

Ethical Dilemma of Using Natural Language Processing (NLP) Machine Learning Method in Auditing Company Internal Communication

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Abstract: *As technology is growing fast, people already noticed that there are a lot of applications for using Artificial Intelligence (AI) and machine learning technology in daily life. This research discusses the ethical dilemma of using the natural language processing (NLP) machine learning method in auditing company internal communication. The results showed that using NLP in auditing is beneficial and would not impair auditors to fulfill a social contract with auditing principles. This paper concluded that it is not unethical to use the natural language processing machine learning method in auditing. Using the natural language processing machine learning method is beneficial for auditors to analyze a large amount of data and information, such as emails, business transactions, and bank statements.*

Keywords: *Ethics in Artificial Intelligence (AI), Machine Learning, Natural language processing (NLP), Auditing, Ethical Dilemma*

1. Introduction

As technology is growing fast, people already noticed that there are a lot of applications for using Artificial Intelligence (AI) and machine learning technology in daily life^[1]. This research discusses the ethical dilemma of using the natural language processing (NLP) machine learning method in auditing company internal communication.

The audit process includes four stages. The first stage is the ingestion of transaction documents. The transaction documents could be in any format such as a Portable Document Format (PDF) or Portable Network Graphic (PNG) file. The second stage is entity extraction. The third stage is semantic analysis. In this stage, the auditors identify entity relations and conduct the machine learning semantic analysis if possible. The fourth stage is to send results feedback into the system. These four stages are typically audit workflow. The natural language processing machine learning method is usually applied at the third stage, the semantic analysis stage^[2].

Natural language processing is a machine learning technique that allows computers to read, interpret and derive meaning from human languages. Machine learning techniques are based on algorithms to identify textual patterns or images visually. Speaking, This paper trains the machine to learn the meaning of the textual or images automatically^[1]. There are two natural language processing models that are frequently used recently: The Continuous Bag of Words (CBOW) model and the Word2Vec Skip-gram model. The CBOW model derives the meaning of the current word based on the previous words and the following words. The Skip-gram model derives the previous words and following words based on the current word^[2].

This research will use the auditing principles as our research theory guidance. The basic principles of auditing that are used in this paper are confidentiality, integrity, objectivity, and independence according to the generally accepted auditing standards. The ethical theories that are used in this paper are consequentialism, utilitarianism, and social contract. This paper used the principles of auditing because the principles are required for the generally accepted auditing standards. To provide public auditing work to client companies, it is required to fulfill the social contract and generate the economic benefit of providing business service.

When considering the background of this research topic, this paper will look at the pros and cons of using the NLP machine learning technique in auditing practice. The pros are using NLP could make audits more transparent, real-time, reliable, cost-effective, verifiable, and accessible transaction records. The cons are using NLP in auditing might cause issues, such as privacy, a judgment made by an AI

algorithm versus a human being, AI in auditing, etc.^[2]. Exploring the ethical dilemma of using NLP in auditing is still at the beginning stage. The Big Four accounting firms showed significant interest in applying AI to auditing practice. Business transaction data usually have abundant strings of characters, numbers, or words. With the use of the NLP machine learning technique, the effectiveness and efficiency of semantic analysis will increase^[3].

The purpose of this research is to explore the ethical dilemma and conduct ethical analysis in auditing using the NLP machine learning method. The research problem is using NLP in auditing company internal communication. The research question of this paper is whether it is ethical for an auditor to rely on NLP in auditing company internal communication. The further research problems that this paper is trying to answer include the pros and cons of relying on NLP in auditing company internal communication; the privacy policy of relying on NLP in auditing company internal communication.

The anticipated significance of this study is based on the influence of ethical issues on auditors, CPA associations, companies, SEC, etc. Accountants will benefit from having NLP as the data analysis skills. Using NLP showed a good example of how to implement advanced technology in business and enhance the effectiveness and efficiency of the audit investigation. Auditing nowadays relied heavily on data mining and data analysis. Therefore, auditors need to stay up to date on the latest technologies which can help to increase the auditing quality. However, there is also an ethical dilemma that auditors could come across, such as whether using NLP impairs auditors' independence or impairs the privacy of clients, etc.

2. Literature Review

The ethical theories in this paper are consequentialism, utilitarianism, and social contract. Ethical theories benefit a lot of areas in business. Hirschauer's^[4] research showed that ethical theories are helpful when integrated with economic analysis, and business ethics teaching. Schwartz^[5] concluded that there is a significant part of ethics content in the writings of management. Tseng^[6] analyzed 85,000 cited references from 3,059 articles from three business journals. They found that ethical theories are useful in business decision-making, corporate governance, and firm performance. Welch^[7] also pointed out that ethical theories, in general, will be helpful and significant for the origin, formation, and direction of the company. Ethical theories will also benefit the company's earnings and profit. This paper selected the ethical theories to testify whether auditors would be able to follow audit principles meanwhile fulfilling the social contract by using NLP in auditing practice.

Bleichrodt^[8] mentioned that the theory of consequentialism is used in accounting for ambiguity aversion in dynamic decisions. Eggleston^[9] mentioned that utilitarianism is different from consequentialism. Utilitarianism will choose the best possible consequentialism of an act. Renouard^[10] explored that it is possible to use utilitarianism to specify corporate social responsibility. Marques^[11] defined utilitarianism as a popular moral theory in business decision-making. Kazmi^[12] concluded that utilitarianism is useful in E-Business equity. He typically mentioned that the influence of utilitarianism is higher than hedonism on brand loyalty^[13]. Ast, F. said that social contract theory is useful and can provide a method for decision making. This paper researches whether using NLP in audit still fulfill these ethical theories.

Using NLP in auditing practice is a new technology application. Iswandi^[3] researched the use of NLP in accounting transaction identification in Indonesian. Li^[1] introduced how the NLP technology is used in audit plan knowledge discovery system. Fisher^[2] wrote the literature reviews on using NLP in accounting and finance. Since using NLP in audit is still a new method, therefore it is important to research ethical issues of using NLP in the audit practice.

3. Methodology

The model is built based on literature reviews and ethical theories of consequentialism, utilitarianism, and social contract. The model is a decision tree model.

The research problem is whether it is ethical to use the natural language processing (NLP) machine learning method in auditing. The ethical theories applied in the model are consequentialism, utilitarianism, and social contract. It is obligated for auditors to fulfill auditing principles while conducting audit practice. In this research, the auditing principles valued are confidentiality, integrity, objectivity, and independence^[8]. Meanwhile, privacy is also an important ethical value this paper is researching on. This research would like to answer the problem that whether using the natural language

processing (NPL) machine learning method in auditing impairs company managers' personal privacy, compared with traditional auditing practice without using the NPL machine learning method.

To better understand the ethical decision tree model that this paper is using. Firstly, this paper would like to know what are the definitions of the auditing principles: confidentiality, integrity, objectivity, and independence^[14].

Auditors should be confidential of company information and data. Auditors should not disclose clients' information and data to a third party without confirmation from the client company. Auditors should maintain integrity when conducting audit practice. Auditors should follow the applicable laws and regulations and avoid conflict of interests^[15]. Auditors should be objective and avoid bias when expressing audit opinions^[15]. Auditors should be independent. The Sarbanes-Oxley Act of 2002 requires audit committees to be responsible for the oversight of auditors' independence^[16]. The Securities and Exchange Commission rules required that auditors should be independent when conducting audit practice and address audit opinions^[17]. In the model, this paper will testify whether using NLP in audit practice still fulfills these audit principles: confidentiality, integrity, objectivity, and independence.

Auditors use NLP techniques to investigate social media which contains images, videos, or voices. The information might contain potential risks of fraud. The auditors' method of using NLP techniques might address the issue of impairing privacy of behavior and action^[18]. Based on these potential risks, this paper develops the ethical decision tree model.

Figure 1 is the decision tree model we developed based on the literature reviews and ethical theories: consequentialism, utilitarianism, and social contract.



Figure 1: Ustration of Ethical Decision Tree Model

The first question is whether the action generates deontic status. If the answer is no, the action is not ethical. If the answer is yes, this decision tree model will ask the second question. Auditors' work should provide certain results and be beneficial to clients. If auditors' work does not have any usefulness, clients will suffer an economical loss^[9]. By the theory of Consequentialism, if the action generates deontic status, the second question we ask is whether the summation of the positive welfare-related consequences is greater than the summation of the negative consequences. If the answer to this second question is no, which means the action is costing the client company money and encountering economic loss, therefore this model will reject the action. If the answer to the second question is yes, then we will continue to ask the third question whether the action produces as high a utility as an alternative action that the agent could perform instead. If the answer to the third question is no it means the action is not as effective as other actions, however, this model might still accept this action based on the answer to the fourth question. If the answer to the third question is yes, then we will ask the fourth question of whether the action will fulfill the social contract with auditing principles. If the answer to the fourth question is no, then the action is not suitable for conducting the audit. This model will reject the action and conclude that this action is unethical for auditors. If the action fulfills a social contract with auditing principles, we would suggest auditors conduct the action.

Under our model, we have one specific consideration of the third question. If the action does not produce as high utility as any alternative action that the agent could perform instead, but the action still fulfills the social contract with auditing principles, the auditors might still conduct the action based on other considerations such as convenience or timeliness.

The research problem this paper discussed is whether it is ethical to use the natural language processing machine learning method in auditing. This paper answers the question by following the

decision tree model we developed based on the literature reviews and ethical theories. In summary, by using the decision tree model, this paper should be able to answer the research problem that whether using the natural language processing machine learning method is ethical, and whether using this new machine learning method will increase auditors' ability to enhance investigate and analyze a large amount of business data.

4. Results

Following the theoretical model developed in Figure 1, we should be able to answer the research problem that whether it is ethical to use the natural language processing machine learning method in auditing. To test the results of the research problem, this paper answers the question by following the decision tree model we developed.

The first question is whether the action generates deontic status. Auditors analyze a large amount of digital data, and using the natural language processing machine learning method would provide more accurate and efficient work. Using the natural language processing machine learning method in auditing will generate deontic status. The second question is whether summing the positive welfare-related consequences greater than summing the negative consequences. Using the natural language processing machine learning method in processing a large number of emails, transaction data tables, or bank statements would be more efficient and less labor cost. The training cost of learning this new machine learning technique is similar to other software techniques at the application level. Therefore, summing the usefulness and timeliness of using the natural language processing machine learning method in auditing is greater than summing the negative consequences. The third question is whether the action produces as high a utility as an alternative action that the agent could perform instead. Using the machine learning method rather than human work is proved to be more efficient and effective. The techniques are cutting the edge nowadays. Using the natural language processing machine learning method in auditing produces as high a utility as an alternative action that the agent could perform instead until another new technology is developed in the future.

The fourth question is whether the action will fulfill the social contract with auditing principles. The auditing principles that these paper values are Confidentiality, Integrity, Objectivity, and Independence[8]. NLP technique is just a tool for analyzing business transactions and information. The NLP technique will not impair auditors maintain integrity when conducting audit practice. Auditors using the NLP method to analyze clients' data still could be confidential company information and data. Using the NLP method in auditing does not impair the applicable laws and regulations or incur conflict of interests. Using the NLP method in auditing will not affect auditors' express audit opinions. Using the NLP method to analyze business data and information is more convenient and transparent. The NLP method does not impair auditors' independence when conducting audit practice and addresses audit opinions.

Figure 2 is the decision tree model results of the research problem based on the literature reviews and ethical theories.

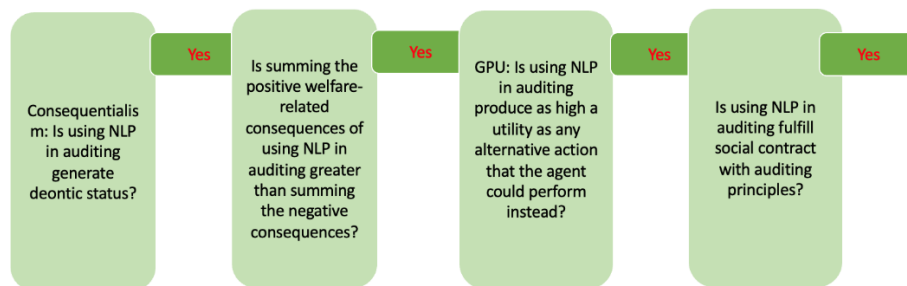


Figure 2: Ustration of Ethical Decision Tree Model Results

5. Conclusions

The research problem this paper discussed is whether it is ethical to use the natural language processing machine learning method in auditing. This paper answers the question by following the decision tree model we developed based on the literature reviews and ethical theories. The results showed

that using NLP in auditing is beneficial and would not impair auditors to fulfill a social contract with auditing principles. This paper concluded that it is not unethical to use the natural language processing machine learning method in auditing. Using the natural language processing machine learning method is beneficial for auditors to analyze a large amount of data and information, such as emails, business transactions, and bank statements. The results of this paper implied that using the natural language processing machine learning method is beneficial to auditors and will not impair auditors to maintain Confidentiality, Integrity, Objectivity, and Independence when conducting auditing practice.

Using natural language processing machine learning method in auditing is still a new method, therefore there is still more research work needed in this new area in auditing. For future work, the research would focus on the ethical dilemma of using the natural language processing method and how this machine learning method affects other accounting principles and regulations. The other research area of using natural language processing in the audit could be focused on the issue of impairing the privacy of behavior and action^[18]. In conclusion, using the natural language processing machine learning method is not unethical, and using this new machine learning method will enhance auditors' ability to enhance investigate and analyze a large amount of business data.

References

- [1] Li, Q., & Liu, J. (2019). Development of an intelligent NLP-based audit plan knowledge discovery system. *Journal of Emerging Technologies in Accounting*, <https://doi.org/10.2308/jeta-19-03-31-16>
- [2] Fisher, I. E., Garnsey, M. R., & Hughes, M. E. (2016). *Natural language processing in accounting, auditing and finance: A synthesis of the literature with a roadmap for future research*. *Intelligent Systems in Accounting, Finance*.
- [3] Iswandi, I., Suwardi, I. S., & Maulidevi, N. U. (2017). Designing rules for accounting transaction identification based on Indonesian NLP. *LOP Conference Series. Materials Science and Engineering*, 180(1), 12147.
- [4] Hirschauer, N., Jantsch, A., & Musshoff, O. (2018). Developing business ethics theory and integrating economic analysis into business ethics teaching - a conceptualization based on externalities and diminishing marginal utility. *Review of Social Economy*, 76(1), 43-72.
- [5] Schwartz, M. (2007). The "business ethics" of management theory. *Journal of Management History*, 13(1), 43-54.
- [6] Tseng, H., Duan, C., Tung, H., & Kung, H. (2010). Modern business ethics research: Concepts, theories, and relationships. *Journal of Business Ethics*, 91(4), 587-597.
- [7] Welch, E. J. (1997). Business ethics in theory and practice: Diagnostic notes A. "A prescription for value". *Journal of Business Ethics*, 16(3), 309-313.
- [8] Bleichrodt, H., Eichberger, J., Grant, S., Kelsey, D., & Li, C. (2021). Testing dynamic consistency and consequentialism under ambiguity. *European Economic Review*, 134, 103687.
- [9] Eggleston, B. (2020). Consequentialism and respect: Two strategies for justifying act utilitarianism. *Utilitas*, 32(1), 1-18.
- [10] Renouard, C. (2011; 2010;). Corporate social responsibility, utilitarianism, and the capabilities approach. *Journal of Business Ethics*, 98(1), 85-97.
- [11] Marques, J. (2015). Universalism and utilitarianism: An evaluation of two popular moral theories in business decision making. *The Journal of Values Based Leadership*, 8(2), 13.
- [12] Kazmi, S. H. A., Zeng, H., & Malik Abid, M. (2016). Effects of hedonism and utilitarianism in advertising in E-business equity. Paper presented at the, 2 582-585.
- [13] Ast, F. (2017;2019;). The deliberative test, a new procedural method for ethical decision making in integrative social contracts theory. *Journal of Business Ethics*, 155(1), 207-221. <https://doi.org/10.1007/s10551-017-3481-y>
- [14] Li, Q., & Liu, J. (2019). Development of an intelligent NLP-based audit plan knowledge discovery system. *Journal of Emerging Technologies in Accounting*, <https://doi.org/10.2308/jeta-19-03-31-16>
- [15] Atwood, J. F. (2018). AICPA auditing standards board releases interpretation on dual reporting. *PCAOB Reporter*, 16(5), 6-7.
- [16] Duska, B. S., Duska, R. F., & Kury, K. W. (2018). *Accounting Ethics*, 3rd edition. Wiley-Blackwell.
- [17] El Hajjar, S., Menassa, E., & Kassamany, T. (2021). An exploratory study of US acquirers' market performance: Pre- versus post-Sarbanes-Oxley act of 2002. *Journal of Financial Reporting & Accounting*, <https://doi.org/10.1108/JFRA-08-2020-0246>
- [18] Casillo, F., Deufemia, V., & Gravino, C. (2022). Detecting privacy requirements from user stories with NLP transfer learning models. *Information and Software Technology*, 146 <https://doi.org/10.1016/j.infsof.2022.106853>