LITERATURE REVIEW – MACHINE LEARNING IN ACCOUNTING AND ASSURANCE

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ABSTRACT

The purpose of this literature review is to gain an understanding of the existing research or literature relevant to the impact of Machine Learning on the profession of accounting and assurance. It provides a comprehensive overview of knowledge about this area of study in the form of a written report. Specifically, the study describes the impacts of ML on accounting and assurance in the following manner; by identifying the emerging trends in these fields, by identifying the impact of ML on the efficiency and effectiveness of these professions, and the inconsistencies and gaps in the research. The details of this study are helpful for the professionals in accounting and auditing as it enhances the readers understanding of the topic at large.

Keywords: Artificial Intelligence, Machine learning, Blockchain, Digitization.

INTRODUCTION

Arthur Samuel first introduced machine learning (ML) in 1959. It is a subfield of Artificial Intelligence that aims to enable computer programs to automatically learn and develop itself by using large amounts of data to provide valuable insights and future predictions (Kaur, 2020). Machine learning consists of neural networks that are like the skills of the human brain. It is developed to mimic human brainstorming patterns. Therefore, after analyzing the sufficient data, it starts interpreting them and connects them to take necessary actions on its own (Helm et al., 2020).

Unlike the traditional computer programs designed to give distinct instructions to the computers for solving a defined problem with both the possibilities of certainty and uncertainty (Rice, 2014). ML enables software applications to become more accurate by using historical data as input and predicting outcomes that are not explicitly programmed to do so (Michie et al., 1994). The fundamental categories of algorithms in ML are supervised, unsupervised, and semi-supervised algorithms (Ayodele, 2010). These algorithms are trained to change and improve themselves, analyze anomalies, remove errors without any human intervention and mitigate the chances of occurring again (Bonaccorso, 2017). They are also used to improve processing speed, review source documents, and find similar patterns from huge or complex data (Mohammed et al., 2016).

Machine learning holds a significant attraction for business world in these contemporary times. The broad range of facilities that it offers and the various applications on business data that it has, allows the organizations to easily cope with the dynamic environmental conditions in diversified industrial sectors (Apte, 2010). ML is beneficial in accomplishing complex business tasks with great accuracy instead of humans who cannot process huge quantum of data and produce accurate conclusions (Finlay, 2017). Similarly, the integration of multiple processing units results in a high processing speed and decreases the element of human biases (Canhoto & Clear, 2020).

Today, extensive research is being conducted on the impacts of machine learning on the professions of accounting and assurance. Its vast application on various tasks such as assessing business risks, analyzing business transactions or activities, and reviewing source

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documents etc. has gotten the attention of many of the large businesses and academics (Atanasovski et al., 2020). Researchers mostly use machine learning to make predictions about accounting estimates, material misstatements, bankruptcy, and fraud. It is also creating a great awareness with respect to the inductive reasoning methodology in accounting and auditing (Canhoto & Clear, 2020).

Deep learning technology that is a subset of a Machine Learning is another emerging form of artificial intelligence. This technology is particularly used in auditing to recognize such patterns in a huge volume of data that are generally impossible for an individual to process (Issa et al., 2016). This emerging technology has led to the increased audit automation and it allows the auditors to create supplementary audit evidence by utilizing big data. The efficiency and the effectiveness of the auditor's decision-making process is also improved by this technology (Sun & Vasarhelyi, 2017).

Numerous large CPA firms are still trying to find other ways in which Machine Learning could be useful for conducting financial statement audits, especially in the risk assessment process (Kokina & Davenport, 2017). However, researchers believe that even though there is an immense potential for a deeper and broader understanding of Machine Learning on audit processes, the logic or accuracy of the patterns identified by it could be questionable. Therefore, some academics are now raising the concerns of potential ethical implications and human biases of Machine Learning in accounting/auditing research and practice (Dickey et al., 2019).

Another major area of research that the researchers widely discuss pertains to the impact of machine learning on the individuals or occupations associated with accounting and audit. It is believed that where some of the accountants/auditors would embrace the challenge of this new business environment, many would fail to adapt and will be left behind (Stancheva-Todorova, 2018). Nonetheless, many researchers concede that the profession of accounting is on its way to make a significant change in the role and the function that it plays in the organization (Donepudi, 2019). However, where there is a substantial amount of literature that has been produced on the applications of ML techniques to audit and accounting procedures, there is a considerable gap of studies on the potential bias and ethical implications of ML on these topics.

The Objective of the Study

The purpose of this literature review is to gain an understanding of the existing research or literature relevant to the impact of Machine Learning on the profession of accounting and assurance. It provides a comprehensive overview of knowledge about this area of study in the form of a written report. Specifically, the study describes the impacts of ML on accounting and assurance in the following manner; by identifying the emerging trends in these fields, by identifying the impact of ML on the efficiency and effectiveness of these professions, and the inconsistencies and gaps in the research. The details of this study are helpful for the professionals in accounting and auditing as it enhances the readers understanding of the topic at large.

Research Design and Identification of Literature

This is kind of a review study, the purpose of which is to analyze or synthesize the research that has already been conducted in primary sources. A review study is generally conducted to summarize the current state of research on any given topic. Therefore, this literature review does the same by critically evaluating the previously published material in Machine Learning in accounting and assurance. The organization, combination, and

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evaluation of the previously published material on this topic enables the readers to understand and identify the relationships, inconsistencies, gaps, and contradictions in the area of ML in accounting and assurance.

A systematic and critical analysis of the literature relevant to the impacts of ML on the profession of accounting and assurance has been done in this study. To identify relevant literature, popular articles and papers were reviewed, and bibliographies of these papers were used to find appropriate sources for further research. The literature used for this study consists of the research paper published in peer -reviewed journals. It is also ensured that a large part of this review includes of studies that are recently published.

Structure of the Report

The literature review is divided into three main parts that include introduction, body and conclusion. The introduction part entails the definition of ML learning and identification of research areas pertaining to ML and the profession of accounting and assurance. The body part consists of eight different areas relevant to the field of ML in accounting and assurance. These areas describe the relationship between ML and finance, ML and assurance process, ML and accounting estimates, ML in financial projections, ML and tax compliance, ML in detecting accounts fraud, blockchain technology, and challenges of Machine Learning for auditors. The last part of this report concludes the entire report and briefly states the findings of this report.

Impacts of machine learning on Accounting and Assurance

Machine learning in accounting has already made its impact by reducing the fear and workload while conducting audits, creating automated forecasts and assisting smart bots in artificial intelligence accounting. The Use of Software makes it easier to manage continuously occurring transactions by recognizing patterns. This has made the tedious tasks of bookkeeping a lot easier for accountants by saving their time and efforts, which can be used in other important tasks (Canhoto & Clear, 2020).

One of the most fundamental ways in which Machine Learning can change the financial industry is by reducing the common errors committed by a human being. Most of the regular data-entry practices and management of invoices and low-level bookkeeping tasks are now replaced by Machine Learning. This in turn, has reduced the chance of incorrect input of accounting information and reduced the workload of accountants (Elmes et al., 2020). While some researchers have shown their concerns toward the eliminating jobs in the profession of accounting and finance, many are confident that it would free up the times of financial professionals that can be used for working on a higher-level aspect within an organization (Galarza, 2017). ML is adding an immense value in financial sectors as now professionals have more time to focus on business strategy and improvement of efficiency and effectiveness of existing business operations.

Similarly, the strong technological base that exists today made a number of accounting processes so effortless that most of the tasks that required a sizable workforce can easily be done automatically or through a minimum human effort by the software (Elmes et al., 2020). Furthermore, nowadays, financial accounting software are so much embedded with A.I. that any software that is without ML would be considered incomplete. For that reason, many of the accounting tasks such as expense accounts, receivable management, payables management, tax calculations and risk assessment can easily be automated with machine learning (Kaya et al., 2019). Therefore, the research conducted on the impacts of machine

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learning on the different accounting and audit areas is discussed in detail in the following part of the report.

Machine Learning and Finance

Technological progression in these times has changed the way finance has been handled. It has made significant progress by reducing costs, enhancing customers' experience and increasing revenue by saving numerous organizations from potential losses and taking corrective actions whenever needed. ML is now further evolving into deep learning, thus, increasing the quality of information and saving costs (Dixon et al., 2020).

Nowadays, numerous operations of finance heavily rely on ML for running a technical software. It offers a wide range of benefits to the companies including risk identification, risk assessment, credit worthiness of the client, credit history, financial footing etc. Similarly, bank reconciliation processes have been automated with the emergence of A.I. as past trends of transaction allocations are used to classify the new ones (Heaton et al., 2016).

This technology has also created features in finance that were not present before. For instance, there are some features that are not part of finance but are now embedded with in accounting software and are playing a significant role in performing accounting functions. Examples of such functions include chat bots, call center automation, and process automation. There is numerous software that entail such features (Emerson et al., 2019). One of the well-known software in this regard is Xero. This software has a chat bot in cloud accounting platforms for small businesses that assists by answering the queries of customers concerning latest financial data, providing the amount of money due from people, balance left in the account, liabilities to be paid etc. (Ahmed, 2020) Furthermore, the coding behaviors of invoice are automatically learned by accounting apps which saves the significant times of accountants and lower the risks of errors as after entering the basic information about transactions, the systems automatically distribute the particular transaction to a specific account (Hedberg, 2020).

The demand for accurate and timely financial projections, financial engineering and accounts estimates have rapidly increased in past few years. Similarly, a vast number of transactions takes place regularly in an organization, Machine Learning provides the ultimate solution to assure smooth and accurate processing of information (De Prado, 2018). This Advanced technological progression of A.I has uplifted the landscape of finance, banking, and accounts analytics. Other primary benefits of ML include assets valuation and management, evaluation of credit worthiness, stock market forecasting, computation of risks associated and reduction of costs (Aziz & Dowling, 2019).

Digitization in operations assisted greatly in detection of frauds, automated trading, and provision of effective advisory services to clients as these functions now heavily rely on neural based software. ML tools are keepers of customer`s confidential information, it informs the concerned user for any suspicious transaction and if system deems necessary it may request the client for provision of additional information to draw conclusions. It offers a wide range of assistance to the companies including risk identification, mitigation, and prevention from rising again (Klaas, 2019). In addition to this, ML is now further evolving into deep learning. This means that it will accelerate the speed and quality of outcomes that it provides.

ML is also creating enormous impact in other financial advisory services. For instance, financial advisors use Algo-trading or Algorithmic trading to draw better trade decisions by analyzing tons of data sets of different markets simultaneously. Algo-trading have become High Frequency Trading (HFT) resulting in a trading at best prices and reduced

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costs by eliminating the human intrusion (Sezer & Ozbayoglu, 2018). It also generates profits at a much higher frequency as it acts proactively by observing the real time rise and fall in stock prices and give suggestions for sales and purchase for thousands of transactions each day (Chan, 2017).

The use of Machine Learning also increased the security aspect of financial data. The financial monitoring and data network security has improved due to the use of ML algorithms that assists in keeping the data secrecy and sustain confidentiality (Papernot et al., 2016). Neural networks observe the normal and abnormal behaviors occurring within transaction sets and highlight those outliers indicating the likelihood of scams (Chio & Freeman, 2018). High processing capacities of machine learning algorithms enable it to detect the real time fraudulent activities, take corrective actions against it and if the system deems necessary it may cease the operations unless validation is received. Some of the biggest companies in the world such as Adyen, PayPal, Payoneer, Stripe, Skrill etc. took a great interest in ML and invested heavily in the security system that is backed by it. For instance, the database of Payoneer clients is estimated to be in millions (Basnet et al., 2008). Therefore, for such a large database a strong transactions security can only be retained by using ML algorithm.

Machine Learning in Financial Projections

Financial forecasting refers to the projections made by enterprises concerning their expected revenues, cash flows, improved profits, and expenses (Cassar, 2009). These predictions are not just judgments, in fact, they are based on sophisticated algorithms which considers huge datasets with an underlying assumption that if factors remained unchanged then the financial trajectory can be drawn with some certainty (Villa & Valaitis, 2019). However, such factors cannot always remain static as businesses keep on evolving and at times change dramatically without any warning or indicator.

In dynamic circumstances the financial projections can easily go in vain due to lack of consideration towards the environment or data that is used as an input for financial forecasting. Therefore, this makes it necessary for accountants to incorporate the data that entails all the relevant dynamics of environment and adjust the prediction model accordingly. The inherent element of uncertainty affects businesses' efficiency, concerning long or short-term predictions. Therefore, in order to take pragmatic decisions, one must take into account the additional information relating to the real time stock market trends, fraud detection, consumers buying patterns and market segmentation to accurately predict the future (Jordan & Mitchell, 2015). However, mining and analyzing this big of a data exceeds the limits of human brainstorming and also of traditional forecasting model capacities. This is where the need for high end technological tools embedded with artificial intelligence (A.I) arises and machine learning (ML) comes into play as it accelerates the performance of the forecasting work with the great accuracy and speed.

Likewise, accountants as a financial advisor for the clients are responsible to effectively manage the financial records and information to provide stakeholders transparent statistics as and when required without any manipulation. This data is then used in one of the most crucial evaluations for business that is forecasting. ML in this regard assists in managing such data effectively and securely by automating many of the processes while at the same time providing productive insights in a variety of ways by using the input queries (Lantz, 2019).

Financial forecasting considers the historic, market and financial information ascertained from the data managed by professional accountants and gets greatly impacted with the volume of data and its accuracy (Cassar, 2009). Enabled with high-tech processing capacity, machine assistants work faster and better than humans using traditional methods.

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Therefore, ML gives results in mere hours unlike the traditional approaches that might take weeks to answer the same queries (Lee & Ha, 2009). This capability of ML is what adds value towards the entity`s decisions. Older methods and tools of forecasting also limit the reliability, innovation, and problem-solving abilities of an individual. Whereas Machine Learning assists in making a quick and accurate predictions by using a large and complex data from numerous sources while at the same time maintaining the reliability of output (Prado, 2020).

The advancement of ML has increased so much that most of the companies have now created their own A.I. program while some are using commercial A.I. Software. This means that those companies who might not be able to afford the creation and maintenance of A.I. program can now easily buy a pre trained ML program according to their need and requirements. Vendors of Machine Learning program embed the ML algorithms that can be trained by the accountants and members of finance teams as and when needed (Brynjolfsson & Mcafee, 2017).

It has been observed that while manipulating the past data as an input for future projection, the ML algorithms not only identify and recognize new patterns, but they also reveal the past unknown relationships between various elements within the data set provided. This assists in forecasting potential errors, rectifying them, and preventing them from occurring again, hence, increasing the reliability of financial forecasts (Qiu et al., 2016). Resultantly, the businesses decisions made based on the output provided by ML becomes more reliable and accurate. Therefore, it contributes towards increasing the wealth of the stakeholders, exploiting new opportunities, finding gateways, and highlighting areas of threats to be converted into strengths (Perrin & Roncalli, 2020). In short, incorporation of ML improves and expands the landscape of forecasting and productive analysis.

Machine Learning and Accounting Estimates

Widespread use of accounting estimates can be witnessed in all the industrial sectors present in the market. Managerial estimates comprising of warranty expense estimation, asset impairment, useful life of asset, depreciation method, estimates of employee pension fund, employee stock options, contingent liabilities, allowances for receivables, estimating doubtful debts, tangible assets valuation and their revaluation are pervasive. Calculations for these estimates are computed while ensuring that an aligned pattern is followed in order to generate consistent values (Lev et al., 2005). These estimates majorly comprise of balance sheet items such as assets and liabilities and their respective heads in income statement.

Estimates are subject to human errors, manipulations by managers and biasness. This has a potential to adversely affecting the reliability of the financial reports which can be misleading for the directors and the decision based on such reports can cause great financial and reputational losses for the companies. These estimates are further incorporated by the auditors in preparation of company`s audit report which can further lower the reliability of company's financials (Petroni & Beasley, 1996). Research shows that Machine Learning boosts performance and improved experience of managerial estimates for auditors, managers, and accountants. The fusion of A.I. along with human intelligence is a promising strategy to achieve better results for the business (Cho et al., 2020). Another research showed that in four out of five insurance lines examined, the data with regards to loss estimates, reserves and realizations produced by ML was superior to the actual managerial estimates reported in financial statements (Ding et al., 2020).

This shows that accounting estimates can significantly be improved through Machine Learning by enhancing the reliability and consistency of accounting estimates. In addition to this, ML estimates can also be used as a benchmark to compare the estimates of the managers

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and auditors. If the deviation from the ML estimates is significant than managers' estimates must be reexamined. Other implications and further research on this area is also required to improve the financial information.

Blockchain Technology

Another significant way in which accounting and finance could be affected by A.I. is using growing blockchain technology. The idea of this technology was first introduced by Stuart Haber and W. Scott Stornetta in 1991 (Bayer et al., 1993). These two researchers sought to create such a system in which timestamps of documents could not be altered. This research led to the creation of a specific type data management technique in which data or information is stored in blocks that are chained together in chronological order. Therefore, the basic purpose of blockchain in accounting and finance is to enable the data encryption in the strings of blocks. In this way, track of time and date of a business transaction could be stored in blocks and can be used to realize the digital transfer of property (Hays, 2018).

This technology could also be used to increase the efficiency of an audit process. Relevancy and reliability of data is extremely important in audit and assurance. Therefore, blockchain can increase the reliability of data by limiting the possibilities of tampering with an electronic record (Sutton & Samavi, 2017). This means that it aids in keeping an extremely exact record of when a transaction has taken place and the person who has authorized it.

The integrity of business transactions can easily be investigated with the combination of blockchain technology and A.I. The computer will do much of the work, leaving only the final analysis for the auditor. In this situation, the main responsibility of the auditors would be to spend most of their time designing, reviewing, and checking how the information flows between systems (Kozlowski, 2018). This alignment of Machine Learning and blockchain, reduces the need for conducting regular audits at specific intervals and creates the possibility of an ongoing auditing. By doing this, auditors or management are notified automatically whenever a potential problem is detected by the system (Chedrawi & Howayeck, 2018). This type of continuous monitoring is only possible with the help of Machine Learning as it would be almost impossible for humans to actively check every transaction on a continuing basis.

Machine Learning and Assurance Process

Using traditional approaches to manage accounts always bear an inherent risk of human error. This can lead to a failure in identification of errors and use of inappropriate corrective internal controls for their mitigation. Eventually, the effectiveness of audit reports could be compromised in these circumstances. However, the use of machine learning algorithms in audit tools has improved the reliability of audit by reducing the risk of inappropriate opinion and increasing auditor`s ability to evaluate the estimates (Cho et al., 2020). The worth of company`s financials before its potential investors and stakeholders have improved by using ML in assurance techniques.

Similarly, Machine Learning provided a fantastic opportunity for accountants and auditors who had to search through a large amount of data every day. Machine learning is used in auditing for numerous purposes. Auditors have always had many transactions to sift through, but they spent most of the time in organizing the data rather than analyzing it. Machine learning can analyze the data hundred times faster than a human can do while at the same time passing a quick and unbiased judgement (Sun, 2019). Therefore, over the past 20 years, an auditor's job is completely changed. For instance, Machine Learning tools allow auditors to analyze multiple contracts in matters of minutes by mimicking the human

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recognition approach and applying it to finding the relevant provisions in contract (Clark, 2018). This way ML helps auditors in optimization of their time and enabling them to use their human judgement to analyze the delivered outcome.

Machine learning tools do not replace the duties performed by the auditor. Rather, it works as an additional tool in auditor`s range of Computer Auditing Tools and Techniques (CAATs). Automated tools are used by auditors to assist them in analyzing the huge data ledgers, highlighting risk indicators, and reporting the findings or exceptions (Hooda et al., 2018). The real training of the Machine Learning begins if the auditor invalidates the exception reported. In that case, the machine algorithm trains itself by finding additional positive or negative elements relating to the data set and applying them on other exceptions, hence getting trained to identify in more improved way. ML also aids by analyzing the patterns in a set of transactions and recognizing the behavior of normal transactions, this approach is then used to further identify the anomalies arising in the data by comparing normal and unusual patterns of business transactions (Samantha, 2019).

Machine learning is serving wonders by accelerating the core audit speed, providing in depth insights and enhancing the quality of work. Therefore, rather than just depending on specific sampling techniques, auditors can benefit from considering whole set of data to report anomalies (Tiwari & Hooda, 2018). Considering the whole population of data lowers the sampling risk and increases the collaboration among audit teams while deciding for testing techniques to be opted in much specific and clear way. All the big 4 firms have been reported to aggressively use A.I. enabled technological tools in order to raise mark of assurance for stakeholders while embedding innovations in their systems (Saleiro et al., 2018).

ML also creates a great value for the senior management and directors of audit firms as it enables them to take decisions based on extensive research and productive analysis (Kogan et al., 2019). ML has made so much impact on audit profession that almost all of the big audit firms in the industry are using Machine Learning Algorithm that are capable to read documents such as leases, sales contracts, derivative contracts etc. (Hooda et al., 2018). These ML algorithms include features that enables them to recognize trend patterns, key terms in contracts and outliers in data set provided which then allows the auditors to take a focused approach towards the audit.

Another use of machine learning in assurance is software such as Halo that enables the auditors to analyze every transaction that took place during the year. It identifies the problematic areas with risk potentials and highlighting questionable nature items from journal entries. This enables auditors to have a wealth of insight when it comes to analyzing and assessing the risks. Conversely, use of this approach by the auditors (that are internal or external) in identifying the anomalies and then considering them "*normal*" as argued by some critics is also risky because at times, a possibility of fraudulent transaction exits in a dataset used for its learning (Hooda et al., 2018). This means that A.I. would inherently believe that the abnormal patterns are normal, and this can be misleading.

Challenges of Machine Learning for Auditors

Research shows that digitizing the audit work is imposing challenges on auditors as a considerable volume of data that auditors use is based on companies' record. Therefore, valid and clear account information and accurate financial statements are needed to assist the external auditors at the year-end of financial period. Otherwise, over-stated or understated accounts figures would lead to the preparation of wrong reports, causing a disruptive and multiplicative effect for stakeholders (Kumar et al., 2017). As the working of A.I. embedded algorithms would be based on the record that the client provides, the expertise of cybercrime

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consultants must be secured by the audit firms in order to assure the integrity of financial and especially nonfinancial data residing at the client`s server (Cho et al., 2020).

Also, due to the innate ethical and confidential restrictions, clients do not let auditors gain complete control over the data. Therefore, auditors will have to apply effective testing controls to gain the relevant and reliable information. Once the completeness, accuracy and valuation of figures stated within has been authenticated, only then the auditors would be able to feed the test data for Machine Learning. Similarly, hackers can also manipulate the client`s data by breaching the security protocols (Clark, 2018).

Companies applying the A.I. to the finance function face the challenge of designing algorithms that produce unbiased results and are not complex for users to understand how they work and make decisions. Therefore, auditors also need to evaluate the element of human biases while training with dataset used as input. The general biases that the researchers in this regard have identified include availability biasness, confirmation biasness, anchoring biasness and overconfidence biasness. Availability biasness refers to the attitude of gathering the available data and forming conclusions of it. Confirmation biasness is the possibility of giving weightage only to data which is aligned with the existing believes. Overconfidence biasness results in the sense of superiority and overestimating one`s own abilities, and anchoring biasness appears when the audit clients establish their own Machine Learning tools that could be incomplete or contain incorrect data, but auditors still use them. Therefore, sometimes auditors start relying too much on the outputs delivered by ML algorithm while ignoring the biasness that has been part of the data which has been used as an input (Dickey et al., 2019). Resultantly, auditors will need to critically evaluate the element of human biases involved while giving inputs. Ignoring this fact can lead to the unreliable and detrimental decisions.

Ultimately in the long run auditors will need to understand the basic workings and functionalities of algorithms and information systems from data scientists just like the present scenario where auditors take guidance from actuarial, valuators and information technology experts. This would increase the burden of knowledge for auditors as they already need to be aware of increasingly complex set of accounting and auditing rules and regulations (Cho et al., 2020). Otherwise, the appropriateness of audit documentation such as working papers and reports for stakeholders would not be much reliable.

Due to the newness of ML in audit, academics are still on the initial stage of identifying and uncovering the potential uses of ML in this area. However, due to the limited empirical evidence available to the researchers, the research on this area is also limited. Therefore, a huge opportunity for research on the impacts of ML on audit still exists. Moreover, no one sees the future of auditorsdiminishing with the advancement in Machine Learning technology.It only liberates the auditors from wasting time on a repetitive task while allowing them to focus on potential risky areas and interpretations.

Tax Compliance

The research conducted by one of the largest audit firm in the world, PricewaterhouseCoopers revealed that a printed version of the IRS US Tax Regulations exceeds 75,000 pages in total. This makes it extremely difficult for taxpayers and even tax professionals, accountants, and auditors to comprehend such a large volume of complex data. Therefore, the company tried to automate the comprehension of tax passages by creating a linguistic system that can organize the reference terms in tax cases and regulations for effective human reading and comprehension (PricewaterhouseCoopers, 2017). A.I. is also being used by the company to automatically process tax notices by using key terms and preparing their responses as well. Similarly, the company's account classification, tax

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compliance and reporting are also done by using ML algorithms (PricewaterhouseCoopers, 2019).

ML is also used to understand the trial balance and classification of transactions by identifying the account names in which a certain transaction fall. This classification is then used for a variety of purposes by the accountants including the calculation of tax and adjustments of accounts with regards to income and expense. Likewise, tax compliance and reporting also plays a significant role in both accounting and audit matters. For this reason, A.I. is used to perform and evaluate the organized and unorganized income tax compliance activities. Other routine and structured activities that used to be performed manually such as gathering trial balance data from source systems, making book/tax adjustments, posting the entries of tax, and completing tax forms is also done using ML capabilities (PricewaterhouseCoopers, 2019).

Tax plays an integral part in accounting and finance function. People providing consultancy services need to be aware of all the applicable tax rules and regulations while providing services to their clients. However, now with the application of Machine Learning model, the research is in process that can provide guidance to the taxpayer while at the same time improving the assessments for the subsequent taxpayers, reducing the role and burden of tax advisor and accountants. The research has also been conducted to train such a Machine Learning algorithm that can access the large volume of tax data, tax codes, tax litigation, and relevant facts for a business enterprise. If a Machine Learning model were to study tax and inquiries of a considerable number of taxpayers than it could learn what deductions to take, how those issues affect income tax liability or refund, and offer guidance (Milner & Berg, 2017). The perfection of such kind of research would totally revolutionize the field of tax and its impacts on corporation individuals, company's accounts, and audit.

Machine Learning in Detecting Accounts Fraud

It has been estimated that organizations in general lose around 5 percent of their annual revenues due to fraud and 1.6 percent of this revenue specifically relates to the fraud in company's financial statement (ACFE, 2014). Additionally, misallocation and misappropriation of resources generate misleading financial data that can harm the reputation and efficiency of the business. Financial statement fraud, (hereafter fraud) also increases the risk of running a business. For example, where company will lose the resources and gets a misleading statement, audit firms might have to face reputational costs, lawsuits, and loss of clients (Perols et al., 2017). Similarly, banks, investors and other financial institutions are more likely to make incorrect loan and investment decisions due to the wrong picture portrayed by the financial statements.

For years, fraud has been a major issue in the sectors like banking, medical, insurance etc. The main reason behind such rise in fraudulent activities is the increase in online transactions and emergence of different payment options. Therefore, with the advancements in technological infrastructure major threats of accounting frauds have also evolved. Now a major portion of accounts transactions take place through online channels and the diversification in payment methods for users has resulted in increased fraudulent traps. Moreover, each transaction carries numerous prospects to be considered while identifying an anomaly. Both financial businesses and fraudsters are using sophisticated tools to improve their operations. Hence, it has become necessary for these companies to effectively identify and prevent the occurrence of fraud to avoid huge losses (Patil & Dharwadkar, 2017). For this reason, while transforming from manual to electronic world of accounting ecosystem, the only tool that can assist in identifying and preventing frauds is the use of Machine Learning Algorithms.

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There are two basic fraud detection systems, namely rule-based fraud detection and Machine Learning based systems. Rule-based is the manual approach in which algorithms cannot recognize the hidden patterns while allowing the fraudsters to create and adapt to new techniques. This creates the need for a system that can analyze data and respond to new situations, and this is where Machine Learning comes into play. It is an efficient way of fraud detection and since it has an extremely fast computing capabilities, it does not even require the guidance of a fraud analyst (Bonaccorso, 2017). Therefore, it helps in reducing false positives for transactions and accounting records because the patterns are detected by an automated system for streaming transactions in a huge volume.

There are two machine learning models that are used for detecting fraud in transactions that are supervised learning and un-supervised learning. The most common machine learning algorithm used for that purpose is "*Isolation Forest Algorithm*." It is based on unsupervised learning algorithm for detecting fraud. It observes real time pattern of each transaction and isolates any anomaly arising unless it is rectified by the system. Unsupervised algorithms identify the subtle and hidden patterns from a given input without having any previous labeled data set. It scans large volume of inputs and flags events with potential loss pattern. Adaptive analytics continuously gives feedback of fraud analyst to the Machine Learning system. Programmed to consider several parameters as location, date, amount, frequency etc. of the event, it aligns the probability of scam for a user. The supervised fraud detection algorithms are trained and tested with enormous data inputs and system tags them as fraudulent exemplars to predict the future results (Gogoi, Borah & Bhattacharyya, 2010). The tedious tasks once conducted by the fraud detection teams can now be effectively managed by quick ML tools reducing time consumption as well as costs.

To provide reliable and relevant financial data to the stakeholders, a company financial statements must be free from material misstatements. However, this is not possible if the company's financials contain unidentified frauds or scams. The business sector that is most prone to such kind of scams is financial sector. Therefore, use of Machine Learning has become inevitable by the financial sector due to its ability to detect frauds at preliminary stages. It also informs the concerned user regarding any suspicious transaction and if system deems necessary it may request the client for further provision of information and keeping confidentiality of customer`s information (Bonaccorso, 2017).

Contrary to the traditional fraud detection methods ML algorithms have expertise to process real time fraudulent actions. Feedzai, a fintech company claims that their ML algorithm is so trained that it can detect 95% of all the anomalies. For this reason, leading financial institutions are already using ML to combat fraud scams (Bazarbash, 2019). This helps the institutions in re-evaluating and altering their current strategy or functions based on the risks identified by the ML technology and present such financial information that could be relied upon.

Based on the credibility of the Machine Learning tools to accurately produce and interpret financial result, in numerous well known financial institutions such as Bank of America, Morgan & Stanley and JPMorgan are spending a great amount of money to unlock the wealth of financial insight provided by the ML program. The primary reason behind such investment is to effectively manage the risk of fraud that these financial institutions face and to automate investments plan and techniques by finding the past hidden relationships from financial data to improve their strategy and operations. In short, ML can play a huge role in preventing and detecting fraud if applied correctly and rigorously (Perols et al., 2017). Once the company succeeds in preventing fraud then its financial statements would automatically start to paint a true financial picture to its stakeholders. In short, rapid decision making, early

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anomaly finding, and business automation are just a few instances of the benefits that can be reaped from using ML algorithm.

CONCLUSION

Even though the concept of Machine Learning has been around since 1959, the detailed search on the subject was initiated in the past couple of decades, whereas most of the research about impact of Machine Learning in areas of accounting and assurance has been initiated in the past four to five years. The theoretical analysis of Machine Learning and its impact on accounting and assurance has revealed that this technology has potential to unearth the numerous benefits. However, the technology is costly and challenging to implement. Companies have long understood the impact of this technology on the business operations as it enables accomplishment of complex business tasks with speed and great accuracy while working on a large quantum of data. However, the vast application of ML on various business tasks such as assessing risks, analyzing transactions, activities, and reviewing source documents etc. has just gotten the attention of many academics and practitioners.

Currently, ML is actively used in making accounting estimates, forecasting, automating low-level business transactions and taxes, finding material misstatements, reading contracts, and identifying frauds. These uses have significantly increased the efficiency and effectiveness of accounting and auditing functions. However, where this technology has played a major role in reducing the workload and errors of financial and audit professionals, it has also threatened the job security of some of the individuals working in these fields. Some researchers believe that this technology will not threaten the jobs in this profession, it will create the opportunity for them to perform high level functions and add value to the organizations.

The researchers have also questioned the integrity of data fed to the M: algorithmas biased and fraudulent data input would result in the inaccurate and ineffective outcome. Therefore, where this technology can be used to enhance the efficiency of the financial and audit processes, the challenges of increased knowledge requirement for accounts and audit professionals as well as requirement of unbiased input data would limit the scope of ML for some time. In short, the ML's ability to safely predict, identify and rectify the data can have many implications on the financial and audit profession, hence, researchers should be encouraged to further investigate the future uses and challenges of this technology.

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