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Utilization of artificial intelligence in finance

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Executive Summary



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Artificial intelligence is now entering a new boom phase, the third in its history, in the wake of a technological innovation known as deep learning. Artificial intelligence is being utilized in various forms even in the financial sector. Financial institutions should utilize artificial intelligence more actively through such means as open innovation.

Advent of deep learning and third artificial intelligence boom

Artificial intelligence research has experienced two previous booms. The first was in the 1950s, when research on using artificial intelligence for deduction and look-up tasks began. Back then, however, computers lacked sufficient processing power to solve real-world problems. Artificial intelligence's applicability was consequently limited to certain fields, such as games.

Artificial intelligence research boomed again in the 1980s with the emergence of neural networks structurally modeled after the human brain. This second boom most notably bore fruit in the form of expert systems, which enable interactive information processing through archiving and analysis of voluminous information. Research on another form of artificial intelligence called machine learning subsequently flourished once large amounts of training data became accessible via the Internet. For applications such as image recognition, however, machine learning proved much less accurate than the human brain. Progress in artificial intelligence research had consequently stalled in recent years.

Now, a technological breakthrough called deep learning is ushering in a third artificial intelligence boom¹⁾.

The biggest difference between deep learning and previous forms of artificial intelligence is an absence of human intervention. Prior to deep learning, artificial research required human intervention to prepare training data, formulate analytical logic and evaluate the analytical results for accuracy. Artificial intelligence analyzes training data and quantifies correlations among extracted data. Such correlations are called feature values. In the case of facial recognition, feature values are structural data on human faces. In the case of language analysis, feature values include

NOTE

1) Deep learning first gained notoriety when a team from University of Toronto unveiled SuperVision at ILSVRC (ImageNet Large Scale Visual Recognition Challenge) 2012, an artificial intelligence image recognition competition. SuperVision utilized deep learning to reduce the recognition error rate to below 16% from around 26% previously.

the frequency with which a given word is followed by another given word in text. Historically, humans were needed to provide feedback to artificial intelligence systems on feature values' significance and evaluate the accuracy of output based on such feature values. With deep learning, by contrast, artificial intelligence itself is able to extract feature values from data and conduct iterative analyses based on those values (such analyses' multiple iterations (layers) are the reason that deep learning is called "deep").

Previously, interpreting data's feature values and tuning of analyses were tasks performed by skilled researchers. Deep learning, however, is a breakthrough in that it has enabled high-order analyses that do not require such human involvement.

Utilization of artificial intelligence in finance

In the financial domain, artificial intelligence is currently being utilized mainly in the following five forms.

(1) Text mining, voice recognition and semantic analysis thereof

First, artificial intelligence is being used to analyze text and human conversations and generate output based on its analysis. A good example is IBM's Watson, which Japanese financial institutions have adopted in their call centers. Additionally, financial institutions are utilizing artificial intelligence to automatically analyze textual information such as corporate disclosures, news and social media content (e.g., Tweets) and generate reports thereon²⁾.

(2) Anomaly detection through pattern recognition

Second, artificial intelligence is being utilized to identify patterns in voluminous historical data and detect behavior that deviates from identified patterns. Examples of such aberrant behavior may include money laundering, illicit transactions and security threats. Upon detecting any such behavior, the artificial intelligence system issues an alert.

(3) Market analysis through data mining

Third, artificial intelligence is being used to analyze actual market data and model market activity or price formation. Research is being conducted on simulation of market participants' behavior in various markets and prediction of regulatory or institutional changes' impact. Available artificial intelligence services in Japan include one that estimates real estate sales prices³⁾.

(4) Formulation of investment strategies

As an extension of market analysis, artificial intelligence is being utilized in the aim of

2) Well-known providers of such content auto-generated through deep learning include Automated Insights (<http://automatedinsights.com/>) and Captricity (<https://captricity.com/>), both of the US.

3) In Japan, Itandi has launched a real estate sales-price information service using artificial intelligence (<http://itandi.co.jp/387/>).

4) In Japan, Money Design offers a service that provides portfolio allocations compatible with customers' risk tolerance and life stage and automatically rebalances the allocations in response to the portfolio's monthly performance.

5) In the US, IPsoft has developed automated business process tools utilizing virtual agents that process natural language.

formulating optimal investment strategies. Most notably, Renaissance Technologies of the US utilizes artificial intelligence to make live trading decision. Additionally, many companies now offer robo-advisory services that use artificial intelligence to recommend portfolios tailored to investors' investment styles⁴⁾.

(5) Utilization for IT system development

Financial institutions have devoted countless man-hours to developing IT systems to properly process diverse financial products and comply with complex, wide-ranging financial regulations and practices. They are applying artificial intelligence to such system development to learn how to reduce errors and adapt more efficiently to regulatory and infrastructural changes⁵⁾.

How should financial institutions utilize artificial intelligence?

Deep learning's competitiveness hinges on the quality of available training data and data processing speed. Financial institutions have been amassing large data archives and utilizing various algorithms since before deep learning's advent. Going forward, financial institutions will likely apply deep learning more broadly, capitalizing on their data archives.

Utilization of deep learning requires a larger investment in computing power than most companies can afford on their own. Major cloud vendors such as Google, Microsoft, IBM and Amazon offer artificial intelligence platforms. Utilizing such platforms to reap the benefits of deep learning while limiting IT investment will likely become the mainstream approach.

Additionally, there are limits to individual institutions and companies' ability to research and utilize artificial intelligence on their own. Institutions and companies will likely have to jointly utilize artificial intelligence through multi-party collaborations. With interest in open innovation growing in recent years even in the financial sector, artificial intelligence research and utilization could become a major sphere of open innovation.

University of Tokyo Associate Professor Yutaka Matsuo, a prolific source of information on artificial intelligence research, advocates tapping into Japan's large pool of artificial intelligence researchers⁶⁾. Japan possesses a wealth of artificial intelligence research dating back to the fifth-generation computer project of the 1980s. How to effectively utilize these human resources will be a key issue going forward.

6) Prof. Matsuo noted in a recent book that the Japanese Society for Artificial Intelligence (JSAI) has 3,000 members whereas the international but US-centric Association for the Advancement of Artificial Intelligence (AAAI) has 5,000 members.

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