Bibliometric Analysis of Algorithmic Power in China Based on CiteSpace

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Abstract. Recently, more and more attention has been paid to the research of algorithmic power. This study used CiteSpace software to visualize and analyze 1084 literatures. The results show that: (1) Research on algorithmic power first appeared in the early 21st century, showing long-term stability and short-term fluctuant growth; (2) High-yield authors in this field have not formed yet, and the cooperation between researchers and research institutions is relatively loose; (3) Through the analysis of key words in the research on algorithms and power, there are mainly three research focuses in the academia: the definition of algorithmic power, the risk of algorithmic power, and the legal regulation of algorithmic power; and (4) With the emergence of many problems such as "algorithmic discrimination", "information cocoon room", "algorithmic gap", "big data killing", "algorithmic tyranny" and so on, the systematic research on algorithmic power has become a major concern of scholars at present without hindering their development.

Keywords: algorithmic power · domestic and international · research status · CiteSpace

1 Introduction

Today, computer technology, like a pair of invisible hands, is trying to rebuild an orderly society, it heralds our "algorithm era" has arrived. From the current situation, the decision of algorithm is not affected by people's subjective emotions. Therefore, it is difficult for people to view these problems from the perspective of thinking. With the emergence of such problems as "algorithmic discrimination", "information cocoon room", "algorithmic gap", "big data kill ripe", "algorithmic tyranny", etc. Without hindering its own development, the systematic study of algorithmic power has gradually become a growing concern of scholars. However, there are few comprehensive articles on algorithmic power, and it is difficult to grasp the overall development context and research focus of algorithmic power. So CiteSpace is going to use the software to analyze the power of algorithm comprehensively and systematically, to draw the core author co-occurrence, keyword co-occurrence and clustering, and so on.

Z. Zhan et al. (Eds.): EIMSS 2022, AHCS 7, pp. 255–262, 2023.
https://doi.org/10.2991/978-94-6463-024-4_27

2 Research Methods and Data Sources

CiteSpace, developed by Chinese scholar Professor Chen Chaomei, is one of the most recognized technologies in bibliometrics. CiteSpace software can help researchers better understand the overall development of research, has been widely used in many areas. In this study, CiteSpace software is used as an analysis tool to study the core authors, institutions and key words of algorithmic power related literature, draw knowledge map and visualize.

The core author is the leader of the development of the discipline and has great influence. Price Theorem is often used in academic circles to determine the core author. The specific formula is as follows [1]:

$$Q = 0.749 \times \sqrt{C} \tag{1}$$

In the equation, Q is the minimum number of posts by the core author, and C is the number of posts by the author with the largest number.

The key word is the article research content and the topic high condensation. The higher the keyword frequency is, the higher the attention degree is, and the more centrality is, the more important the keyword prominence is.

All the research documents are sourced from HowNet China (CNKI), and the search time interval is from January 1, 2000 to April 24, 2022. Search "title" includes "algorithm" and "power" documents. In order to ensure the academic value of literature, only selected CSSCI literature. Then, the literature obtained was verified by manual checking, and 1084 articles were obtained.

Through the keyword clustering of CiteSpace, we can explore the research topics in this field, and we can judge the research characteristics of different periods by combining frequency, centrality and prominence. Run CiteSpace to cluster keyword generation maps (Fig. 1). The clustering module value of the network modularization evaluation index (Q value) is 0.6426 (when Q value is more than 0.3, it means clustering is better), and the average contour value of clustering of the network homogeneity evaluation index (S value) is 0.8205 (S value is more than 0.5, it means homogeneity is higher), which indicates that the network clustering of the atlas is reasonable. After all, CiteSpace is a bibliometrics software. Although CiteSpace can analyze the subject direction from an objective point of view, it is easy to overlook some characteristics, but often very important research content, can not be used as a basis to determine the subject direction. Therefore, this study combines keyword frequency and centrality, clustering, final judgment algorithm power research has three main focuses: algorithm power definition, algorithm power risk, algorithm power legal regulation.

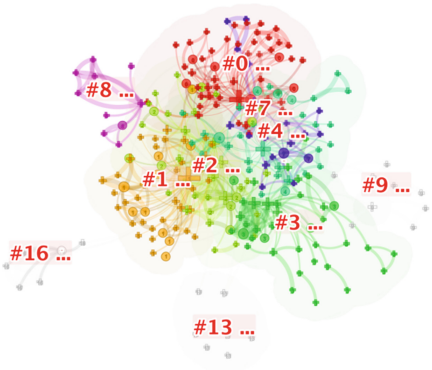

Fig. 1. Keyword Clustering Atlas of Algorithmic Power Research

3 Analysis of Research Progress

3.1 Concept of Algorithmic Power

In the current power research, there is some controversy about whether algorithm is a kind of power. The essence of the debate is that different scholars have different understandings of algorithm and power. Compared with the view that algorithm is a kind of power held by most scholars, few scholars explain it from the perspective of "right". For most domestic scholars, the "algorithm is a power" on the same attitude.

In the understanding that algorithm is a kind of power, algorithm constitutes a kind of social structure of "technological unconsciousness", whose logic is usually "black box state", which is regarded as a new form of hegemonism, and the code logic embedded in algorithm acts as capitalist power [2]. Algorithms are also becoming a medium for expressing power, and algorithms play a vital role in the process of expressing power [3]. The generation of algorithmic power is due to the function of the algorithm itself, that is, the final algorithmic result presented is the decision-making result made by the algorithm itself through reasoning, perception, classification and optimization of the data, and the decision-making result will eventually act on the social ontology, which is called algorithmic power [4].

Based on the influence and power of algorithmic power, this power derives from "algorithmic association" [5]. That is, a set of people, resources, processes, and so on under the specific rules of an algorithm generated by a force, which is also considered a "social technology set" of a power [6].

The understanding of "algorithmic power" can be most intuitively analyzed from the two dimensions of "algorithmic" and "power". At the technical attribute level, the algorithm learns from "inference", "perception", "classification" and "optimization" data to "learn" human decisions, and the learning process looks for and tests complex mathematical correlations between candidate variables based on the large data set provided to maximize predictive results. But the characteristics of the algorithm are more complex, and the understanding of the algorithm in the real political operation and public governance should be shifted from the technical attribute to the social attribute and the mutual structure of the two, thus clarifying the power nature of the algorithm.

Algorithmic power is defined as a technical power produced by human decision making through code settings, data processing, and machine automation [7]. Power is the influence, dominance and control exerted on others by a subject's possession and use of resources [8]. Therefore, algorithmic power is defined as the influence and control on government, citizen, social organization and other objects generated by the developer and controller of an algorithmic platform. With the wide application of computer technology in social life, it has changed the interconnection between the parties to a certain extent. The application of algorithm technology is the influence and control power of algorithm technology developer, investor and controller to citizen, organization and government through technology advantage. Generally speaking, power is regarded as a kind of public power. The algorithm not only coordinates the public power to govern the society, but also replaces the public power in fact.

Interpreting "algorithmic power" from the dimension of dominance, i. e. the dominance of algorithms in the political field, which is embodied in the ability of algorithms to allocate social resources and dominate civil behavior [9]. The government uses the algorithm to assist itself to carry on the governance decision-making, then reallocates the social resources materially, but citizen's social cognition and behavior will be guided, constructed and disciplined by the algorithm power in the microcosmic [10]. Through the power relations to individual or group behavior of effective guidance, which in the essence of the algorithm is a power relations for governance as the goal.

Algorithmic power can be subdivided into three aspects: power as technology, power as data operation and power as extension of subject power [11].

The power as technology is to understand algorithm power from the angle of technology attribute, and technology power is the essence of algorithm power. As the power of data operation, the algorithm power is explained from the data angle, which is the basic element of the algorithm. As the extension of subject power, the subject can refer to the country, capital and public, and different subjects endow the algorithm with different power directions and fields.

At the level of power as data operation, algorithmic power can be further explained based on information dominance. Domination is the essential characteristic of power, and the tool or carrier of exercising power is information. It is precisely the efficient processing of information based on algorithmic technology and the influence of citizens' behavior and decision-making by means of information carriers that information dominance is the core of algorithmic power [12].

3.2 Risk Problem of Algorithmic Power

According to the definition of the development stage of algorithm technology by American scholars, it is in the third stage of algorithm development: super algorithm stage. At this stage, with the extensive application of the algorithm in the society, an autocratic form similar to capital autocracy will be formed. In other words, humans would be highly dependent on algorithms for overall species degradation. Thus algorithmic power embodies the dictatorship of machines over humans.

As to the characteristics of algorithmic power, its appearance is a kind of technical power, and behind it is capital power [13]. In the process of algorithm design and

development is closed, so there may be "capital" under the intent of the black box operation, then the algorithmic power can be understood as the capital oligarchy and the conspiracy of the technical elite [14]. More specifically, algorithmic technologies have gained momentum and are evolving into a win-win society of digital oligarchs and their technical elites, along with those in power.

The risk problem of algorithmic power is divided into three parts: the strong expansion of algorithmic decision-making power, the failure of power balance mechanism, the erosion of individual freedom and rights.

At the level of decision power expansion, the "uniqueness" of algorithm decision has 100% decision power for human being. The essential difference between algorithmic decision and non-algorithmic decision lies in autonomy and automation, which means that machines make self- choices and decisions without human intervention. The decision makers can discuss with each other when they disagree with the important decision items. This kind of business communication can not only standardize the operation process of the items, but also help the decision makers to find the problems and fill the loopholes. Once the algorithm is used, all the decision-making process is carried out by the machine, and there is no open communication with the human decision-maker, so the power is in the hands of a machine rather than the human decision-maker. Then algorithmic power may eventually evolve into the technological superiority or even hegemony of algorithms over human beings.

For the randomicity of decision making, the function and operation rules of the algorithm system can only be set beforehand, and can not meet the needs of human randomicity in the later stage. The artificial randomness of the situation is that when people cannot reasonably anticipate the conditions under which the planned actions will operate, they will not devote too much energy and resources to the plan to limit the control of the decision maker [15].

If the preposition of the decision algorithm can not satisfy the artificial randomness, the technical system which is independent of the human decision-maker will face the risk of expanding the decision-making power.

At the level of the failure of power balance mechanism, the traditional power structure has been broken by the decision system of private subject intervention algorithm. The R&D and operation of ADSS can not be completed by the government alone, so we need to invest professional personnel in each stage of the system. At this time, the government needs to purchase the technology and service of the private sector to participate in the whole process planning of the whole system.

As a kind of technical power, the algorithmic right constructed on the basis of algorithm is mathematical logic, which can promote the technicalization of power operation [16].

In government governance, the government entrusts the algorithm to make governance decisions on its behalf, and the algorithm is endowed with some administrative execution power. Civil servants in the age of algorithms rely on the "optimal decision" made by machines without thinking about how to make the "optimal decision". Once destructive results occur, the autonomous decision-making of algorithms can easily lead to public officials using power transfer to shirk their responsibilities, making it difficult to pursue relevant responsibilities and safeguard public interests [17].

In terms of the erosion of individual freedom and rights, the situation where rights are used to check and balance power has formed a situation where rights are controlled by power. From the perspective of the dual dimension of "power-right", power and right are relative, and usually the two forces balance each other. However, due to the blessing of algorithmic power, this leads to an imbalance in the originally balanced "power-rights" relationship. The result is the expansion of power and the restriction of rights [18].

The big data capability of the algorithm can obtain the information of each individual and make accurate analysis of the information, but the individual does not understand the algorithm, which causes the algorithm to help the expansion far more than the protection of rights, making the administrative subject and the relative. The information asymmetry and the unequal status gap between people have deepened.

In the process of urban intelligent governance, all things in the city are abstracted into data, so that the entire city can be monitored in real time, and this scene is exactly what Foucault described as "panopticism"-style monitoring, which makes the private domain and the public The boundaries of the realm are blurred, and the privacy and legitimate rights of the public are violated.

3.3 Legal Regulation of Algorithmic Power

The widespread application of algorithms not only brings convenience to human beings, but also brings increasingly serious risks to government governance. However, the rapid development of new technologies has not left enough time for the law to deal with it. Compared with the private law response that grants emerging rights or imposes new types of obligations, it is more feasible to strengthen administrative supervision through administrative regulations. At the same time, criminal law and civil law regulation generally belong to post-event supervision, and their regulatory logic is damage consequences plus legal responsibility. For the automated decision-making of diverse and complex algorithms, flexible administrative regulations need to be introduced.

On one hand, the focus of my country's administrative regulation on algorithms is to strengthen the algorithm supervision power of the administrative supervision department to restrict the algorithm power, specifically in the supervision subject, supervision object and supervision method of algorithm decision-making. On the subject of supervision, due to the technical professionalism of the algorithm itself, government departments should set up corresponding professional algorithm supervision agencies. In terms of supervision objects, both the algorithm decision-making body and the algorithm itself need to be the supervision objects. Algorithms are inherently abstract, and accountability must belong to an active individual, that is, the negative effects of algorithmic decision-making should ultimately focus on the behavior of algorithm designers or users.

On the other hand of administrative control, it is necessary to strengthen the national data sovereignty to restrict the power of algorithms. From the perspective of power subjects, algorithmic power can be controlled by both state subjects and non-state subjects. The country should be the center of power. When faced with algorithm technology, the government should hold the dominant power in the initial stage of algorithm program development, and change the way of thinking of algorithm design and development. The government plays a leading role in this transition to reduce the risks posed by the

"algorithmic black box", while reducing the extent of problems that were not deeply managed by the government in the past.

4 Conclusion

Domestic scholars first made a certain explanation on whether "algorithm is a kind of power". Scholars have different opinions on algorithms and power, but the arguments of Chinese scholars are more supportive of "algorithm is a kind of power". Corresponding research has also been made on the risk issues and legal regulations brought about by the application of algorithmic power.

For the concept interpretation of algorithm, domestic scholars have made specific explanations from the perspective of "algorithm" and "power", whether it is from the two-dimensional subdivision explanation of "algorithm" and "power" or from the essence of "algorithmic power" From the perspective of perspective, scholars have provided rich theoretical explanations. But in fact, in addition to studying "algorithmic power" itself, from the perspective of theory and practice, we should analyze "where does algorithmic power come from" and "how to control algorithmic algorithmic power" in more detail. In other words, the perspective of analyzing algorithmic power needs to be further explored from the source and construction level of algorithmic power.

The political science research of algorithms is essentially mediated by intelligent algorithms, examining the interaction and tension between state subjects and non-state subjects in terms of power, or the interaction and tension between government subjects and non-government subjects in terms of power.

At the same time, algorithmic power can effectively guide the individual or group behavior of national citizens, which produces a new socio-political structure. "Configuration" originally refers to the setting of initial instructions by a computer. Applying this concept to this refers to the permeable political influence of algorithmic power in the development of an information society. In the political structure of algorithmic power, if no one proposes reflection or attempts to change, and does not introduce an active adjustment mechanism, it will permeate the entire society according to the logic of power, and will appear as an arbitrary and generalized form of governance.

In the mechanism of algorithmic power operation, it is not only necessary to look at the initiative and intention of the subjects including the leader, designer and general users, but also to examine the execution mechanism and results. That is to say, the corresponding problems are seen through algorithm power, but there is no corresponding control path, so this is an important part that is missing in disciplinary research. This paper hopes to do further research on this issue in the future.

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