Legal Regulation of Algorithmic Gender Discrimination in the Digital Age

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Abstract: With the advancement of technology, algorithms have become increasingly widely applied in people's lives, and the interdisciplinary issue of algorithms and sociology has become a new hot topic of widespread concern today. Some researchers have compared algorithmic discrimination to the information gap and preliminarily summarized the categories of algorithmic discrimination, but there is a lack of systematic and comprehensive explanation of its characteristics, classification, adverse effects, and development direction. Therefore, the research topic of this article is a more microscopic topic of algorithmic gender discrimination under the topic of algorithmic discrimination, using case analysis and systematic review. The article summarizes its concept, types, and analyzes the three reasons for its emergence. From the endogenous logic of algorithms to the inappropriate data added during the construction and upgrading of algorithms, to the non-standard system, gender discrimination in algorithms can be caused. The negative impact it brings is multifaceted in terms of economy, society, and technology. Finally, the article provides suggestions for addressing algorithmic gender discrimination from the perspectives of legislation, justice, and worker information security. This paper hope to provide theoretical basis for future in-depth research and effectively solve the problem of algorithmic gender discrimination.

Keywords: algorithmic discrimination, algorithmic gender discrimination, machine learning, legal regulation

1. Introduction

In today's era, with the rapid and explosive development of digital technology, people's life mode is completely different from the past. This new lifestyle that people rely on new technology like internet, phone and AI technology expose people to more problems - a form of discrimination by machine algorithms against direct social groups, especially women. In the past, people have always believed that robots and code are supposed to be fair and judge everything even, but more and more studies show a very different view. Due to unrepresentative or incomplete training data, some systems and AI will lead to algorithm and judgment bias, resulting in obvious unfair treatment of the two social groups in their algorithms. In 2019, Genevieve, co-author of *When Good Algorithms Go Sexist: Why and How to Advance AI Gender Equity*, applied for the same credit card with her

husband [1]. It's worth noting that Genevieve actually has a slightly better credit score, with the same income, expenses and debt as her husband, but the company that handled the credit card set her available limit at half of her husband's. This example is actually similar to another case of 2019, after a couple compared their Apple Pay availability, they found that the wife's available credit was only 1/20 of the husbands, and in such shocking news, Apple customer service employees couldn't explain why the algorithm set the husband's available limit to 20 times that of the wife's.

The issue of gender equality is a hot topic in the current era, and many people put forward their constructive opinions. The anti-gender discrimination movement #Kutoo in Japan is a good demonstration of women's resistance to the strict norms imposed on them by society [2]. However, if people live in an era where even the tools, they use are potentially sexist, how can gender discrimination really be addressed or improved? That is to say, algorithmic gender discrimination is a problem that should be overcome in today's society, and solving algorithmic gender discrimination can promote gender equality well. This article will focus on the causes of algorithmic gender discrimination and the corresponding solutions.

2. Concept and Categories of Algorithmic Gender Discrimination

2.1. Concept of Algorithmic Gender Discrimination

To explain the concept of algorithmic gender discrimination, the reader should first understand the concept of algorithms. An algorithm is a computer program expressed mathematically or in computer code, and the predictive consequences are determined by the algorithmic model and data input. With the acceleration of artificial intelligence, algorithms are widely used in almost every aspect. Especially as algorithmic begins to intervene and dominate human social affairs, algorithms will have an immeasurable impact on our lives and the future. Based on this, the legal and ethical risks that algorithmic bias may bring are also beginning to attract people's attention.

The bias in algorithms actually has aroused wide public concern a few years ago: in 2015, the automatic recognition function of Google Images software labeled two black people as "gorillas"; The example shows that Algorithms can be discriminatory. And when algorithmic discrimination occurs in the field of gender, there's algorithmic gender discrimination. In 2018, Amazon's recruitment software was found to lower the weight when it reads keywords in resumes related to woman, women and women's colleges -dispelling a widely misconception about computer technology that algorithms tend to make fair decisions [3]. The gender discrimination hidden behind the algorithm has also begun to emerge as one of the ethical issues of the AI era.

In addition to the Amazon example, other examples show that algorithms have learned to discriminate on the basis of gender. In December 2022, Yu Yang, assistant professor at the Institute of Cross Information at Tsinghua University, led a team to do an ai model gender discrimination level assessment project. Yu Yang's team figured the ai model's tendency to predict what gender the occupation was. The test model included gpt-2, the predecessor of Chat Gpt, a chatbot developed by the artificial intelligence company OpenAI. It showed that gpt-2 predicted that teachers would be male 70.59% of the time, and doctors 64.03% of the time. Other ai models tested in this test project including Bert, developed by google, and Roberta, developed by Facebook. All the AI tested showed a preference for men [4].

2.2. Categories of Algorithmic Gender Discrimination

In order to better understand and solve the problem of algorithmic discrimination, scholars have proposed various classifications of algorithmic gender discrimination. Among these research, biased discrimination, error-based discrimination, interaction-based discrimination and cumulative discrimination are more appropriate as the classification.

Biased discrimination arises from the fact that the algorithm results are biased against certain groups, which may originate from preconceived bias in the data collection and processing process, or from bias in the algorithm design and implementation process. Error-based discrimination refers to when the algorithm results have errors due to data quality and other reasons, which may lead to discrimination. For example, data for certain groups are sparse, which may affect the algorithm's accuracy in identifying these groups. Interaction-based discrimination is the process of interaction between algorithms and humans that generates bias and discrimination. For example, certain algorithms may discriminate against certain groups by creating biases due to human behavior and preferences. Cumulative discrimination is due to the fact that algorithm results may be biased because of historical discrimination. For example, certain algorithms may be biased against certain groups because of historical discrimination against those groups. This classification is more focused on the impact of algorithm results on groups and more focused on discrimination effects, and it can also cover various possible discrimination scenarios more comprehensively, which can be used as a basis for a comprehensive assessment of algorithmic discrimination problems.

3. The Reasons for the Formation of Gender Discrimination in Algorithms

3.1. The Logic of the Algorithm

The logic of the algorithm itself may cause gender discrimination. In other words, the differentiated and personalized research and development of algorithm is undoubtedly lurking against the risk of discrimination.

The result of the Amazon case above may be caused by the theory and operation of the algorithm. The logic of the algorithm is to use historical experience data for machine learning and automatic decision -making. Therefore, this type of algorithm decision can only be based on historical cases rather than creating new cases. It can only be based on existing standards rather than creating new standards. Under such circumstances, the training data set used by algorithms is very important. There may be gender deviations, that is, the number of data samples of certain gender is far less than other gender, which causes the algorithm's prediction, evaluation or decision -making of the algorithm to be not accurate enough, and even discriminatory results. For another example, the data of the car accident experiment is based on the various physiological data of men, including height and muscle distribution. The lack of this data makes women more likely to be injured in a car accident. Similarly, in the recruitment market, a man who does not need to get pregnant and take care of young children is used as a standard worker. The length of time for a man to go to the toilet is set as a standard time length for workers to leave. The lack of data in this field has systemic discrimination at the level of data collection and standard formulation. Data is the basic support and underlying logic of the algorithm, so algorithm discrimination becomes more serious on the basis of data collection and discrimination.

3.2. A gender Role Embedded in the Construction of the Algorithm

There is also a gender role embedded in the construction of the algorithm, which may be unconscious or conscious of the developer.

Practice shows that the so -called "technical neutral" and the "algorithm neutral" derived from this are just a fantasy, and the algorithm is completely likely to act as a tool for discrimination. Algorithm discrimination is mainly derived from the input data. If the data used in the training algorithm itself is the result of discrimination selection, the algorithm may be discriminated against. Because the algorithm is developed by human beings, when involving people's participation, it is inevitable to integrate into the prejudice of the developer. This may be related to the loss of women's voice in the STEM (science, technology, engineering and mathematics) discipline [5]. In

other words, male engineers' thinking, and value concepts are more inclined to male perspectives. Due to complex social and historical reasons, during the construction of algorithms, the proportion of male engineers in the workplace is higher than that of female engineers. The European Economic and Social Council recently pointed out that "the development of artificial intelligence is currently conducted in a homogeneous environment composed of young white men." There is the root cause under the cause on the surface, coding subjective discrimination, essentially gender discrimination.

3.3. The Stage of the Algorithm

The algorithm is still in the stage of starting and development in the world, and there is an insufficient regulation of relevant system.

On the one hand, generally speaking, how to regulate the algorithm is being considered at the beginning, there are still several legal gaps. On the other hand, all of the algorithmic gender discrimination is almost indirect discrimination, then the employer of the application algorithm has many reasons to defend the indirect discrimination. Unless the plaintiff can prove that the algorithm causes gender discrimination, it is difficult to start the remedy of gender discrimination in the workplace. Even if the liability for proof of gender discrimination is upside down to the employer, the employer may not be responsible, because the employer can refuse evidence on the grounds that the algorithm is business secrets and is protected by patent.

4. The Negative Effects of Algorithm Gender Discrimination

4.1. In the Field of Economic

Economic losses caused by algorithm discrimination are multiple aspects. Algorithm discrimination may exacerbate the current status of incomplete development of women's human capital. When the algorithm that causes gender discrimination is applied to recruitment resume screening or performance evaluation system, it will cause the ability of certain gender individuals to be mistakenly evaluated, decided, or predicts, especially the relatively weak groups such as women and sexual minority groups. At the same time, the algorithm might not only cause the direct loss of interests, but also may cause legal disputes, which will affect the interests and reputation of algorithm developers and users, and form a situation of double losses in the economic field. In 2019, the Civil Organization Electronic Privacy Information Center filed a complaint with the Federal Trade Commission, accusing Hire Vue of the enterprise recruitment algorithm developed by it may have gender discrimination.[6]. Discontinued caused Hire Vue a certain economic loss.

4.2. In the Field of Social Construction

Algorithm discrimination may also cause social unfairness. The principle of the algorithm is neutral, but the application of the algorithm is not neutral. Algorithms cause gender discrimination to lead to unfair treatment of individual individuals of different gender in assessment, decision -making or prediction, which will affect the professional development of the individual and even the future living standards. Due to the unfair treatment of individuals, the sense of happiness is reduced, and the overall happiness of society is affected [7]. In addition, the application of algorithms is intent to use the neutrality of technology to promote equality. But the gender discrimination caused by it will strengthen the prejudice and stereotypes of gender character in society, which will be harm to equality and promotion, and will affect the overall fairness and peace of society. To make matters worse, the algorithm makes the indirect gender discrimination that is unable to obtain evidence become more difficult to know, notice, and confirmed, and further causes the difficulty of female workers to obtain relief.

4.3. In the Field of Technology

In addition to the above two points, algorithmic discrimination will also affect the development of technology. On the one hand, the most direct result of discrimination is the inequality between men and women in terms of opportunities, resources, evaluation standards, etc., resulting in a decrease in social fairness. According to statistical regression analysis using CGSS (Chinese General Social Survey) data, social equity is positively correlated with individual innovation and entrepreneurship abilities in society [8]. Scholars in the relevant field explain that social inequality leads to a decrease in workers' sense of gain. The sense of gain is one of the reasons that drives workers to invest in themselves and continuously improve their innovation ability. If workers find that investing in themselves cannot achieve fair returns, they are likely to lose interest in investing in their own human capital [9]. If the above situation occurs among individual workers, it will cause a decrease in the overall innovation ability of society and slow technological development from a macro perspective. On the other hand, the serious consequences of gender discrimination in algorithms, once announced by researchers, can make algorithm users question the credibility of the algorithm. If it goes deeper, it can lead to panic and a complete negation of the algorithm. Due to fear, fewer technical personnel are willing to participate in the improvement project of algorithms, resulting in imperfect algorithms being unable to correct deficiencies and forced to stop the development process.

5. Recommendations for Regulating Algorithmic Gender Discrimination

5.1. Recommendations for the Law

The government propose to establish a law related to algorithmic discrimination with a specially designed section on gender discrimination. Such a law should stipulate the responsibilities and obligations of algorithm developers and users, including but not limited to the following aspects:

First, the government should strengthen the legal regulation of algorithmic sex discrimination and establish a corresponding legal framework and system to protect the interests and rights of the public. The law should clearly prohibit algorithmic discrimination, especially gender discrimination. For example, New York City has adopted a legal measure called the Machine Learning Equity Act, which requires government agencies to monitor the use of machine learning algorithms and ensure that algorithms do not discriminate against certain groups. Algorithms should operate in a fair, neutral and non-discriminatory manner and should not favor or discriminate against any specific group of people.

Secondly, ensure the transparency of information. Algorithm developers should disclose the training data, design process and evaluation results of the algorithms so that the public can monitor and evaluate the fairness of the algorithms and any discriminatory behavior. For example, the Federal Trade Commission of the United States requires credit scoring agencies to disclose their algorithms to ensure that they do not discriminate against certain groups.

Thirdly, algorithm review and regulation. The law should establish a special body or agency to review and regulate algorithm discrimination and punish and penalize violators.

5.2. Recommendations for Workers' Information Protection

The government is also suggested to establish a better mechanism to protect workers' information and set more costs for companies to implement algorithmic discrimination. The reasons why a better worker information protection mechanism regulate algorithmic gender discrimination is clear. The essence of algorithmic discrimination is bias and stereotyping based on personal information;

therefore, protecting the privacy and security of personal information can prevent companies from implementing algorithmic discrimination through personal information.

5.3. Recommendations for the Reliability of Data

To reduce the regulation of algorithmic gender discrimination, the reliability of data in the algorithm should be increased as well. On the one hand, increasing diversity is an important measure to reduce gender discrimination in algorithms. Diversity should be added in the process of data collection and processing to ensure that algorithms do not discriminate against certain groups. For example, Google uses a method called "blind review" in the recruitment process, which hides the gender and other personal information of job seekers, thereby reducing gender discrimination in the recruitment process. On the other hand, Unfair data should be corrected. In many industries, women are generally paid less than men, which may lead to algorithmic gender discrimination in hiring and promotion when put these data into algorithmic. By revising these data, the algorithmic gender discrimination can be reduced.

5.4. Recommendations for the Whole Society

At the social level, it is recommended to increase the promotion of gender equality concept and social role reshaping; encourage women to enter the technical field, improve gender sensitivity in technical coding, and change the situation that the Internet and artificial intelligence industries are monopolized by men. At the same time, it is necessary to raise public awareness, as this is one of the important steps in addressing gender algorithmic discrimination [10]. The public needs to understand how algorithms work and how algorithms may discriminate against certain groups. This can be achieved through channels such as education, media, and social media. For example, a non-profit organization in the United States, the Algorithmic Justice League, aims to raise public awareness of algorithmic discrimination. The founder of the organization, Joy Buolamwini, once discovered that some facial recognition algorithms cannot accurately recognize the faces of black women, so she founded the organization to promote algorithm fairness and transparency. The organization raises public awareness of algorithmic discrimination through educational and promotional activities and calls on the government and businesses to take measures to address this issue. Through these measures, gender discrimination in algorithms can be eliminated, allowing algorithms to assess people's abilities and backgrounds more fairly.

6. Conclusion

This paper discusses the concept of algorithmic sexism, different types of algorithmic sexism, the reason of it's origin, the harm it may bring, and suggestions of solving algorithmic sexism from various aspects. Although sexism has already been a hot topic for a long time. However, algorithmic discrimination is a problem just been brought out by new AI technology in recent years. To be honest, algorithmic discrimination is still a brand-new field, yet algorithmic sexism is just a tiny topic under this massive field. Being stuck in a rut and not looking for solutions because of the problems that new technologies may bring is not the best choice, and multiple initiative must be taken to solve it, which requires the attention of the whole society not only include females but all social group. Hopefully, the suggestions provided in this article can be useful in solving this problem, and hopefully, the problem of algorithmic sexism can be properly solved in the near future.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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