ALGORITHMIC MANAGEMENT AND THE REPRODUCTION OF CAPITAL IN THE BRAZILIAN INSURANCE MARKET

SERGIO AMADEU DA SILVEIRA

Sérgio Amadeu da Silveira is an associate professor at the Federal University of ABC (UFABC) and PhD in Political Science at the University of São Paulo (USP). In this article, he contributed with the conception of the research design; development of the theoretical discussion; interpretation of the data; support in the text revision; writing of the manuscript and translation and revision of the foreign language version.
Federal University of ABC (UFABC) – Santo André, São Paulo, Brazil.
E-mail: samadeu@gmail.com. ORCID: 0000-0003-1029-9133.

JOYCE ARIANE DE SOUZA

Joyce Ariane de Souza is a PhD student and Master in Human and Social Sciences from the Federal University of ABC. She is a specialist in Digital Communication from the School of Communication and Arts of the University of São Paulo (ECA-USP). Graduated in Social Communication with a degree in Journalism from the Methodist University of São Paulo. Researcher at the Free Technologies Laboratory of the Federal University of ABC (LabLivre/UFABC). In this article, she contributed with the conception of the research design; development of the theoretical discussion; interpretation of the data; support in the text revision; writing of the manuscript and translation and revision of the foreign language version.
Federal University of ABC (UFABC) – Santo André, São Paulo, Brazil.
E-mail: joyce.souzaa@gmail.com. ORCID: 0000-0001-6087-877X.

PPG|COM Programa de Pós Graduação COMUNICAÇÃO MESTRADO E DOUTORADO **UFF**

Abstract

In several corporations and private and public institutions, operating routines are moving from being controlled and administered by bureaucratic systems to being governed by algorithmic systems. This phenomenon alters the quality and form of control of work processes. This article relates the dynamics of this scenario in the Brazilian insurance market. From the collection of documents, reports and marketing and training materials of insurance market professionals, we sought to analyze and map how and in which processes the algorithms are being used and how this has altered the internal and operational routines of this segment, aiming at increasing the profitability of the Capital.

Keywords
Algorithmic management; Big data; Control; Work; Insurance market.

Introduction

Technological processes can acquire economic and political dimensions (Winner, 1980). Even when they are born apparently free of implications that go beyond their own original dynamics, when they appear to be devoid of any consequences beyond the experiences they provide, we observe ambiguity and reconfiguration in technological processes with important consequences for economic, social and political systems. However, certain inventions—from their conception—aim to obtain objectives of high relevance to society. This is the case of algorithmic systems.

A set of finite routines, logically chained, unambiguous, linked to the structure of data that can be gathered in software or embedded in devices that operate in an interconnected way and aim to achieve certain objectives in the administration and operation of symbols, things or people (Seaver, 2019), we call an algorithmic system. They are present in most of the platforms that we use daily on the Internet. They control city flows, run behind Waze and Uber, operate the routines of a hydroelectric power plant, distribute ads to reach us when we do a search for a particular word or product on Google, and identify people among thousands of faces captured by surveillance cameras, among other applications. Such systems are far from impartial, neutral operators. They target certain objectives that they are created and developed to implement.

The article will seek to relate, from the analysis of documents, reports, marketing and training materials for insurance market professionals, the ongoing dynamics of the inclusion of algorithmic processes in the routine of Brazilian insurance companies, highlighting important differences from exclusively bureaucratic management to algorithmic management.

Bureaucratic management

Max Weber defined bureaucracy as the realization of a type of rational-legal legitimate power that is formed of paid employees, with defined powers, position, and obligations established in a hierarchical line (Weber, 1982). Bureaucracy operates from impersonality. It does not matter who is the official, who will carry out an action, he must follow the rules and the task as previously established, from which he draws his authority. Likewise, the citizen who seeks bureaucratic authority must receive impersonal treatment based exclusively on the universality of the law.

Bureaucratic management has consolidated the capitalist company and the modern state. Bureaucracy has made it possible to organize and largely control the activities of these structures. We can see bureaucracy as a blocker or mitigator of feelings, personal preferences and passions in the daily conduct of private and public business. As a device at the service of the institution's objectives, we can see bureaucratic management as a desiring-machine that intends to overcome the inconstancy of the human. Compare the way families live and are managed: there are routines, but they are easily suspended and negotiated according to moods, wills and a series of concrete situations in which affections strongly alter daily life. These family routines are not based on laws and other controls to be followed.

The bureaucratic organization of work or the management of employee activities, in enterprise or in the State, ideally seeks to overcome uncertainties and the absence of consolidated rules and intends to trigger a continuous organized process to better accomplish the ends of the enterprise that should be rationally organized. It is a specific type of permanent control technology based on a set of laws or rules in which the upper levels give limited orders to the lower levels. It is a technology of domination in the words of Max Weber:

> (...) an inanimate dead machine is a clotted spirit. Only the fact of being so gives it the power to force men to serve it and to determine, in such a dominant way, the day to day of their professional lives, as is, in fact, the case in the factory. The

> clotted spirit is also that animated machine represented by bureaucracy, with its specialization of trained professional work, its delimitation of powers, its regulations and its hierarchically graduated relations of obedience. Allied to the dead machine, it is occupied in manufacturing the external form of that servitude of the future, to which, perhaps one day, men will be obliged to submit without resistance (...) (Weber, 1999, p. 199, our translation)

Weber also predicted that the bureaucratic structure would lead to the concentration of material means of administration in capitalist corporations and states, and only saw the possibility of the bureaucracy growing and advancing (Weber, 1981, p. 257).

This concentration of control may lead to the autonomization of the bureaucratic apparatus. Pedro Castelo Branco, in analyzing the crisis of the bureaucracy, brought Karl Löwith's understanding that bureaucracies, in some cases, would tend to become autonomous and that "bureaucratic rationality would become irrational" (Branco, 2016, p. 68):

> (...) just as that which was a mere means (to an otherwise valuable end) becomes an end or end in itself, the actions intended as a means become independent rather than an end, oriented toward man and his needs. This opposite marks all modern culture: its establishments, institutions, and enterprises are rationalized in such a way that these structures, originally prepared by man, now in turn surround him and define him like a "prison" (Lowith, 1997, p. 155 apud White, 2016, p. 68, our translation)

Bureaucratization as imprisonment of the organizations that execute it is an image of modernity and dehumanization that would be in the course of capitalism. But would algorithmic management be a mere improvement of bureaucratic management described and thought by Max Weber?

Algorithmic management

Some sociologists present algorithmic systems as the continuation and advance of the general bureaucratization process of societies.

> The phenomenon of algorithmic governance is part of a longer historical trend toward the mechanization of governance. Sociologists since the time of Weber have highlighted ways in which the legal-bureaucratic organization of the state is subject to the same modernizing trends as the design of industrial factories (Kanter, 1991; Weber, 1947). The result is a system of governance that is machine-like in nature: tasks are subdivided and roles are specialized so as to perform the business of governance as efficiently as possible (Danaher et al., 2017, p. 2).

Even if we indicate that management or algorithmic governance results from the deepening of the tendency of mechanization and automation of bureaucratization processes, that the current datafication or massive data collection comes from the biopolitical processes of statistical use (Hacking, 2006; Foucault, 2008), it is necessary to analyze if there are elements qualitatively different among them. For this, it is necessary to clearly understand the elements of management carried out by algorithmic systems.

Sociologist Aneesh Aneesh (2009) differentiates forms of governance based on the principles that drive them. For Aneesh, bureaucracy follows the rationality of laws and rules, the market follows price signals and algorithmic management systems follow the determinations of programmed codes. This is an algocracy. The law can be interpreted in a more or less flexible way depending on the bureaucrat who applies it, but the algorithm, to be flexible, must have been programmed for that, otherwise it tends to be rigid. The legality and illegality of the bureaucratic decision becomes an algorithmic system, true or false, zero or one, inside or outside.

> While algocracy may appear to have bureaucratic structures embedded in it (e.g., legally permissible operations for a teller or the greater access to the same transaction

available to the manager), the underlying software program is driven by the algorithm, or more deeply, the binary code. Imperatives of programming are not bureaucratic but mathematical even while a programmer codes bureaucratic controls in a software system. Algocracy may encode not only bureaucratic but also non bureaucratic, less hierarchical governance as seen in peer-to-peer programming schemes or open-source development projects. The notion of algocracy thus implies 'rule of the algorithm' or 'rule of the code' (Aneesh, 2009, p. 350).

Algorithms can't be ambiguous. Algorithmic systems will have difficulty living with dubiousness. Algorithms are written to follow a series of rules or are defined to act according to the presented data. Tarletton Gillespie showed in his text about the public relevance of algorithms that they depend on data structure that can include, exclude or downgrade certain information (Gillespie, 2018, p. 98). Algorithms are excellent classifiers, orderers, segregators and can also be reconfigurers.

This coded ability to act is related to performative effects in the environments in which they act. Inspired by the speech act theory, Galloway (2006) wrote that code is the only language that does what it says. The coded algorithm executes and generates effects on those who interact with it. Some researchers indicate that algorithmic systems can modify the environment and the practices of people in their area of action.

> Code has become indisputably as important as natural language because it makes things happen, which requires it to be executed as commands that the machine can execute. Code executed on a machine is performative in a much stronger sense than language (Hayles, 2005, p. 49-50, our translation)

The performativity of algorithmic systems has implications for society, aesthetics and politics. In other words, there is a "constitutive interweaving" in which "it is not only we who create the algorithms, they also make us" (Introna & Hayes 2011, p. 108). As Gillespie well noted, "Users reconfigure their practices to suit the algorithms they depend on" (Gillespie, 2018, p. 98). An example of this discursive practice is in Dan Mcquillan's work on algorithmic states of exception. The researcher argues that "algorithms change everyday life" and transform "the use of forecasting into a form of governance" (Mcquillan, 2015, p. 564).

The management of activities and workers performed by algorithms generates a type of behavior that should suit the degree of flexibility imposed by it. The behaviors of employees, workers, and service providers can be precisely defined by algorithms. Precise scores and hierarchies are made throughout the work process, the sensors of which can give information about each act performed. Standards can be extracted from each employee who is treated like a machine, since precision, dedication, concentration, correctness and agility are required of him.

No doubt algorithmic decision-making systems can be integrated into bureaucratic systems. This is currently the case. Bureaucracies are increasingly using algorithms to support decisions. However, the increasing possibilities of data extraction, storage, and processing by so-called machine learning is generating a possibility of pattern extraction that was not possible before. These same algorithms that extract patterns from data can make predictions about almost anything that is requested. For this, it is enough to have data and models of projections about the future.

John Danaher (2016), in analyzing whether algorithmic decision making could in any way affect the legitimacy of what is decided, warning us that some algorithmic systems that depend on a wide variety and amount of data use so-called data mining to search and identify patterns and correlations that can serve to detect fraudsters, tax evaders, terrorists, and also to make predictions based on historical information and thus avoid lending to a likely bad payer or determining a possible low penalty for a repeat offender. The problem lies precisely in the probability and the possibility made real by algorithmic systems.

Mareike Möhlmann of the University of Warwick and Lior Zalmanson of Tel Aviv University highlighted five features of algorithmic management: 1) performs the constant tracking of workers; 2)

carries out the permanent evaluation of the performance of those who interact with the algorithmic system, activated by data trackers; 3) automatically implements decisions with little or no human intervention; 4) engenders the interaction of workers with a system and not with people, greatly increasing the degree of abstraction and blurring the accountability of the company; 5) performs its actions with little transparency (Möhlmann & Zalmanson, 2017, p. 4-5).

In their research on algorithmic management practiced by Uber, from interviews and follow-up at the Drivers Forum in New York and London, Möhlmann and Zalmanson detected all the attributes of algorithmic management that they had found in theory: drivers are constantly tracked by the Uber application; in addition to online monitoring, any passenger can evaluate a driver at the end of a trip and vice versa; the Uber application can automatically penalize drivers who do not act in accordance with company policies or needs; when they need to clarify doubts or understand procedures they are forwarded to automated relationship systems; passenger destinations are hidden from drivers until the passenger enters the vehicle, in addition to other determinations that Uber makes in a completely opaque manner (Möhlmann & Zalmanson, 2017, p. 4-5).

In the article *What does Machine Learning actually mean*?, published by the World Economic Forum, Bernard maintains that artificial intelligence and machine learning are often confused. However, "artificial intelligence refers to a machine's ability to perform intelligent tasks, while machine learning refers to the automated process by which machines extract significant patterns from data" (Bernard, 2017, online).

Machine learning algorithms are not based on rules, but on data, i.e. they accomplish their purpose by extracting from the databases that feed them. One of the deep learning models, which uses so-called neural networks to make their predictions, creates a series of layers of calculations that are not even known by their developers. This phenomenon is called by researchers the "inscrutability of deep learning algorithms," that is, it is not possible to exercise knowledge about them (Potts, 1999; Bornstein, 2016).

The problem lies exactly in the legitimacy of these algorithms' decisions in processes that have consequences for people's lives. One can know the input data and the output data that expose the solution of a certain algorithmic process, but one does not know which steps and how many steps were taken to reach a conclusion.

Even less complex machine learning algorithms are generally not open to auditing. They are opaque, to avoid discovery of business secrets, so that the source code of their programming is unknown to competitors, being under closed license (Pasquale, 2015). In addition, algorithmic opaqueness is defended by technological platforms that claim that knowledge about the routines and operations of algorithms would allow their objectives and effects to be neutralized by users.

Danaher states that it is necessary to work with a distinction between interpretable and non-interpretable algorithmic systems (Danaher, 2016, p. 248). In a manifesto called *Principles for Accountable Algorithms*[1], headed by researcher Nicholas Diakopoulos, it is proposed that:

> Algorithms and the data that drive them are designed and created by people—there is always a human ultimately responsible for decisions made or informed by an algorithm. "The algorithm did it" is not an acceptable excuse if algorithmic systems make mistakes or have undesired consequences, including from machine-learning processes (Principles, 2017, online).

Thus, there is pressure for the assimilation of principles of transparency and accountability of algorithmic systems, that they undergo some explanation about their functioning. The means by which an algorithm discovered a certain pattern or arrived at a certain prediction can be as important as its result.

---

1 Retrieved November, 08th, 2019, from: https://www.fatml.org/resources/principles-for-accountable-algorithms.

Understanding that a probability will not always be realized is another great difficulty of using algorithmic systems, especially those that will classify and perform exclusive scores of users of a private insurance system in Brazil— a market that includes insurance, pension and capitalization.

The insurance market and the insertion of algorithmic processes

Jathan Sadowski in an important article called *When data is capital: Datafication, accumulation, and extraction* (2019) presented data as a form of capital and not as a commodity. For Sadowski, the data, more than vital for competition among capitalist groups, has its collection driven by the perpetual cycle of capital accumulation. Capital has discovered that data extraction from the universe can be extremely profitable and serve innumerable purposes. Obviously, just as with capital, not all data is the same, nor can it be used in the same way. This implies the value derived from data.

The different segments of the economy, for Sadowski, accumulate various types of data to meet their needs and objectives. Thus, he highlights five main ways in which data is used to create value. These are: profiling and targeting people; optimizing systems; managing and controlling things; modeling probabilities; and underpinning the construction of devices, systems and things. Countless platforms such as Uber, Facebook and Airbnb, among others, could not function without data (Sadowski, 2019).

In the insurance market, if before the evaluation of a customer in contracting a product and/or service from this sector were carried out exclusively by employees trained to identify the precise characteristics of those who would fit the business model of an insurance company, now this scenario has changed and, increasingly, these analyses are being carried out in an automated way, by systems that include statistics, data mining, artificial intelligence, and machine learning, among others.

It is possible to observe, during the formation and expansion of the insurance market, the transformation of data understood simply as input into capital. Data and algorithmic systems are capital goods, indispensable investments for their reproduction.

In the area of car insurance, for example, it is not enough to analyse the profile of the contracting person; insurers also carry out a preliminary inspection of the vehicle to ascertain whether the characteristics reported are true and whether the car is in perfect condition. This inspection, which used to be carried out by employees, who either went to the contractor or received the vehicle at their workplaces, is now carried out in a 100% automated manner.

One of the systems that has been adopted by Brazilian insurance companies for these online surveys is IBM Watson™ Visual Recognition, which uses deep learning algorithms (machine learning from Artificial Neural Networks) to analyze images.

With this system, the insurance contractor receives a message on his mobile device with a link that directs him to the application. From there, following the instructions, the user himself sends images of certain angles of his car, such as the diagonal rear and front of the vehicle, engine, and chassis, as well as documentation. The system makes the analysis and issues an evaluation alert to the insurance company informing if that vehicle is in condition to be insured or not.

As explained by Aneesh (2009), IBM Watson™ Visual Recognition is a striking example of the logic of "in or out" algorithmic management. Either the contractor is accepted or not in the survey.

IBM Watson™ Visual Recognition, although widely used by the insurance industry in matters related to survey images, is a system, as described by IBM itself on its website, of virtual classification of any visual content. It understands the content of images, analyzes them for scenes, objects, faces, colors, foods, among others, and allows clients to create and train their classifiers. To do so, clients need to feed the Watson database with their own image collections. In addition to the insurance industry, IBM Watson™ Visual Recognition has been used in manufacturing, visual auditing, social listening, commerce, retail and education.

Another IBM technology being implemented by some insurance companies, such as *SulAmérica*, is Chatbots with Watson Conversation. If before the client or the insurance broker called the insurance company requesting information and was attended by employees who staffed the relevant center, today both the client and the insurance broker must first talk to a robot, which presents possible alternatives to the doubts and questions received. According to information released by *SulAmérica*, in 2018 alone, more than 1 million calls were made by Chatbots with Watson Conversation.[2]

HDI is also another example of an insurance company that has invested in artificial intelligence for contact with consumers, eliminating the call center composed exclusively of employees. The company created Sofia, a virtual assistant made available on the site and the insurance company's application on Android and iOS. Along with contact with the client via chat, Sofia also performs other services such as the opening of a claim, which was previously done by telephone contact with employees located in the customer relationship center and through the 24-hour assistance of the insurance company. Sofia was developed from the collection of 62 thousand questions and over 60 thousand unique users.

In the area of health insurance, insurers are automating all processes related to administration, which includes payments to third parties, such as hospitals, medical clinics, laboratories, and others, as well as reimbursement to the clients themselves. Before, these processes were made in an integrated way between the employees of the insurers and those who worked in these locations. Now, there are employees only acting to feed these systems with information such as invoice numbers and images of procedures. The systems perform all the informational assessments, with integration to the databases necessary for consultations, such as invoices issued, and presents deficiencies, such as problems with payments or failure to meet norms and regulations, to the National Supplementary Health Agency (ANS). This agency, linked to the Ministry of Health of Brazil, regulates the market for private health plans.

One of the systems used by health insurance companies, such as *Amil* and *Unimed*, is from TOTVS, a company that currently serves more than 70 health insurance operators, representing 17 million lives, according to information released by the company itself[3].

TOTVS also provides insurers with an environment for automated management of their teams. In this area, the insurer determines and inserts the targets of the health plans sales and the calculations concerning commission payments. The system generates a ranking and a score referring to the performance of each registered employee. Those responsible for the performance of the sales teams in the companies follow the performance of the employees with the platform and define, by the rankings presented, whether or not a certain employee will remain in the company.

Still in the area of private insurance in Brazil, but in the private pension sector, we can see the automation of services with the use of artificial intelligence. This is the case of Otto, a chatbot, developed by *Via Cognitiva* and designed to assist insurance brokers and financial market professionals with exclusive questions about private pension plans.

Otto was developed from a massive collection of private pension data and has a cloud system where more than 300 question-and-answer interactions on the subject are stored. The system still has the ability to learn from user interactions and feed them back into its database.

Until last year, it was employees of the insurance companies that acted as Otto, gathering questions, collected in chats with insurance brokers and employees of the financial market, and seeking answers to assist brokers in sales. Now, this sector shows that it is also becoming automated.

Porto Seguro, the fourth largest insurance company in the country, according to data released by the Union of Entrepreneurs and Independent Professionals of Brokerage and Insurance Distribution of

---

2   Retrieved November, 01st , 2019, from: http://sulamerica.comunique-se.com.br/show.aspx?idMateria=49+NxRtOix6Td7vFBY-i00Q==.

3 Retrieved November, 01st , 2019, from:https://www.totvs.com/saude/.

the State of São Paulo (RANKING), also created an AI platform called Conquista, which was launched in October 2019.

Developed from the collection of consumer-behavior data, the platform will offer what the insurer calls "advice aimed at achieving life goals." That is, based on the data collected, *Conquista* will suggest to insurance brokers and independent investment agents what to offer each client, for example, the purchase of an automobile or the purchase of a house via an insurance company consortium, or a trip or a private pension.

The technology used by *Conquista* is a robot advisor, which works basically as an investment portfolio managed by algorithms that customizes offers according to the profile of each consumer.

So that the platform has its database constantly fed with new profiles, Porto Seguro has created a strategy to increase the remuneration of insurance brokers who market products through it.

In addition, the platform will rank the insurance broker, presenting a panel with the "evolution of performance" and "prospects in progress", i.e., the company will control via algorithm the work that will be exercised by third parties, which in this case are the insurance brokers.

Final considerations

Frank Pasquale (2015), in his book Black Box Society, analyzing the technological development and computerization of processes by algorithms, already warned that anyone could be labeled with derogatory features in a database and that companies could use these tools to choose who they accept.

> Companies were gathering millions of records from pharmacies. They then sold them on to insurers eager to gain a competitive advantage by avoiding people likely to incur high medical fees. Since 1 percent of patients account for over one-fifth of health care costs, and 5 percent account for nearly half of costs, insurers who can "cherry-pick" the healthy and "lemon-drop" the sick will see far more profit than those who take all comers. Prescription data gave insurers the information they needed to tailor policies to exclude preexisting conditions and to impose higher charges for some members. Ironically, this kind of data was originally gathered to help patients in emergency care settings—to assure access to a record of their medications. But when that plan failed, the records were quietly repurposed as a means of discriminating against the sick. If there's one thing Wall Street loves, it's a quick pivot to a winning business strategy (Pasquale, 2015, p. 27).

In this example, Pasquale refers to the first major complaint in the United States in 2008 made by journalist Chad Terhune about the purchase and sale of personal data and how this information was essential to increase the profitability of insurance companies in the marketing of health plans.

We can extend this analysis to other examples reported here. Systems are being developed for insurance companies to market more and more of their services and products, with fewer and fewer employees and with 100% automated management for total control of their operations, the work performed by their employees and by third parties—as we notice in the case of tools that manage the performance of insurance brokers—and consumers, since the platforms are constantly collecting data and feeding their big data banks.

Based on the purchase of personal data, the same way American insurance companies were able to select the so-called healthy cherry on the cake in the health area, we see now in Brazil that similar situations can be applied, from the hiring of employees to the acceptance of customers.

Systems of knowledge and classification of individuals and groups are not new and have not emerged only with technological advance, but there is a deepening of this system, and in an obscure way.

If before, when turned down for hiring or when fired by a company, the employee had recourse to remedy and reevaluation with the human who evaluated him and scored him. With machine learning systems, artificial intelligence and algorithmic management, this classification has become completely

obscure. Now he is evaluated by algorithms from which neither he nor, in most cases, the one evaluating the results presented by these systems understands how they work.

The same occurs with consumers who are constantly being reached by microtargeting strategies (direct marketing techniques, based on the analysis of personal data and involving predictive segmentation) of insurance companies.

The survey presented here gathered some examples that allow us to observe that automated systems will reduce the discretion of bureaucracy in companies. Algorithmic systems will increase the controls of employees, traders, workers and customers. The modeling of machine learning will force the industry into making constant adjustments in predictive projections with the aim of increasing profitability and reducing the customer base and social segments that have a high financial demand. Also, the small companies in the insurance chain, the brokers, are being and will be more and more subjected to the algorithmic decisions of what composes the so-called intelligent systems, reducing even more their flexibility to negotiate with their customers.

By subjecting the growth of its profit margins to the dictates of machine learning algorithms, the insurance industry will only be left with the need to expand data collection and further automate its internal activities, which will lead to the replacement of workers, but will also reinforce the dependence on conducting statistical projections and algorithmic modeling. Thus, algorithmic management will be more important than bureaucratic management. The attempt at accuracy will acquire the condition of truth, from within or outside the model, of zero or 1. Bureaucratic management of the insurance ecosystem will be less and less relevant in this scenario of neoliberalism and prediction capitalism.

References

Aneesh, A. (2009). Global labor: Algocratic modes of organization. Milwaukee. *Sociological Theory*, v. 27, n. 4, p. 347-370.

Bernard, Z. (2019). What does Machine Learning actually mean? *World Economic Forum*. Retrieved from: https://www.weforum.org/agenda/2017/11/heres-what-machine-learning-actually-is.

Bornstein, A. (2006). Is artificial intelligence permanently inscrutable? Despite new biology-like tools, some insist interpretation is impossible. *Nautilus*, v. 1. Retrieved from: http://nautil.us/issue/40/learning/is-artificial-intelligence-permanently-inscrutable.

Branco, P. H. V. B. C. (2016). Burocracia e crise de legitimidade: a profecia de Max Weber. São Paulo. *Lua Nova*, n. 99, p. 47-79.

Danaher, J. (2016). The threat of algocracy: Reality, resistance and accommodation. *Philosophy & Technology*, v. 29, n. 3, pages 245-268.

Foucault, M. (2008). Nascimento da Biopolítica. *Course taught in the Collège de France* (1977-1978). Rio de Janeiro: Martins Fontes.

Galloway, A. (2006). Language Wants To Be Overlooked: On Software and Ideology. *Journal of Visual Culture*, v. 5, n. 3, pages 315-331.

Gillespie, T. (2018). A relevância dos algoritmos. *Parágrafo*, v. 6, n. 1, pages. 95-121. http://revistaseletronicas.fiamfaam.br/index.php/recicofi/article/view/722

Hacking, I. (2006). *The emergence of probability: A philosophical study of early ideas about probability, induction and statistical inference*. Cambridge: Cambridge University Press.

Han, B. (2018). *No Enxame: perspectivas do digital*. Petrópolis: Editora Vozes.

Hayles, K. (2005). *My Mother Was a Computer: Digital Subjects and Literary Texts*. Chicago: University of

Chicago Press.

Watson Visual Recognition. *IBM*. Retrieved from: https://www.ibm.com/br-pt/cloud/watson-visual-recognition.

Introna, L. D. , Hayes, N.. (2011). On sociomaterial imbrications: What plagiarism detection systems reveal and why it matters. *Information and Organization*, v. 21, n. 2, pages 107-122.

Kitchin, R. (2014). *The data revolution: big data, open data, data infrastructures and their consequences*. London: Sage.

Lowith, K. (1997). Racionalização e liberdade: o sentido da ação social. In: Martins, José de Souza; Foracchi, Marialice Mencarini. *Sociologia e sociedade*. Rio de Janeiro: Livros Técnicos e Científicos.

Marx, K. (2005). *Grundrisse: Foundations of the critique of political economy*. London: Penguin UK.

Mcquillan, D. (2015). Algorithmic states of exception. *European Journal of Cultural Studies*, v. 18, n. 4-5, pages 564-576.

Mohlmann, M. , Zalmanson, L. Hands on the wheel: Navigating algorithmic management and Uber drivers' autonomy (2017). *International Conference on Information Systems (ICIS 2017)*, Seoul, South Korea, pages 10-13.

Pasquale, F. (2015). *The black box society*. Cambridge, US: Harvard University Press.

Potts, W. J. E. (1999). Generalized additive neural networks. *Proceedings of the Fifth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, San Diego California, Estados Unidos, pages 194-200.

Ranking das Seguradoras (2018). *SINCOR-SP*. Retrieved from: https://www.sincor.org.br/wp-content/uploads/2019/05/ranking_das_seguradoras_2018.pdf.

Sadawoski, J. (2019). When data is capital: Datafication, accumulation, and extraction. *Big Data & Society*, v. 6, n. 1, pages 1-12.

Seaver, N. (2019). Knowing Algorithms. In Vertesi, Janet; Ribes, David. *digitalSTS – A Field Guide for Science & Technology Studies*. Estados Unidos: Princeton University Press.

Solução completa de gestão para a área de saúde. *TOTVS*. Retrieved from: https://www.totvs.com/saude/.

Sul América conquista três Prêmios de Inovação CNseg. (2018). *SulAmérica. Sala de Imprensa*. Retrieved from: http://sulamerica.comunique-se.com.br/show.aspx?idMateria=49+NxRtOix6Td7vFBYi00Q==.

Weber, M. (1999). Economia e sociedade. *Volume 2: Fundamentos da sociologia*. Brasília: Ed. UnB.

Winner, L. (1980). Do artifacts have politics?. *Daedalus*. Estados Unidos: The MIT Press. Vol. 109, No. 1, Modern Technology: Problem or Opportunity?

Yeung, K. (2017). Algorithmic Regulation: A Critical Interrogation. *TLI Think! Paper* 62/2017; Regulation & Governance, Forthcoming; King's College London Law School Research Paper No. 2017-27. p. 1-39. Retrieved from: https://ssrn.com/abstract=2972505.