

Decision-Making: Human and Machine

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Abstract. Background: in modern society, decision-making happens everywhere and anytime. There are many factors influencing people in making decisions, which will be analyzed with examples in the paper. Technologies also help humans in making decisions: merits and demerits of them are briefly introduced with a discussion of the example in a hedge fund in which there have already been technologies used in the industry for years. Method: qualitative research -- case study research and record keeping by searching and reading articles written by scholars or official institutions, and reviewing and analyzing them to have a conclusion on the matter relating to humans and machines' performance in decision-making. Conclusion: By comparing the merits and demerits of humans and machines in the decision-making process, it can be concluded that cooperation between humans and machines may lead to better results at a time since they have a supplementary relationship. In other words, machines might be excellent in the fields in which humans are weak, and vice versa, which makes the collaboration of them to be the best solution so far.

Keywords: human factors on decision-making; AI used in Hedge funds; qualitative research.

1. Introduction

In modern society and in business, people are constantly faced with making large and small decisions, but it is not easy to make rational decisions because there are many factors that may be easily overlooked that influence people's decisions, such as the weather. As society advances, more and more technologies are emerging to help people make decisions, such as models and artificial intelligence systems, but the principles and advantages, and disadvantages of technological decision-making are not widely known to the public. In this paper, some of the factors that influence people's decision-making in daily life will be introduced and demonstrated with some examples, and the application of models in the field of business investment, such as hedge funds, will be presented as an example to discuss the strengths and weaknesses of machines. Finally, it will be presented how humans and machines complement each other to make better decisions.

Here is a summary of the remarks that appeared for the following. Human factors that influence decision-making are introduced after a history of the efforts made by humans in the decision-making process. The reasons mentioned include environmental factors with two examples shown and anchoring effects. Then a hedge fund example is introduced, with background information on hedge funds, to analyze the strength and weaknesses of machines in the area of generating judgments. Before concluding, the performances of humans and machines in the process of making decisions are compared.

2. Human Factors on Decision-Making

2.1 Background

Humans have been seeking and inventing better tools for making decisions since the beginning of time. In the words of Buchanan and O'Connell, "From those earliest days, we have strived to invent better tools for the purpose, from the Hindu-Arabic systems for numbering and algebra, to Aristotle's systematic empiricism, to friar Occam's advances in logic, to Francis Bacon's inductive reasoning, to Descartes's application of the scientific method [1]." At the same time, the influence of personal factors in decision-making has been explored, and several behavioral-related subjects have been developed in various fields - such as behavioral economics and behavioral sciences – for scholars to explore in greater depth. However, as this exploration progresses, researchers are becoming

increasingly aware of the large biases in human decision-making – Kahneman declares the variability in human decision-making is referred to as "noise" [2] - as well as the depth of influence of various neglected factors that lead to adverse outcomes due to poor decision making. Some of the influencing factors are briefly listed in the following.

2.2 Environmental Influence

2.2.1 Example: Parole Rates

The influence of environmental factors on human decision-making is a factor that is always overlooked. In Kahneman's book *Noise: A flaw in human judgment*, released in 2022, this idea is repeatedly argued and supported by data. In the book, Kahneman cites the example of parole rates being influenced by weather: the data show that in general, the parole rates of individual judges are higher when the weather is bright than when it is cloudy [2].

2.2.2 Example: Social media and Consumer Behavior

Social media can greatly influence people's consumption decisions in today's technologically advanced century, taking social media and consumer behavior as an example. Almost 70% of the world's population uses social media - for example, Twitter, Instagram, and Facebook. In other words, one in three people uses social media [3]. Without a doubt, businesses also see an opportunity in this: they are hiring Internet celebrities or advertising to drive up their company's sales. A good illustration of this would be when people see posts, videos, or comments on the products from stunning influencers, consumers might have the illusion that if they own a product, they will be like an influencer who advertises a product, which creates demand and then irrational shopping [4].

2.3 Anchoring Effect and Wine Pricing Example

The famous anchoring effect is also one of the relevant theories that influence people's decision-making. In the book *Influence: The Psychology of Persuasion*, there is an example of an experiment on wine pricing. After asking people to quote the last two digits of their insurance policy number, they were asked to price the same bottle of wine, and the results showed that the larger the last two digits of the insurance policy number, the higher the price of the wine quoted, and vice versa. Capturing the weakness of human psychology, in sales and others in the negotiation process often also use the anchoring effect: first, quote a high price, and then quote the bottom price to achieve more deals [5].

3. Machine and Decision-Making: Hedge Funds Example

3.1 Machine Definition: Importance of Artificial Intelligence in Businesses

It is important to have a concept of the machine before further discussion. In the age of evolving technology, machines are being used in a wider range of fields and are becoming more powerful. In this article, machine refers to something other than the traditional machine used for production, and focuses more on the technological aspect. Artificial Intelligence (AI), for example, is defined as -- in an article called *What is artificial intelligence (AI)?* -- the mimicking of technology, especially computers, of human cognitive processes. In simple terms, AI works by inputting a large amount of data into a system, and the computer analyzes the data and tries to find correlations and patterns between the data to eventually analyze the future situation or for decision-making [6]. An article written by Ashely Watters, published on CompTIA, declares that 86% of CEOs claim that AI is an important technology in the office by 2021, and 91.5% of advanced businesses have invested in the AI industry. This is a testament to the important role that the AI industry plays in modern business [7].

3.2 Artificial Intelligence used in Financial Sector: Hedge Funds

3.2.1 Hedge Fund Introduction

Take the example of hedge funds in the financial sector. According to the definition given on the Investopedia website, a hedge fund is a type of investment in which a manager has a large amount of money and uses a series of strategies such as leverage to achieve high returns that outperform the market. Usually, the clients of hedge funds are relatively wealthy because the hedge fund is a type of relatively high-risk investment [8]. A report declares that there were \$ 3.87 trillion of assets around the world managed by hedge funds managers which the number is around 18,000 worldwide, and it is predicted to increase to \$4.28 trillion by 2025 [9].

3.2.2 Machine's Merits in Hedge Fund

Indeed, machines in hedge fund investments can outperform human beings to some extent. Automation or machines are used in the industry of hedge funds for decades, with advancements every year. In a research article written by Grobys et.al. in 2022, the authors categorize the Artificial Intelligence used in hedge funds into four: discretionary, systematic, combined, or artificial intelligence and machine learning (AIML) – listed from the least automated to the completely automated. The result shows that AI-based hedge funds generally produce about 0.75% return per month, which is 0.5% higher than the performance of the human-guided ones [10].

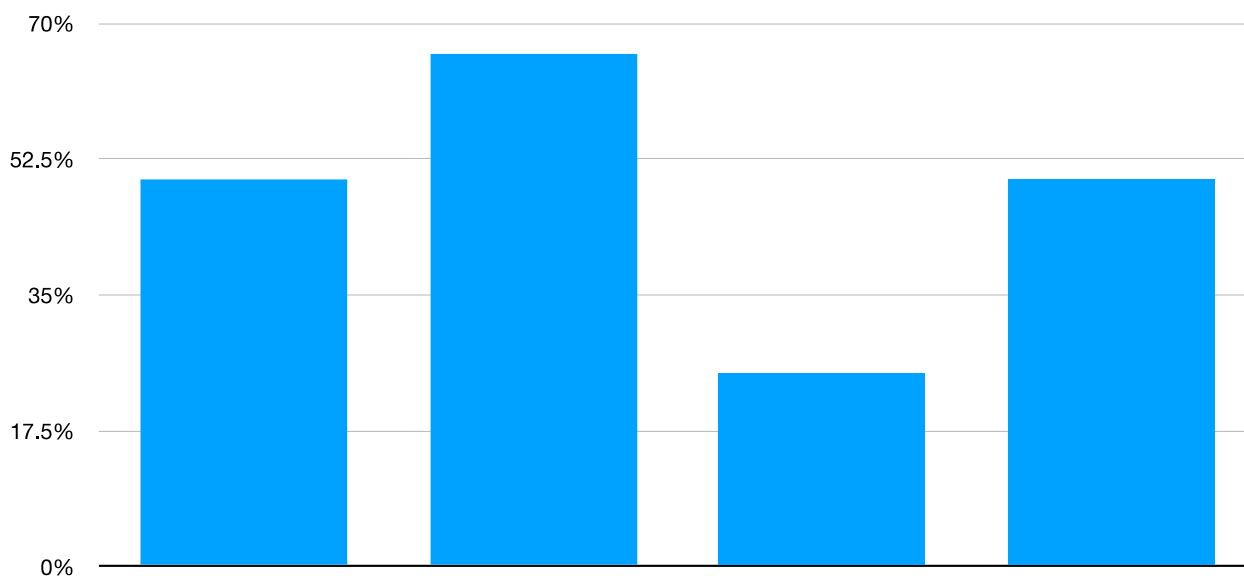


Fig. 1 Hedge Funds Institutions Using Technologies Percentage

Figure 1 shows the percentage of hedge fund institutions using technology in managing the funds for a different purpose, which the data comes from the *Hedge Fund Sentiment Survey*. From left to right, more than 50 percent of hedge fund managers acknowledged using artificial intelligence (AI) or machine learning to guide their investment decisions; the technology is used by three-quarters of them to generate ideas and improve portfolios; one-fourth uses it to automate the execution of trades, and more than half of the institutions surveyed had used technologies for more than 3 years [11].

3.2.3 Machine's Flaws in Hedge Fund

On the other hand, in another article, it is pointed out that AI or machine is flawed and may not be as good as it is universally believed to be. First of all, the reason why many academic articles state that AI has a high success rate in making decisions and predictions in the financial industry is because they have selected the best-performing models for their research. In other words, those models that did not perform well were not selected for the study or were intentionally ignored by academics. Also,

some AI algorithms do not work in real-life investing. Given multiple variables, the machine often gives the best solution among many variables, leading to misleading results. Secondly, the AI logarithm operates as a "black box", in other words, it is not clear how AI works in the financial industry and is not transparent enough to the public. What is more, in the academic articles studied by Cuzzolin and Bucynski, no models have taken into account aspects of business regulations and ethics, which could potentially sow potential pitfalls in investing or could lead to uninformed investor confidence in AI investments in the future. If investors invest using a model that does not take these factors into account, they will suffer losses [12].

4. A Discussion of Human and Machine

4.1 Supplementary Relationship

After the analysis above, it is easy to see that both humans and models are imperfect in terms of making decisions. However, it is not difficult to find that the two can complement each other in many aspects. First of all, as humans, it is inevitable that they have emotions and are potentially influenced by their surroundings all the time when making decisions, but they are not aware of it themselves. But machines are emotionless, in other words, they are relatively always rational, so they can combine the predictions or recommendations given by the model to make each decision more accurate and freer from other non-relevant noise. For example, in the medical field, studies have shown that the same doctor may make different diagnoses of the same disease at different times, which is a manifestation of noise, but this would be greatly reduced, and the rate of misdiagnosis would most likely be reduced if a machine is used for disease diagnosis [2]. Second, the machine's ability to process data is also beyond the reach of humans. For example, the ability to aggregate and analyze big data, analyzing gigabytes of data, is difficult for humans to accomplish, and systems may be able to find out flaws that are hard to be found by humans manually by analyzing data. Yet, humans can use the analyzed data to perform more creative activities, and this creativity is currently missing. Some of the other qualities that machines are missing include leadership, teamwork, social skills, etc [13].

4.2 Human & Machine Collaboration

To make manual and machine work better together, here are some suggestions for improving cooperation. First, training for both humans and machines is essential. Staff should know how to communicate with the machine using instructions it can understand and how to operate the system appropriately. For the machine, there should be professionals to teach the machine how to perform the work designed for it, and with the relevant data system. The second issue is about the black box. The aforementioned mistrust of AI investments by hedge fund clients due to the opaqueness of how AI works in hedge funds is an issue that should be addressed. Researchers should explain to the public in more detail and straightforward language the principles and logic behind the operation of the machine, as well as the reasons behind the accident, so as to gain more public trust in the machine, which will also allow the machine to help people in all aspects of society better and more widely in the future [13].

5. Conclusion

Humans are very susceptible to unnoticed factors when making decisions: for example, the many changes influenced by the external environment: changes in parole rates influenced by the weather, irrational shopping influenced by social media. and the anchoring effect of human psychology. As time progresses, more and more technologies are being used to make decisions, for example, in the hedge fund sector, data show that more than half of the fund managers use technologies in their investments, but technology is not infallible and cannot always make the right conclusions. Therefore, for now, human-machine cooperation is the optimal solution for making decisions. In the future, as

technology advances, it is possible that machines will become more and more flexible to deal with unexpected situations in the choice-making process until they eventually arrive at an independent choice.

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