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The risks of artificial intelligence for the finance

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Abstract

What happens on social networks can help us identify the risks of applying artificial intelligence to financial markets. What does this have to do with narratives and trust?

Zusammenfassung

Was auf Sozialen Netzwerken geschieht, kann uns helfen zu verstehen, wo Risiken in der Anwendung von künstlicher Intelligenz an Finanzmärkten liegen. Was hat dies mit Narrativen und Vertrauen zu tun?

Artificial intelligence (AI) describes a system that replicates human abilities such as creativity and self-improvement so that it can function autonomously in complex, changing environments. We have researched the development possibilities[1] and current state of AI applications in financial markets[2] in our past research. As with all other developments, the application of AI systems also poses risks to investors and financial markets.

The problem with causalities and explainability

The advantage of many AI systems is that the systems can independently search for structures and patterns in data sets and the user no longer has to explicitly specify the causal relationships. The relationships found by a system do not necessarily have to correspond to causality that is comprehensible to humans, but can still lead to the same result. For example, an AI system can be set up to recognize a dog or a child without the system knowing what constitutes a dog or a child for a human. The fact that an AI system can find a solution to a problem does not automatically mean that the system contains the mechanisms needed in practice to find the solution to the problem.[3]

However, this should not be seen exclusively as a disadvantage or a risk. In the case of groundbreaking scientific discoveries, a pattern is often first identified and only then are the reasons sought. The most prominent example is the story of Isaac Newton and the apple. First came the observation that an apple always falls vertically, and then the understanding of gravity was developed.

Now let's imagine an AI system that is supposed to recognize patterns in financial market data that indicate a price increase in the stock market. Depending on the complexity of the data patterns, this does not necessarily mean that the user can understand the circumstances that lead to rising markets. This can occur, for example, if the number of explanatory factors is too high and they must be laboriously linked together. While it may be known how the AI system is set up, it may not be comprehensible to the user why a certain result is generated. In such cases, a system is said to lack explainability. [4] The user must then come up with an economic model, independent of the AI system, as to why a price increase in the stock market should be

[1] Ebert (2023): Artificial intelligence - the great revolution in the financial sector as well?"
[2] Ebert und Immenkötter (2023): "Machine learning in financial markets: Come to stay"
[3] Russel and Norvig (2010): "Artificial Intelligence: A Modern Approach", 3rd ed., Prentice Hall, p.21.
[4] Cp. Roscher, et. al (2020): "Explainable Machine Learning for Scientific Insights and Discoveries", Cornell University.

expected given the data. Because of the lack of explainability, he cannot refer to the results of the system.

Further complicating matters, the data used for training or as an application may not contain the information necessary to make informed decisions for future price developments. In such cases, patterns are identified in data sets that correspond to a false positive. Due to the lack of explanation and given complexity, verification may be difficult or impossible.

Social media as a forewarning

In networks such as Facebook/Instagram, LinkedIn or Twitter, AI systems learn which topics and opinions may be relevant to users based on what the system has learned about them. The system then identifies new posts to which it assigns a high probability that users will be interested. By interpreting the algorithms, users can find themselves in a kind of virtual echo chamber where they regularly hear their own opinions.[5] The narrative that users believe becomes more and more entrenched as the choice of information presented is limited or distorted. A so-called confirmation bias occurs[6].

Since there is a not inconsiderable amount of false or at least misleading information in the social media, this also consolidates spurious connections that cannot stand up to factual scrutiny. This process was particularly frequent during the Covid 19 pandemic, when there was little reliable information and virtual echo chambers thus formed, which led to polarization in public opinion and could not be resolved even after the relevant information appeared.[7]

Reinforcing narratives in financial markets

For adherents of classical portfolio theory (Markowitz's mean-variance optimization) and the CAPM (Capital Asset Pricing Model), AI systems offer new ways to create investment strategies. Since it is extremely challenging to determine the relevant dependencies between individual securities in a data set full of noise, classical statistics quickly leads one into a dead end or delivers fragile results. Here, AI systems offer the possibility to identify robust dependencies (e.g. correlations) in broad data sets that would otherwise be lost

[5] Cp. Bessi (2016): "Personality traits and echo chambers on facebook" in *Computers in Human Behavior,* 65 or Boutyline & Willer (2016): "The Social Structure of Political Echo Chambers: Variation in Ideological Homophily in Online Networks" in Political Psychology 38/2.

[6] For explanation see for example Wikipedia.

[7] Modgil (2021): "A Confirmation Bias View on Social Media Induced Polarisation During Covid-19" in Information Systems Frontiers.

in the noise of the data. The identified dependencies are then used to construct portfolios according to Markowitz.[8]

The crucial problem with this approach is not the new way of implementation, but the assumption that the underlying theory is the correct way. If an AI system finds a complex relationship that is not apparent to humans, it cannot be used as evidence for the underlying assumption of the theory's validity. In practice, this may be commonplace, but it is not consistent with the scientific principle of falsification. For example, Professor Macros López de Prado, who is well known for research and application of AI systems, sees that artificial intelligence will dominate finance with scientific support, and as a result investing will no longer be a game of chance. [9] However, this insight can only be true if the scientific findings also provide the appropriate foundation for investing.

AI systems can generate information that reinforces users' economic narratives. The confirmation bias thus generated can end in systematic wrong decisions in the investment process. It is not far-fetched to think that risk positions can be taken unconsciously and unnoticed in this way.

This idea is reminiscent of the years before the financial crisis, when portfolios were often managed on the basis of the value-at-risk indicator, which created a false sense of security. In many cases, the risk metric was not able to forecast the market slumps of the financial crisis at that time.[10] The rest is sufficiently documented history.

Systemic risks arising from artificial intelligence

Systemic risks may even lurk at other corners. If decision-making and action in financial markets increasingly falls into the hands of artificial intelligence, the available information (e.g. prices) will be generated to a significant extent by the AI systems themselves through their recommendations and decisions. As AI systems are subsequently trained with the information that has already been generated with the help of AI systems, this can end in a self-reinforcing process. Greg Jensen, CO-CIO of the hedge fund house Bridgewater Associates, who himself uses AI systems in analysis, already saw this as a realistic scenario two years ago and a systemic danger for the coming years.[11]

Artificial intelligence and the trust asset of investing money

[8] Cp. López de Prado (2020): „Machine Learning for Asset Managers", Elements in Quantitative Finance, Cambridge University Press, UK.
[9] López de Prado (2018): "Advances in Financial Machine Learning", Wiley, USA, S.4.
[10] For example Nassim Taleb 1997: https://www.fooledbyrandomness.com/jorion.html
[11] Cp. Bridgewater Associates / MIT Sloan Investment Conference (February 2021)

Investment thrives on investors' trust in the institution to which they have entrusted their money.[12] It is the responsibility of the institutions to learn how to deal with AI systems, to find relevant application areas and to continuously improve the systems. In doing so, institutions must always be aware of the limitations of their AI systems. If this process is not carefully implemented and monitored, institutions risk losing the trust of their investors. Even though AI systems are already being used successfully in various financial institutions, in order to maintain investor confidence, care must be taken not to fall prey to the current gold rush mood and end up in a world of false security, as was experienced before the financial crisis.

In addition to the risks described above, however, as the investment world once again becomes more quantified, artificial intelligence can and will be as well a tool to help investors further improve investment approaches based on commercial principles.

[12] Cp. Kleinheyer and Mayer (2019): „Geldanlage ist Vertrauenssache“, Flossbach von Storch Research Institute.

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