

The Impact of Algorithmic Bias on Consumers

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Abstract: Algorithmic bias has aroused people's attention to the ethical problems of intelligent services, and directly affects consumers' willingness to use intelligent services. The purpose of this study is to explore the effect of algorithmic bias on consumers' willingness to use intelligent services, which has positive significance for the future design of intelligent services.

Keywords: Algorithmic bias; consumers; willingness to use.

1. Introduction

The advent of the digital era promotes the development and maturity of algorithms, big data, Internet of Things and other technologies, and companies make more use of data analysis, big data technology and artificial intelligence to assist enterprise operations and organizational decision-making (Mikalef et al., 2018) ^[1]. According to one data, 200 American institutions that participated in the survey in 2018 all adopted the same machine learning technology, among which 91% of large banks adopted deep learning algorithms to make data-driven decisions. Artificial intelligence services based on algorithms and big data are also integrating into consumers' lives. For example, Netflix uses artificial intelligence technology, not only based on the user's own and others' historical viewing records, but also combined with specific time, device, geographical location and other information to provide users with personalized movie recommendations. The latest data estimates that 35% of Amazon's purchases and 80% of Netflix's video views come from their recommendation system (West et al., 2018) ^[2]. As the application scenarios of algorithms become more and more extensive, the ethical issues brought by emerging technologies such as artificial intelligence also attract more attention and research. For example, Tay, a chatbot developed by Microsoft in 2016, spread racist information during the interaction with users (Yampolskiy et al., 2016) ^[3]. Various algorithm recommendations and models are increasingly influencing consumer behavior, and the problem of algorithmic bias and discrimination is gradually exposed. However, there is almost no research on consumers' willingness to use artificial intelligence services with algorithmic bias, so this study will explore the impact of algorithmic bias on consumers' willingness to use.

2. Literature Review

Artificial intelligence service is a personalized, dynamic and digital high-quality service solution provided by enterprises, whose core is perception and connectivity (Dreyer et al., 2019) ^[4]. Intelligent service based on algorithm can improve efficiency to achieve the purpose of reducing cost and flexibly solving practical problems (Porter et al., 2014) ^[5]. The advantages of using artificial intelligence in the marketing process include: ready to work, lower error rate, and more flexible adjustment and deployment according to demand (Davenport et al., 2020) ^[6]. In view of the above obvious advantages, artificial intelligence has also been

applied in medical, social media, retail and other fields (Yadav et al., 2020) ^[7]. In addition, artificial intelligence based on algorithm analysis has also been widely used in service marketing practices such as product recommendation and advertisement delivery (Puntoni et al., 2021) ^[8], such as sketching consumer portraits and precise advertising positioning (Kietzmann et al., 2018) ^[9]. Consumers will also reduce the search effort and time cost because of the application of algorithms to more quickly screen the choice that meets their needs.

Consumer classification has some value for consumers' self-affirmation: when consumers are classified into a certain social label, personalized classification indicating that they are a valuable group is more conducive to satisfying identity motivation (Summers et al., 2016) ^[10]. Consumer classification labels are often used in recommendation and prediction systems. Compared with traditional recommendation systems, algorithm-based intelligent recommendation can process data more quickly and has the ability of self-learning and correction. A study by Highhouse (2008) ^[11], showed that the use of algorithms to predict the performance of employees in the process of employee recruitment is more accurate than that of human experts. In addition, in terms of predicting the release and re-offending of defendants, compared with the results predicted by human judges, Ai algorithms reduce crime rates by 24.700% to 41.900%. To sum up, the performance of artificial intelligence in precision marketing, human resources, crime prediction and other aspects has surpassed the performance of human prediction based on experience or intuition (Longoni et al., 2019) ^[12]. As a computer program, algorithms are characterized by impartiality and objectivity, but in the development of artificial intelligence, there are inevitable algorithmic bias.

In summary, existing studies mainly focus on the role of artificial intelligence technology in personalized classification (Kumar et al., 2019) ^[13], bias phenomenon and mitigation and avoidance methods (Van Giffen et al., 2022) ^[14]. Consumers' willingness to use AI services with algorithmic bias is ignored. In fact, in the case that the algorithmic bias can't be completely avoided, consumers' willingness to use is the most important indicator for enterprises to judge whether the algorithm is a good use to achieve marketing purposes, and is a key variable to improve the marketing level of enterprises. However, the existing studies have not been able to empirically test the relationship between intelligent service algorithmic bias and consumers'

willingness to use it. Expectation-confirmation theory shows that users' intention to use is determined by their satisfaction, which in turn is influenced by users' confirmation of pre-use expectations (Bhattacharjee, 2001)^[15]. Therefore, it is of great theoretical and practical significance to explore the influence of consumers' pre-use expectation on their intention to use. Consumers' different expectations of service results may affect their psychological feelings about the algorithmic bias of intelligent services, and then affect people's willingness to use artificial intelligence services with algorithmic bias. Therefore, this study focuses on the influence of artificial intelligence service algorithmic bias on consumers' usage intention under the guidance of different expectations.

3. Theoretical Derivation

When carrying out recommendation prediction services, algorithm-based artificial intelligence tends to make classified recommendations according to user community or taste subdivision (Puntoni et al., 2021)^[8], in an attempt to enhance consumers' willingness to use. Consumers' expectation of artificial intelligence results is an important variable driving consumers' use behavior. In fact, different expectation of results has a great difference in influence, and users' use intention is determined by their satisfaction, while user satisfaction is affected by users' confirmation of the result expectation (Bhattacharjee, 2001)^[15]. Expectation breach theory explains how individuals react to events in an interactive environment (Burgoon et al., 2016)^[16]. In the context of this study, before using artificial intelligence services, people will have expectations on the quality of service results, and if the service results do not match the expectations, an expectation breach will occur. Research has found that negative breach behaviors may lead to consumers' negative perceptions of intelligent service providers (Waddell, 2018)^[17]. With the development of intelligent services, the problem of algorithmic bias is gradually exposed.

Because algorithms that automate or aid human decision making may produce unjust and unequal discriminatory outcomes and adversely affect certain populations or communities, this inequity is known as algorithmic bias (Kordzadeh et al., 2022)^[18]. algorithmic bias can occur at different stages of operation using an algorithm. Incomplete data, inadequate representation and inappropriate selection may lead to algorithmic bias (Favaretto et al., 2019)^[19]. For example, because women have historically had fewer opportunities to demonstrate their abilities in management positions, talent analytics systems are more likely to unfairly recommend men over equally qualified women for management positions because female-related datasets are not well represented (Gal et al., 2017)^[20]. The design of algorithms may also lead to biased output of algorithmic results (Silva et al., 2019)^[21]. For example, using sensitive features involving race, gender, or geographic location: A study showed that advertisements in the fields of technology, engineering, and science recommended by algorithms tended to be shown more to men than to women, because the algorithm design sought to optimize advertising costs (Lambrecht et al., 2019)^[22], thus showing gender discrimination.

Many people believe that algorithms are perfect (Jussupow et al., 2020)^[23]. Therefore, if they perceive that the algorithm is biased, the expectation of perfection of the algorithm is denied, and they will avoid it by not using the algorithm. In

view of the characteristics of algorithmic bias, the algorithmic bias in the service process of artificial intelligence is a negative violation behavior, so it will have a negative impact on consumers, and then affect consumers' willingness to use the artificial intelligence service, and the negative effect will be strengthened with the increase of the degree of algorithmic bias. Therefore, according to the expectation-confirmation theory, when the actual result is inconsistent with the expectation, that is, when there is deviation, consumer satisfaction will be affected, which will affect the behavioral intention of consumers (Bhattacharjee, 2001)^[15]. In summary, this study proposes the following hypothesis:

When using artificial intelligence services, when there is algorithmic bias, consumers have lower willingness to use them; When there is no algorithmic bias, consumers are more willing to use it.

4. Conclusion and Significance

Through literature review and theoretical derivation, the results of this study show that the bias of artificial intelligence service algorithm has a significant impact on consumers' intention to use, as follows: The bias of artificial intelligence service algorithm has a significant impact on consumers' intention to use. For the intelligent service with algorithmic bias, it is considered to have the negative characteristics of unfairness and injustice, resulting in consumers' lower willingness to use the intelligent service; For the intelligent service without algorithmic bias, it can well meet consumer expectations, meet consumer preferences and needs, and promote consumers' higher willingness to use. This study enriches the research on the bias of artificial intelligence service algorithm. Most existing studies focus on the role of artificial intelligence technology in personalized classification (Kumar et al., 2019)^[13], bias phenomenon and mitigation and avoidance methods (Van Giffen et al., 2022)^[14]. Combined with the expectation-confirmation theory (Bhattacharjee, 2001)^[15], this study discussed the significant effect and mechanism of artificial intelligence service algorithmic bias on consumer usage intention, which not only enriched the research on artificial intelligence service with algorithmic bias, but also expanded the application range of expectation confirmation theory.

5. Limitations

The results of this study have important marketing implications for enterprises to enhance consumers' willingness to use AI services. The results of this study show that when using artificial intelligence services, consumers are less willing to use them when there is algorithmic bias; When there is no algorithmic bias, consumers are more willing to use it. Moreover, compared with the absence of algorithmic bias, consumers perceive a stronger breach of expectation in the case of algorithmic bias, which leads to a lower willingness of consumers to use artificial intelligence services. Therefore, enterprises should try their best to improve artificial intelligence technology and avoid the occurrence of algorithmic bias. Based on the limitations of artificial intelligence, it is not almighty, and artificial intelligence algorithms are difficult to be absolutely neutral, but deviation control can be carried out from the process of data mining, collection and application. For example, ensuring data accuracy and representativeness to avoid algorithmic bias; When using artificial intelligence technology for user portrait,

discriminatory algorithmic design is excluded to eliminate algorithmic bias. In this way, the deviation degree of artificial intelligence service algorithm can be reduced, the negative effect of consumers can be alleviated, and the willingness of consumers to use can be improved.

References

- [1] Mikalef P, Pappas I O, Krogstie J, et al. Big data analytics capabilities: a systematic literature review and research agenda[J]. *Information systems and e-business management*, 2018, 16: 547-578.
- [2] West A, Clifford J, Atkinson D. "Alexa, build me a brand": an investigation into the impact of artificial intelligence on branding[J]. *The Business & Management Review*, 2018, 9(3): 321-330.
- [3] Yampolskiy R V, Spellchecker M S. Artificial intelligence safety and cybersecurity: A timeline of AI failures[J]. *arXiv preprint arXiv:1610.07997*, 2016.
- [4] Dreyer S, Olivotti D, Lebek B, et al. Focusing the customer through smart services: a literature review[J]. *Electronic Markets*, 2019, 29: 55-78.
- [5] Porter M E, Heppelmann J E. How smart, connected products are transforming companies[J]. *Harvard business review*, 2015, 93(10): 96-114.
- [6] Davenport T, Guha A, Grewal D, et al. How artificial intelligence will change the future of marketing[J]. *Journal of the Academy of Marketing Science*, 2020, 48: 24-42.
- [7] Yadav M S, Pavlou P A. Technology-enabled interactions in digital environments: A conceptual foundation for current and future research[J]. *Journal of the Academy of Marketing Science*, 2020, 48: 132-136.
- [8] Puntoni S, Reczek R W, Giesler M, et al. Consumers and artificial intelligence: An experiential perspective[J]. *Journal of Marketing*, 2021, 85(1): 131-151.
- [9] Kietzmann J, Paschen J, Treen E. Artificial intelligence in advertising: How marketers can leverage artificial intelligence along the consumer journey[J]. *Journal of Advertising Research*, 2018, 58(3): 263-267.
- [10] Summers C A, Smith R W, Reczek R W. An audience of one: Behaviorally targeted ads as implied social labels[J]. *Journal of Consumer Research*, 2016, 43(1): 156-178.
- [11] Highhouse S. Stubborn reliance on intuition and subjectivity in employee selection [J]. *Industrial and Organizational Psychology*, 2008, 1(3): 333-342.
- [12] Longoni C, Bonezzi A, Morewedge C K. Resistance to medical artificial intelligence[J]. *Journal of Consumer Research*, 2019, 46(4): 629-650.
- [13] Kumar V, Rajan B, Venkatesan R, et al. Understanding the role of artificial intelligence in personalized engagement marketing [J]. *California Management Review*, 2019, 61(4): 135-155.
- [14] Van Giffen B, Herhausen D, Fahse T. Overcoming the pitfalls and perils of algorithms: A classification of machine learning biases and mitigation methods[J]. *Journal of Business Research*, 2022, 144: 93-106.
- [15] Bhattacharjee A. Understanding information systems continuance: An expectation-confirmation model [J]. *MIS quarterly*, 2001: 351-370.
- [16] Burgoon J K, Bonito J A, Lowry P B, et al. Application of expectancy violations theory to communication with and judgments about embodied agents during a decision-making task[J]. *International Journal of Human-Computer Studies*, 2016, 91: 24-36.
- [17] Waddell T F. A robot wrote this? How perceived machine authorship affects news credibility[J]. *Digital journalism*, 2018, 6(2): 236-255.
- [18] Kordzadeh N, Ghasemaghahi M. Algorithmic bias: review, synthesis, and future research directions[J]. *European Journal of Information Systems*, 2022, 31(3): 388-409.
- [19] Favaretto M, De Clercq E, Elger B S. Big Data and discrimination: perils, promises and solutions. A systematic review[J]. *Journal of Big Data*, 2019, 6(1): 1-27.
- [20] Gal U, Jensen T B, Stein M K. People analytics in the age of big data: An agenda for IS research[J]. 2017.
- [21] Silva S, Kenney M. Algorithms, platforms, and ethnic bias: An integrative essay[J]. *Phylon (1960-)*, 2018, 55(1 & 2): 9-37.
- [22] Lambrecht A, Tucker C. Algorithmic bias? An empirical study of apparent gender-based discrimination in the display of STEM career ads[J]. *Management science*, 2019, 65(7): 2966-2981.
- [23] Jussupow E, Benbasat I, Heinzl A. Why are we averse towards algorithms? A comprehensive literature review on algorithm aversion[J]. 2020.