ARJ-09-2023-0269>

- [50] Zhen, X., & Zhen, L. (2023). Accounting Information Systems and Strategic Performance: The Interplay of Digital Technology and Edge Computing Devices. *Journal of Grid Computing*, 22(1), 5. <https://doi.org/10.1007/s10723-023-09720-8>
- [51] Zhang, C., et al. (2023). Ethical impact of artificial intelligence in managerial accounting. *International Journal of Accounting Information Systems*, 49, 100619. <https://doi.org/10.1016/j.accinf.2023.100619>
- [52] Fülöp, M., et al. (2023). Ethical concerns associated with artificial intelligence in the accounting profession: a curse or a blessing? *Journal of Business Economics and Management*, 24, 387-404. <https://doi.org/10.3846/jbem.2023.19251>
- [53] Shiyyab, F. S., et al. (2023). The Impact of Artificial Intelligence Disclosure on Financial Performance. *International Journal of Financial Studies*, 11, <https://doi.org/10.3390/ijfs11030115>
- [54] Shankar, A., et al. (2024). Exploring enablers and inhibitors of AI-enabled drones for manufacturing process audits: A mixed-method approach. *Business Strategy and the Environment*, n/a(n/a). <https://doi.org/10.1002/bse.3679>
- [55] Rodgers, W., Al-Shaikh, S., & Khalil, M. (2024). Protocol Analysis Data Collection Technique Implemented for Artificial Intelligence Design. *IEEE Transactions on Engineering Management*, 71, 6842-6853. <https://doi.org/10.1109/TEM.2023.3269291>
- [56] Qasim, A., El Refae, G. A., & Eletter, S. (2023). A Proposed Model to Integrate Drone Technology in Accounting for Long Term Contracts: A Cash Flow Management Perspective. <https://doi.org/10.34028/iajit/20/3A/5>
- [57] Marques, S., et al. (2023). The Impact of Intelligent Systems on Management Accounting. *International Journal of Intelligent Information Technologies (IJIT)*, 19(1), 1-32. <https://doi.org/10.4018/IJIT.324601>
- [58] Lambert, K. J., & Fegley, T. (2023). Economic Calculation in Light of Advances in Big Data and Artificial Intelligence. *Journal of Economic Behavior & Organization*, 206, 243-250. <https://doi.org/10.1016/j.jebo.2022.12.009>
- [59] Hu, K.-H., et al. (2023). Governance of artificial intelligence applications in a business audit via a fusion fuzzy multiple rule-based decision-making model. *Financial Innovation*, 9(1), 117. <https://doi.org/10.1186/s40854-022-00436-4>
- [60] Goto, M. (2023). Anticipatory innovation of professional services: The case of auditing and artificial intelligence. *Research Policy*, 52(8), 104828. <https://doi.org/10.1016/j.respol.2023.104828>
- [61] Ramzan, S., & Lokanan, M. (2024). The application of machine learning to study fraud in the accounting literature. *Journal of Accounting Literature*, ahead-of-print(ahead-of-print). <https://doi.org/10.1108/JAL-11-2022-0112>
- [62] Liao, C., & Ma, T. (2024). From fundamental signals to stock volatility: A machine learning approach. *Pacific-Basin Finance Journal*, 84, 102283. <https://doi.org/10.1016/j.pacfin.2024.102283>
- [63] Yang, X. (2024). Optimizing Accounting Informatization through Simultaneous Multi-Tasking across Edge and Cloud Devices using Hybrid Machine Learning Models. *Journal of Grid Computing*, 22(1), 12. <https://doi.org/10.1007/s10723-023-09735-1>
- [64] Subedi, M. (2024). Principles based accounting standards, audit fees and going concern: evidence using

advanced machine learning. *International Journal of Accounting & Information Management*, 32(2), 308-344. <https://doi.org/10.1108/IJAIM-02-2023-0026>

- [65] Rahman, M. J., & Zhu, H. (2024). Detecting accounting fraud in family firms: Evidence from machine learning approaches. *Advances in Accounting*, 64, 100722. <https://doi.org/10.1016/j.adiac.2023.100722>
- [66] Bochkay, K., et al. (2023). Textual Analysis in Accounting: What's Next?*. *Contemporary Accounting Research*, 40(2), 765-805. <https://doi.org/10.1111/1911-3846.12825>
- [67] Zhao, J., & Wang, X. (2023). Unleashing efficiency and insights: Exploring the potential applications and challenges of ChatGPT in accounting. *Journal of Corporate Accounting & Finance*, 35. <https://doi.org/10.1002/jcaf.22663>
- [68] Wood, D., et al. (2023). The ChatGPT Artificial Intelligence Chatbot: How Well Does It Answer Accounting Assessment Questions? *Issues in Accounting Education*, 38, 1-28.
- [69] Bavaresco, R. S., et al. (2023). Machine learning-based automation of accounting services: An exploratory case study. *International Journal of Accounting Information Systems*, 49, 100618. <https://doi.org/10.1016/j.accinf.2023.100618>
- [70] Shapovalova, A., et al. (2023). MODERNIZATION OF THE NATIONAL ACCOUNTING AND AUDITING SYSTEM USING DIGITAL TRANSFORMATION TOOLS. *Financial & Credit Activity: Problems of Theory & Practice*, 4(51).
- [71] Zhu, D. (2022). A Fuzzy Comprehensive Evaluation and Random Forest Model for Financial Account Audit Early Warning. *Mobile Information Systems*, 2022, 5425618. <https://doi.org/10.1155/2022/5425618>
- [72] Zheng, M. (2022). Advanced Artificial Intelligence Model for Financial Accounting Transformation Based on Machine Learning and Enterprise Unstructured Text Data. *Mobile Information Systems*, 2022, 5708652. <https://doi.org/10.1155/2022/5708652>
- [73] Vărzaru, A. A. (2022). Assessing Artificial Intelligence Technology Acceptance in Managerial Accounting. *Electronics*, 11. <https://doi.org/10.3390/electronics11142256>
- [74] Vărzaru, A. A. (2022). Assessing the Impact of AI Solutions' Ethical Issues on Performance in Managerial Accounting. *Electronics*, 11. <https://doi.org/10.3390/electronics11142221>
- [75] Nielsen, S. (2022). Management accounting and the concepts of exploratory data analysis and unsupervised machine learning: a literature study and future directions. *Journal of Accounting & Organizational Change*, 18(5), 811-853. <https://doi.org/10.1108/JAOC-08-2020-0107>
- [76] Mousa, G. A., Elamir, E. A. H., & Hussainey, K. (2022). The effect of annual report narratives on the cost of capital in the Middle East and North Africa: A machine learning approach. *Research in International Business and Finance*, 62, 101675. <https://doi.org/10.1016/j.ribaf.2022.101675>
- [77] Liu, X. (2022). Accounting and Financial Management Cost Accounting Integrating Rough Set Knowledge Recognition Algorithm. *Discrete Dynamics in Nature and Society*, 2022, 9286252. <https://doi.org/10.1155/2022/9286252>
- [78] Lehner, O. M., et al. (2022). Artificial intelligence based decision-making in accounting and auditing: ethical challenges and normative thinking. *Accounting, Auditing & Accountability Journal*, 35(9), 109-135. <https://doi.org/10.1108/AAAJ-09-2020-4934>
- [79] Krupa, J., & Minutti-Meza, M. (2022). Regression and Machine Learning Methods to Predict Discrete

Outcomes in Accounting Research. *Journal of Financial Reporting*, 7. <https://doi.org/10.2308/JFR-2021-010>

- [80] Hanauer, M. X., Kononova, M., & Rapp, M. S. (2022). Boosting agnostic fundamental analysis: Using machine learning to identify mispricing in European stock markets. *Finance Research Letters*, 48, 102856. <https://doi.org/10.1016/j.frl.2022.102856>
- [81] Chen, X. I., et al. (2022). Predicting Future Earnings Changes Using Machine Learning and Detailed Financial Data. *Journal of Accounting Research*, 60(2), 467-515. <https://doi.org/10.1111/1475-679X.12429>
- [82] Agustí, M. A., & Orta-Pérez, M. (2023). Big data and artificial intelligence in the fields of accounting and auditing: a bibliometric analysis. *Spanish Journal of Finance and Accounting / Revista Española de Financiación y Contabilidad*, 52(3), 412-438. <https://doi.org/10.1080/02102412.2022.2099675>