Development of Artificial Intelligence and Effects on Financial System

Minzhen Xie
The only author Room 701, No52 Hebinbei Road, Conghua District, Guangzhou, Guangdong, China (61)0402557505
Mxie0002@student.monash.edu

ABSTRACT In recent years, due to the rapid development of artificial intelligence (AI) and machine learning, its application has been widely used in many aspects of financial area, as well as significantly impacts financial market, institutions and regulation. The artificial intelligence technology brings enormous change to the entire financial industry, which creates a series of innovative financial services such as intelligent consultant, intelligent lending, monitoring and warning, and intelligent customer service as times required. In this paper, it aims to summarize the development and application of artificial intelligence and machine learning in financial system, as well as its impacts on macroeconomics and microeconomics. In the meantime, it is realised that a series of problems and risks were conducted by artificial intelligence during its use. Lastly, some suggestions and strategies are provided for reasonable usage of artificial intelligence in financial risk management, based on the financial risk management raised by artificial intelligence.

1. INTRODUCTION
As the booming development of Internet and information technology, as well as in the context of Internet-Finance, method of financial data wrangling is not only limited to traditional statistical approach, but also adopt and combine with various information processing technology such as machine learning, which has obtained significant achievements. For example, Support vector regression algorithm and time series model in machine learning are used in the performance measure problem in establishing prediction model, which could improve the accuracy of prediction and financial data analysis. [1]

In the stock investment of financial market, public always wish to grasp the rule behind the transaction, which could be used for analysis and prediction [2]. Investment experts from all around world are also trying to apply different methods of investment analysis and data mining in the amount of stock data, in order to find out potential operating rules and stock trading rule behind the stock market, and to predict the stock market trend, aiming to maximize the profit. Since the stock market is affected by various market and non-market factors, which interact with each other, it is difficult to establish an accurate model to describe the mechanism of internal interaction [3]. Therefore, machine learning, as a “black box” model prediction, is increasingly being used in stock market prediction.

With the increasing of computer computing power, more sophisticated artificial intelligence algorithm can satisfy the need of new power in financial field. More specifically, artificial intelligence is widely used in investment management, algorithm trading, fraud detection, loan and insurance underwriting. Besides, artificial intelligence has profound impacts on financial regulation institution, and will help regulators to determine illegal compliance, evolve from past experience based on supervise
transaction with algorithm and analysis of massive amount of data, while new required skills and knowledge for regulators will be presented.

Therefore, this paper aims to summarize the development of artificial intelligence and machine learning in financial field, and the impacts on macroeconomics and microeconomics, as well as providing suggestions for enhancement of financial regulation by using artificial intelligence and machine learning.

2. DEVELOPMENT AND APPLICATION OF AI AND MACHINE LEARNING IN FINANCIAL FIELD

2.1 The Development of Artificial Intelligence in Financial Field
With the rapid development of artificial intelligence technology, AI is widely popularized in financial field. Factors that accelerate the Fintech development, promote the development of artificial intelligence and machine learning in financial field, and drive financial institution to reduce cost, management risk, improve quality of service and increase profit by using AI and machine learning. In early 1960s, one of the algorithms in machine learning-Bayesian Statistics become famous, it has been widely used in financial area until now [4]. Moreover, the reason that Bayesian Theory become popular in financial area, is its application in auditing area. In the auditing field, judgement made by auditor, used to rely on professional knowledge and experience, but different cases have different situations. Various uncertain factors need to be considered in the decision-making of auditing. Therefore, Bayesian model provides objective and rational probability to auditor and help them to make more accurate assessment, as well as reducing the misjudgement caused by auditor’s personal emotion [5]. In the initial stage of cooperation between artificial intelligence and financial industry, it focuses on reducing the workload of financial practitioners by computing power of computers. Until 1980s, Expert System (intelligence system based on knowledge) is used in the financial industry to predict the trend of market and provide customize financial plan. A basic Expert System includes six components, which are knowledge base, data base, inference engine, explanation facility, knowledge acquisition and user interface, as figure 1 shown. Hodgkinson and Walker [7] raised a rule-based Expert System to achieve decision-making process, which helps financial intuitions to make decision on credit application of cooperate credit loan. Shue et al. [8] establish Expert System contains domain knowledge base and operational knowledge base, to credit ranking of listed companies in Taiwan stock market. Janulevicius and Goranin [9] built up a risk management Expert System to help middle and small-sized enterprise to solve the problem of lack of access to professional data security analysis due to limited fund.

![Fig. 1 Basic structure of Expert System](image)

In 1990s, due to improved computing power of computer, a series of artificial technologies are used in financial fraud detection. Artificial intelligence trying to analyze massive amount of data and find out the outlier to determine financial fraud. [10] As the increasing computing power of computer and
continuous improvement of artificial intelligence algorithm, the integration of artificial intelligence and financial industry will be higher and higher, and it will also be applied to more aspects in financial field.

2.2 Application of Artificial Intelligence in Financial Field

The application of artificial intelligence and machine learning in financial field can be divided into four aspects. Firstly, it is customer-oriented (front-end) applications, including credit scoring, insurance and customer-oriented service robot; secondly, management level (back-end) applications, including capital optimization, risk management and market impact analysis; thirdly, financial market transactions and portfolio management; lastly, AI and machine learning are used in financial institutions for “RegTech” or financial regulators for “SupTech”.

In addition, AI and machine learning are widely used in specific scenarios such as quantitative transactions in the financial field, natural language processing, semantic search and intelligence investment consultants.

3. DATA MINING

The application of data mining is widely used and cover wide range of aspects, especially being used popularized in financial and manufacturing industry. [11] With the advent of the era of big data, data mining is attracting more attention than ever, specific in precision marketing and market analysis. With the benefit of development of data mining technology and computer technology, establishment of data warehouse develop rapidly [12]. Especially in the securities investment of financial markets, investment experts from various countries use different stock analysis methods for data mining from massive stock data, in order to find out the potential operating rules and stock trading rules behind the stock market, and realize forecasting changes in the stock market in the future to achieve the goal of maximizing returns [13-14]. Regular data mining methods include association rule learning, cluster analysis, classification analysis, sequence analysis, deviation detection, prediction analysis, pattern similarity mining and regression analysis. [15-18]

Data mining being used popularity in financial application. Marketing is one of the earliest application of data mining, especially achieving well performance in e-commerce. Data engineer in-deep mining and analyze on customer’s browsing data, search data, order records and other behaviour to identify the customer’s purchasing behaviour pattern, which achieve significant performance on advertisement and product recommendation. On the aspect of risk analysis and fraud detection, analyzing banks or insurance customer’s creditworthiness, asset and loan configuration, to detect fraud behaviour, such as bad debt and fraud insurance. In the manufacture industry, according to the comprehensive analysis of data, to identify the outlier and mining the data to analyze the cause of product failure or expose the unqualified product, which helps the quality inspection engineer to find out the flaws and make corrective measurement. In addition, the financial data generated by most banks and financial institutions is relatively structured and highly reliable, which is advantageous for data visualization and data mining, as well as being applied to approaches like pattern analysis to detect money laundering and other financial crimes.

4. IMPACTS OF ARTIFICIAL INTELLIGENCE ON MICROECONOMIC

The rapid development of artificial intelligence has brought new impacts and vitality to various industries. In addition to the practice field of traditional artificial intelligence- the Internet industry, it also brought new impact and vitality to traditional industries, such as manufacturing and service industries.

1) Artificial intelligence can automate “programmable work”. Once the cost of this automation is much lower than the labor cost, industry will not hesitate to use artificial intelligence to replace this part of the labour force. It will result in a large number of “programmable” practitioners unemployed. Moreover, most of the unemployed “programmable” practitioners are low-level skill and educated practitioner, which is difficult to re-educated to satisfy the new position. On the other hand, artificial intelligence brings new vitality to employment, even though AI will replace most of the ‘programmable
work” practitioners. The demand to “non-programmable work” practitioners will increase. Practitioners with high-level education and skill practitioners will increase in the long term and in large numbers as well.

2) Since the artificial intelligence changes the structure of labor market, it promotes the redistribution of internal income distribution among labor. There will be more significant differences in the income of labor with different skill levels. The change of income distribution also reflects on the component (industry). The industry with less “programmable” work is less affected by artificial intelligence, and the change in income distribution is also less than other industries.

3) Upgrading and transforming with the industry structure of market: every technological innovation brings a new industry replacement and upgrade. From the financial, manufacture in the past to Internet and technology company nowadays. The arrival of artificial intelligence will strengthen the dominant position of technology and Internet companies; therefore, traditional industries must transform and integrate new technology to avoid being eliminated by the wave of development. [19]

4) The impact of artificial intelligence on the innovation ability of enterprises: As the labor force develops toward high technology and high knowledge, enterprises need strong innovation ability and speed to maintain core competitiveness. Enterprise managers must be keenly aware of the cutting-edge technology and be bold to use new technology to innovate products. [19]

5) The impact of artificial intelligence on human resources: As enterprises need innovation to maintain core competitiveness, high-end talent resources will be particularly popular, artificial intelligence expert will become an important asset of enterprises. Companies will also attract talent through more favorable conditions. [19]

5. THE IMPACTS OF ARTIFICIAL INTELLIGENCE ON MACROECONOMIC

1) The impact of artificial intelligence on economic growth: Artificial intelligence is mainly embodying in the automated processing of “programmable” work, thereby by reducing labor costs and improving production efficiency in the production process, it brings the profits. However, it will lead to cost increase in non-automated sector, which will reduce the share of capital return in the economy.

2) The impact of artificial intelligence on industrial organization: The first channel is the direct impact of technology, and second channel is the change of enterprise structure caused by technology. With the development of artificial intelligence, the trend of mergers and acquisitions of downstream enterprises by the large platform enterprises will become more obvious. Large-scale platform enterprises are not competing for direct market profits and shares, but the data resources of entire industry chain, so as to better develop artificial intelligence.

3) The impact of artificial intelligence on trade: Since artificial intelligence has significant impact on factor returns, and changes the relative returns between different elements, so that the dynamic advantages of countries change. High-tech, high-knowledge talents are vital factors in the development of artificial intelligence, therefore, talents will become important targets of trade.

4) The impact of artificial intelligence on GDP: Artificial intelligence can play an important role in e-commerce recommendation system, which could change people’s consumption habit and promoting consumption. It can satisfy the requirement of stimulating domestic demand and become a new carriage that drives consumption.

5) The impact of artificial intelligence on public policy: Based on the negative impact of artificial intelligence on the labor market, the government should formulate targeted public policies to ensure that overall social welfare is not impaired and alleviate the pressure caused by income inequality, which could better enjoy the productivity growth brought by artificial intelligence and the economic growth by social stability. For example, after the first industrial revolution, many low-skilled laborers in the UK were unemployed, resulting in uneven income distribution. The British government solved the problem of income inequality by providing free public education for the unemployed and improving the legal
status of the trade union. Future public policies for artificial intelligence can also be: re-education of unemployed people, taxation of robots and raising minimum guaranteed income standards. [20]

6) The impact of artificial intelligence on macroeconomic research methods: Traditional economic research methods focus on the small samples and low-dimensional data, which make the traditional economic model have certain limitations. After applying AI in it, when researching new economic models, it is possible to use large-sample, high-dimensional data to verify. Artificial intelligence will greatly promote the development of economics.

6. CONCLUSION

As a new field full of opportunities and challenges, artificial intelligence is an inevitable outcome of the development of science and technology, but at the same time, there are corresponding challenges in applying artificial intelligence. Therefore, the financial system should completely understand artificial intelligence and make its application system in the financial field more consummate. In order to design a complete artificial intelligence, it is necessary to set guiding principles firstly, which aims to guide the whole process of artificial intelligence development, design, use, management and control, and carefully promote artificial intelligence applications in the field of financial risk management. In the field of financial risk management, the used of artificial intelligence for information collection must follow certain criteria to ensure the legitimacy of information collection and the interests of those who do not harm the information source. The types and strength of artificial intelligence information collection and behavior of information collection are standardized. What’s more, we should focus on R&D and application of user information encryption technology and strengthen the application of artificial intelligence in the field of financial risk management.

REFERENCES

[1] F Li, ZH Han, EY Feng. Financial data analysis based on machine learning [J]. Sciences & Wealth, 2016, 6: 624.
[2] WQ Huang, XT Zhuang, S Yao. A network analysis of the Chinese stock market [J]. Physica A Statistical Mechanics & Its Applications. 2009, 388 (14): 2956-2964.
[3] T Preis, DY Kenett, HE Stanley, D Helbing, E Benjacob. Quantifying the behavior of stock correlations under market stress [J]. Scientific Reports, 2012, 2 (7420): 752.
[4] RT Bayes. An essay towards solving a problem in the doctrine of chances [J]. Resonance, 2003, 8: 80-88.
[5] JE Sorensen. Bayesian analysis in auditing [J]. Accounting Review, 1969, 44(3): 555-561.
[6] KC Chen, T Liang. PROTRADER: An expert system for program trading [J]. Managerial Finance, 1989, 15(5): 1-6.
[7] L Hodgkinson, E Walker. An expert system for credit evaluation and explanation [J]. Consortium for Computing Sciences in Colleges, 2003, 19(1): 62-72.
[8] LY Shue, CW Chen, W Shue. The development of an ontology-based expert system for corporate financial rating [J]. Expert Systems With Applications, 2009, 36(2): 2130-2142.
[9] Justinas Janulevičius, N Goranin. Expert system for data security risk management for SMEs [J]. Science – Future of Lithuania, 2013, 5 (2).
[10] J West, M Bhattacharyya. Intelligent financial fraud detection: A comprehensive review [J]. Computers & Security, 2016, 57(C): 47-66.
[11] QH Sun, FX Shen. The application of data mining in the era of big data [J]. Electronic Technology and Software Engineering, 2016 (6): 204.
[12] J Han, M Kamber. Data Mining Concepts and Techniques [M]. Mechanical Industry Press, Beijing, 2001.
[13] R Tsaih, Y Hsu, CC Lai. Forecasting S&P 500 stock index futures with a hybrid AI system [J]. Decision Support Systems, 1998, 23(2): 161-174.
[14] NK Liu, KK Lee. An intelligent business advisor system for stock investment [J]. Expert Systems, 2010, 14(3): 129-139.

[15] David Hand, Heikki Mannila, Padhraic Smyth. Data Mining Concepts and Techniques [M]. Mechanical Industry Press, 2003.

[16] Rakesh Agrawal, Tomasz Imielinski, Arun Swami. Mining association rules between sets of items in large databases [A]. Proc. ACM SIGMOD Conference, Washington, 1993, [C]: 207-216.

[17] E Cohen, M Datar, S Fujiwara, A Gionis, P Indyk, R Motwani, JD Ullman, C Yang. Finding interesting associations without support pruning [J]. Knowledge & Data Engineering IEEE Transactions, 2001, 13(1): 64-78.

[18] MJ Zaki. Scalable algorithms for association mining [J]. IEEE Educational Activities Department, 2000, 12(3): 372-390.

[19] S Makridakis. The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. Futures, 2017.

[20] J Cao, YL Zhou. Research progress on the influence of artificial intelligence on economy [J]. Economics Information, 2018, 1: 103-115.