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STUDYING ALGORITHMS IN SOCIAL SCIENCES: A SYSTEMATIC REVIEW

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Abstract

In recent years, the discourse surrounding algorithms and artificial intelligence has been extensively addressed in the social sciences. The dimensions of algorithms discussed by social scientists are numerous, both in terms of themes and in the techniques and approaches used to study them, with the ANT perspective proving particularly valuable as a framework for interpreting the human-machine relationship. This work aims to provide a systematic review of these elements through a bibliometric examination and an in-depth analysis of articles published in 2024. Our objective is to address the gap in the existing literature and offer a comprehensive resource that will contribute to advancing future research in this interdisciplinary field.

Keywords

AI, algorithm, bibliometric analysis, digital methods

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1. INTRODUCTION

The most significant transformations affecting contemporary society in recent years have been driven by algorithms and artificial intelligence (AI). It is difficult to imagine a field of human activity untouched by the technological revolution driven by AI implementation. Technological mediation extends to the productive sector, politics, education, and social relations. Algorithms and AI are now pervasive: they influence how we access information, make decisions, and communicate. AI has been applied in a wide range of fields, from education to healthcare and beyond. Its impact is transforming industries and enhancing human capabilities worldwide. However, while AI offers enormous opportunities, significant challenges also emerge. Its impact on society is not always positive or neutral. Far from being "invisible" and purely instrumental technologies, algorithms and AI profoundly influence individuals and society, whether positive or negative, depending on how they are designed and used. The growing influence of AI is also evident in regulatory efforts. The introduction of the General Data Protection Regulation[1] (GDPR) in Europe was one of the first attempts to regulate the use of algorithms to ensure transparency and the protection of personal data. More recently, the European Union has proposed the AI Regulation to ensure the development of safe systems, particularly in high-risk sectors such as healthcare and transportation. These regulatory efforts respond to concerns about the responsible use of AI, balancing technological innovation with individual rights.

In the academic sphere, the risks and implications arising from artificial intelligence (AI) and algorithms have also begun to receive growing attention. Alongside studies aimed at technological development, innovative and critical approaches are emerging, analysing the interaction between AI, society, and individuals. Among these, a particularly significant contribution comes from the socio-technical approach inspired by Bruno Latour's work, which examines the networks of relationships between human and non-human actors.

Despite the increasing recognition of this perspective, there remains a lack of systematic analysis assessing whether and how the Actor-Network Theory (ANT) perspective has influenced these discussions. Moreover, although ANT serves as a direct or indirect reference in this body of research, its methodological impact remains largely unexplored.
This paper aims to fill this gap by analyzing the key themes in the academic literature on the social implications of AI and algorithms,

[1] Available at https://european-union.europa.eu/index_en

investigating whether and how the Latourian approach emerges in theoretical and empirical applications. Given the increasing academic focus on the risks and opportunities of AI, as well as the need for a critical framework that moves beyond purely techno-centric perspectives, this study has a twofold objective: first, to identify the key themes explored in social science research and assess the extent to which the socio-technical approach inspired by Latour's work is present; and second, to explore and analyze the empirical methods employed in studies that, in various ways, draw upon the socio-technical framework of ANT. Addressing these two questions will help elucidate how the Latourian perspective enriches theoretical debates and translates into concrete methodological tools for investigating the relationships between AI, algorithms, and individuals.

2. THE CONTRIBUTION OF ANT IN THE STUDY OF AI

The Ant perspective has significantly contributed, radically challenging the previous image of algorithms and AI as efficient and neutral tools. The Actor-Network Theory (ANT) (Latour & Woolgar, 1979; Callon, 1984; Law, 1992) views social, material, technological, and scientific domains as profoundly intertwined. ANT emphasizes the role of non-human actors—referred to as "actants"—within social processes. In this framework, actors are not defined by intentionality but by their ability to bring about change and alter the status quo (Latour, 2007). From an ANT perspective, AI and algorithms are seen as products or effects of a heterogeneous network of constantly evolving relationships between human and non-human actants (Latour, 2007; Halford et al., 2010). In this sense, AI and algorithms can be considered non-human actants endowed with authority, functioning in an often opaque manner that may embed particularistic perspectives or erroneous learnings. Within this framework, two key lines of inquiry into the relationship between AI, humans, and society can be identified: the first examines the role and agency of non-human actors, while the second focuses on the experiences and perspectives of human actors.

In the first research stream, we find studies on algorithmic biases, aiming to demonstrate how algorithms can systematically discriminate specific vulnerable categories, such as women, people of colour, or individuals with disabilities. Algorithmic bias happens due to poorly designed codes or training data incorporating biases. A well-known example is Amazon's hiring algorithm, which excluded women due to being

trained on data reflecting gender-biased hiring practices. Algorithmic biases can also result from programming or design errors; this was the case with the Italian Ministry of Education's algorithm for assigning teaching posts, which sparked widespread protests due to its poor functioning. These biases, along with the opaque functioning of AI, are of concern because they can sometimes impact people's lives, alter the perception of specific categories, or affect how individuals engage with sociality and even understand the world. This phenomenon is often referred to as "algorithmic authority." Facebook's algorithm can be mentioned to illustrate how collective phenomena can be triggered by simple algorithmic logic. YouTube's censorship algorithm, instead, has been shown to influence content creators' perceptions of precariousness due to its opaque functioning. On individuals, these biases can produce harms of allocation or harms of representation (Crawford, 2017). The former has economic repercussions, while the latter acts at a cultural level. Allocation harms occur when a system unfairly distributes opportunities or resources. In contrast, harms of representation happen when systems reinforce stereotypes or diminish specific groups. YouTube's censorship algorithm, for instance, has been shown to influence content creators' perceptions of precariousness due to its opaque functioning.

The second line of inquiry focuses on human actors and has emerged in response to the technological determinism implied in some AI studies, which viewed human subjects as passive in their interactions with AI. The rediscovery of human agency occurred stepwise, with the foundation being studied on algorithmic awareness. Algorithmic awareness refers to users' understanding and recognition of how algorithms operate and impact various aspects of daily life. This awareness is unevenly distributed among the population and has led to a new form of digital divide. Awareness is a prerequisite for the development of "folk theories" (DeVito, 2017). The concept of "folk theories" refers to the informal, often simplistic explanations people develop to make sense of complex systems, such as algorithms. Platform users engage daily with AI algorithms, and in some cases—mainly when the platform's functioning affects whether or not they achieve their goals—they develop theories to make sense of what happens and to understand their actions or strategies. These folk theories are used for various reasons, including attempting to tame or subvert algorithms and AI by repurposing them for unintended uses. These practices are called "algorithmic resistance" and represent an advanced form of algorithmic awareness. Such practices have been documented in contexts like delivery platforms (Tuomi et al., 2023) or Instagram influencers (Bonini, 2022), where subjects are more aware of what is

happening and, thus, more inclined to develop such strategies.

Three points need to be made regarding the critical scholarship on these issues. First, while this reflection highlights key contributions, the study of AI through the lens of Actor-Network Theory (ANT) is not confined to the themes addressed here. Other research explores additional aspects, such as human and non-human actors' power of translation within the network. Second, the two strands mentioned focus on a central element in the broader debate on AI, particularly in understanding how awareness can serve as an antidote for citizens to mitigate the adverse effects of AI. Furthermore, within these two strands, we find studies employing diverse and sometimes innovative methodologies, reflecting this field's richness and methodological pluralism. The last point to consider is that while ANT generally follows a network-based approach, this does not imply that all studies inspired by this paradigm necessarily adhere to this strategy. Some research diverges from classical network analysis, adopting alternative methodological frameworks and, in some cases, innovating the instrumentation used to study socio-technical dynamics. This variation highlights the adaptability of the socio-technical perspective and its potential to generate novel research designs that go beyond conventional network analysis.

3. RESEARCH DESIGN AND ANALYSIS STRATEGY

Based on the premises presented in the previous paragraphs, our research questions can be summarized as follows:

> 1. Which macro-themes are the social sciences focusing on in the study of algorithms? To what extent are these themes inspired by the Latourian perspective?
>
> 2. Which empirical approaches are emerging in the study of algorithms? Are there innovative approaches?

To address the research questions, the work was divided into two parts. In the first part of the study, a bibliometric analysis was conducted. In the second part of the work, through an in-depth analysis of articles published in 2024, we examined the techniques used for studying AI.
Bibliometric analysis can be defined as:

> A popular and rigorous method for exploring and analyzing large volumes of scientific data […]. Its popularity can be attributed to (1) the advancement, availability, and accessibility of bibliometric software and databases such as Scopus and Web of Science (2) and the cross disciplinary pollination of the bibliometric methodology (Mukherjee et al., 2021: 1).

Bibliometrics offers comprehensive analyses of scientific literature on a given topic by employing various tools to synthesize the state of the art in a specific field of study and highlight emerging research trends (Page et al., 2021). It is important to present a comprehensive bibliometric analysis on the two research themes of this work, as over the years, systematic reviews on algorithms and AI have predominantly been conducted within STEM disciplines. Few reviews in the social sciences have focused on specific aspects, such as algorithm audits (Bandy, 2021) and decision-making algorithms (Mahmud, 2022). To provide a broader perspective, this study aims to offer a systematic review through a thorough bibliometric examination.

The dataset was constructed on 01/10/2024 using data export tools from Scopus and WoS. In relation to both AI and algorithms, the bibliometric research conducted so far has not only been concentrated in STEM fields but has also been limited to a single database (idem). For this reason, both themes were analyzed simultaneously. It is frequently recommended to use both Scopus and Web of Science simultaneously in bibliometric analyses, as their strengths complement each other (Caputo and Kargina, 2022) (Sánchez et al., 2017). Google Scholar was not included in the analysis because, despite offering broader coverage across all disciplines, a significant portion of its sources and materials come from unknown or less verifiable origins (Leydesdorff et al., 2016). Additionally, its records are not easily compatible with those from more structured databases like Scopus and Web of Science. The keywords for collection are in the table below (Tab. 1).

Table 1. Extraction query

Concept	Data-base	Query
AI	Scopus	TITLE-ABS-KEY ((“artificial intelligence”) OR (“ai”))
	WoS	TOPIC ((“artificial intelligence”) OR (“ai”))
Algorithm	Scopus	TITLE-ABS-KEY ((“algorithm*”))
	WoS	TOPIC ((“algorithm*”))

Regarding the type of document, only articles were included in the analysis. Contributions were restricted to those published in English. Given the objective of research, only articles categorized within the social sciences were selected. Additionally, to ensure that the contributions considered were firmly situated within the domain of social sciences, a secondary filter was employed, including only articles published in peer-reviewed social science journals[2]. The specified time frame ranged from 2013 to 2024. The bibliometric analysis was conducted on articles from 2013 to 2023. The in-depth analysis of empirical methods focused on the years 2023 and 2024. Specifically, for 2024, all available articles were analyzed, while for 2023, the 100 most-cited articles (in descending order) were examined. For both years, those whose content proposed empirical methods inspired, even indirectly, by the socio-technical approach were selected. In Tab 2 a table of inclusion criteria.

Table 2. Inclusion criteria

Type of document	Articles
Language	English
Time Frame	2013 to 2024 (bibliometric); 2023-2024 (in-depth analysis)
Disciplines	Social Sciences; Communication; Sociology; Social Issues; Cultural Studies; Social Work; Women Studies; Family Studies; Anthropology

[2] The journal “Sustainability (Switzerland)” was excluded, despite its focus on social issues, because preliminary analyses showed that only a small portion of its articles were centered on social science topics

Journals	Algorithmic Cultures Essays On Meaning Performance And New Technologies; Algorithmic Society; American Journal Of Sociology; Annals Of The American Academy Of Political And Social Science; Annals Of Tourism Research; Big Data And Smart Digital Environment; Big Data And Society; Big Data Society; Canadian Journal Of Communication; Children And Youth Services Review; Cogent Social Sciences; Communication Culture Critique; Communication Methods And Measures; Communication Research; Communication Research And Practice; Communication Today; Communications European Journal Of Communication Research; Continuum Journal Of Media Cultural Studies; Convergence; Convergence The International Journal Of Research Into New Media Technologies; Critical Inquiry; Critical Sociology; Critical Studies In Media Communication; Cultural Studies; Current Issues In Tourism; Digital Journalism; Economy And Society; Educational Communications And Technology Issues And Innovations; Environment Development And Sustainability; Ethics And Information Technology; European Journal Of Communication; European Journal Of Cultural Studies; Feminist Media Studies; Frontiers In Communication; Frontiers In Sociology; Futures; Global Media Journal Canadian Edition; Hermes Journal Of Communication; Human Behavior And Emerging Technologies; Humanities And Social Sciences Communications; Humanities Social Sciences Communications; Information Communication And Society; Information Communication Society; Information Society; Information Technology Tourism; Interaction Studies; Interdisciplinary Science Reviews; International Journal Of Communication; International Journal Of Cultural Studies; International Journal Of Hospitality Management; International Journal Of Human Computer Interaction; International Journal Of Population Data Science Ijpds; International Journal Of Qualitative Methods; International Journal Of Tourism Research; International Review Of Information Ethics; Internet Policy Review; Jasss The Journal Of Artificial Societies And Social Simulation; Javnost The Public; Journal Of Advertising; Journal Of Communication; Journal Of Hospitality And Tourism Insights; Journal Of Hospitality And Tourism Technology; Journal Of Information Communication Ethics In Society; Journal Of Information Technology Politics; Journal Of Informetrics; Journal Of Mathematical Sociology; Journal Of Safety Research; Journal Of Social Computing; Journal Of Travel Research; Journalism; Journalism And Media; Journalism Mass Communication Quarterly; Journalism Practice; Journalism Studies; Learning Media And Technology; Media And Communication; Media Culture And Society; Media Culture Society; Media International

	Australia; Network Science; New Media And Society; New Media Society; Online Social Networks And Media; Pnas Nexus; Poetics; Policy And Internet; Political Communication; Popular Communication; Profesional De La Informacion; Quality And Quantity; Quality Quantity; Routledge Advances In Sociology; Sage Open; Science Technology Human Values; Scientometrics; Social Indicators Research; Social Media And Society; Social Media Society; Social Network Analysis And Mining; Social Networks; Social Research; Social Science Computer Review; Social Science Quarterly; Social Sciences; Social Sciences Basel; Societies; Socio Economic Review; Socio Economic Systems Vol 2; Sociological Methodology; Sociological Methods Research; Sociology Compass; Sociology Of Health Illness; Studies In Big Data; Surveillance Society; Sustainability Switzerland; Technology In Society; Television New Media; Theoretical And Practical Issues Of Journalism; Theory And Society; Theory Culture Society; Tourism Analysis; Tourism Economics; Tourism Management; Tourism Management Perspectives; Triplec Communication Capitalism Critique; Work Employment And Society; Zygon.

A total of 4762 articles were collected. This number was reduced after cleaning operations, which involved eliminating duplicates and removing records with missing information. The final number of articles in the dataset was 3982.

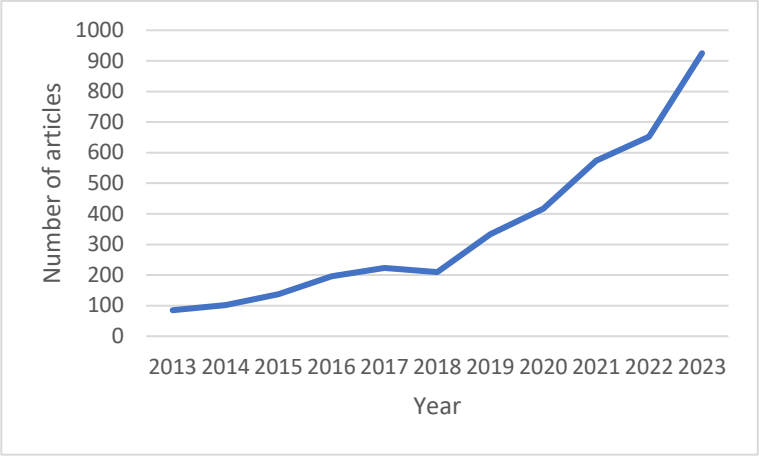
The bibliometric analysis was conducted using Bibliometrix, a comprehensive package designed for quantitative bibliometric research, developed in the R programming language. This package features the user-friendly Biblioshiny interface, used for this work. Bibliometrix is widely acknowledged for its robustness and versatility, proving particularly effective in analyzing datasets derived from multiple databases, as demonstrated in the present study (Aria & Cuccurullo, 2017; Arruda et al., 2022). In the second part of the work, the techniques used in the study of AI were classified based on the role of AI and human actors in the production of data relevant to the research.

4. STUDYING AI: BIBLIOMETRIC AND TOPIC ANALYSIS

From the annual production graph of articles, it can be observed that in 2013, 85 articles were published on artificial intelligence and algorithms. Production has grown steadily, reaching 223 articles in 2017 and showing continuous growth in the following years. There is an annual growth rate

of 26.96%. This trend reflects a growing interest in these topics, which have become increasingly central to the social sciences. This growth can be interpreted through the concept of "datafication" (Van Dijck, 2014), which describes how social practices also occur online, making it necessary for social sciences to study them (Van Dijck et al., 2018).

Figure 1. Annual production

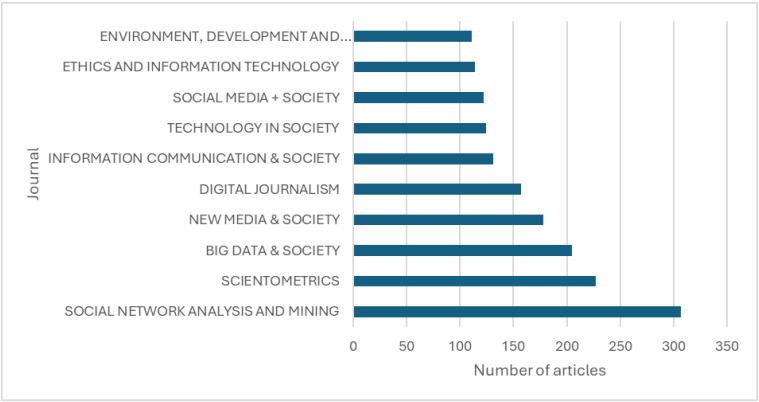


The two most relevant sources are *Social Network Analysis and Mining* (307 articles) and *Scientometrics* (227 articles). The fact that the aim of these two journals is more oriented towards technical and empirical approaches, such as the use of data mining techniques, social network modeling, and quantitative analysis of science, suggests that the social sciences' interest in artificial intelligence and algorithms has developed mainly from an empirical and computational perspective[3]. These journals fully qualify as social science journals, but they also discuss algorithms as tools, not just as objects of research. In these journals, the emphasis is placed on tools and methods for data analysis, rather than on critical reflection. This implies that the inspiration behind the techniques is not necessarily socio-technical; rather, it is more likely to be purely technical. After these first two journals, a significant thematic diversification and attention to critical dimensions can be observed. Journals such as *Big Data & Society* (205), *New Media & Society* (178), and *Digital Journalism*[1] (157) offer a more reflective and interdisciplinary contribution,

[3] For a detailed understanding of the journals' characteristics, please refer to their Aim and Scope pages

focusing on the ethical, cultural, and social implications of data and algorithm usage. Moreover, journals covering topics related to the environment, digital ethics, and the responsible use of technology are emerging, highlighting a wide range of themes that the social sciences are addressing.

Figure 2. Top 10 most relevant resources



From the analysis of the most frequent words[4], a significant focus on social networks emerges, with "social network" appearing 353 times, followed by terms such as "platform" (84 occurrences) and specific references to platforms like "Facebook" (66) and "Twitter", "YouTube" (65). These occurrences clearly indicate that literature focuses on digital platforms. In second place is the term "ethics" (101 occurrences), which is particularly interesting as it highlights that, in addition to interest in technical aspects, there is likely a strong concern for the ethical implications of the use of algorithms and artificial intelligence. Among the most frequent words, "covid-19" (49) also appears, which can be interpreted in several ways. The first interpretation is that the pandemic is mentioned as it caused the inability to conduct research in physical fields, thus increasing the number of occurrences of the word. A second interpretation is that covid forced many in-person activities to move online, opening many opportunities to study social phenomena previously carried out differently. A third interpretation concerns the massive increase in phenomena such

[4] For the text-based analyses, a stop-list was constructed, containing the words used in the query and all the words and expressions referring to types of algorithms and technical procedures. Lemmatization was also performed.

as disinformation and conspiracy theories during the pandemic (Bianchi, 2023). Words like "algorithmic culture" (31), "algorithmic governance" (29), and "bias" (29) signal a lesser but present interest in themes associated with the field of "critical algorithm studies" (Moats and Seaver, 2019).

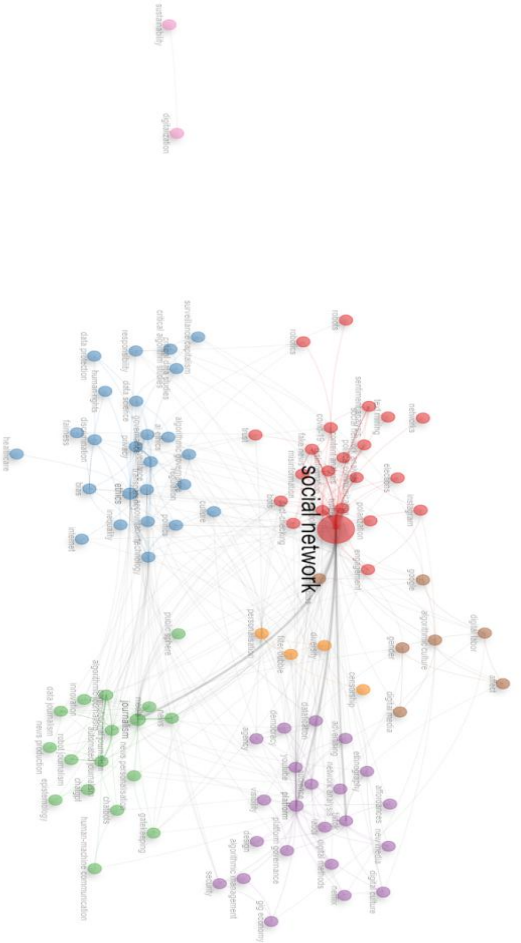
Table 3. Author Keywords Occurrence. Occurrence > 40

social network	**353**
ethics	101
journalism	89
platform	84
facebook	66
twitter	65
youtube	65
surveillance	59
personalisation	51
technology	51
privacy	50
covid-19	49
social network analysis	47
tiktok	46
datafication	45
sentiment analysis	44
transparency	44
computational journalism	43
automated journalism	42

In this section of the work, we will identify the themes and the relationships between them in the literature on algorithms within the social sciences. To achieve this goal, we will use a social network analysis conducted using Bibliometrix on the authors' keywords will be presented. This involves analyzing the relationships between the keywords chosen by the authors. Each keyword is represented as a node, and the connections between keywords form links. The result is a semantic network that highlights the main themes through the keywords that characterize them and any relationship

between them. The clusters have also been renamed with labels that summarize the content of each cluster[5].

Image 1. Social Network Analysis of Authors' Keywords



[5] Louvain was the clustering algorithm used. Normalization was performed using the Jaccard index. Repulsion strength = 0.5; minimum number of nodes = 2.

The red network node, renamed "social networks and analysis techniques", dominates the network, reflecting the importance of platforms in the debate on algorithms and AI. In addition to terms typically associated with social networks, such as polarization, misinformation, fake news, and fact-checking, some of the favored techniques for studying social networks also appear, such as content analysis, sentiment analysis, and text analysis. These techniques have experienced a strong surge due to the study of social networks and have been refined to levels never seen before (Zimmer & Proferes, 2014) also due to COVID, which appears in the same cluster (Cinelli et al., 2020). In this cluster, an empirical dimension emerges; however, it does not draw inspiration from a socio-technical approach. The techniques mentioned are, in fact, limited to textual statistical methods applied to content extracted from social networks.

The second cluster considered is the blue cluster - labeled as "ethics of algorithms" - which seems to highlight terms related to the broader concept of ethics. Among the words in this cluster, we find algorithmic governance, bias, responsibility, discrimination, inequality, and fairness—central concepts in discussions about the ethics of algorithms. It is now well-known that algorithms can perpetuate biases, such as those based on race or gender (Noble, 2018). The presence of the word healthcare probably signals the under-researched yet necessary topic of algorithmic bias and the use of AI in the medical field, as well as its possible impacts on patients (Henwood & Marent, 2019). Also present in this cluster are critical algorithm studies, critical data studies, and data science, which refer to the flourishing fields of research in sociology that aim to study algorithms as socio-technical objects (Aragona & Felaco, 2020). Addressing the ethics of algorithms inherently places the topic within an ANT perspective, even if not explicitly stated. This perspective recognizes that algorithms are not neutral artifacts, but rather sociotechnical constructs embedded with biases and discriminatory logics. These biases should not be seen merely as technical flaws but as the result of interests and power dynamics inscribed into algorithmic design. Furthermore, this topic highlights how algorithmic ethics should not be conceived as an abstract normative principle but as the emergent outcome of a network of interacting actors, both human and non-human.

The green cluster, "algorithm and journalism", concerns the macrotheme of journalism. This cluster is one of the two with the most connections to the red cluster, indicating a relationship between journalism and social networks through AI and algorithms. Automated journalism, robot journalism, and data journalism are some of the words found in this cluster, alongside terms that open important ethical and social implications,

such as the phenomenon of gatekeeping. This concept refers to the selection of news disseminated to the public, which, while previously managed by journalists, has now been transformed by algorithms. It is, in fact, personalization algorithms that compose users' news feeds (Carlson, 2019). It is also interesting to note the presence of the word ChatGPT, increasingly used for producing articles without human intervention (Pavlik, 2023). In a certain sense, this cluster aligns with a Latourian perspective for studying algorithms, problematizing them in relation to their interaction with human actors. In a certain sense, even if not explicitly, this cluster aligns with a Latourian perspective for studying algorithms, as it problematizes them in relation to their interaction with human actors. ANT allows journalism to be analyzed not merely as a human activity but as a network of both human and non-human actors (journalists, readers, algorithms, platforms). Algorithms function as actants that influence the circulation of news, redefining the logic of gatekeeping (Carlson, 2019).
The purple cluster, the second most connected to the red cluster, gathers terms related to social networks, such as TikTok, but also other platforms like Netflix. It is renamed “digital platforms and governance”. Again, we see techniques and fields of study involved with these platforms, such as network analysis and ethnography. The difference between the two clusters lies in concepts such as affordances, digital culture, platform governance, and algorithmic management, which reflect an interest in how digital platforms regulate and manage their users through the broad use of algorithms.

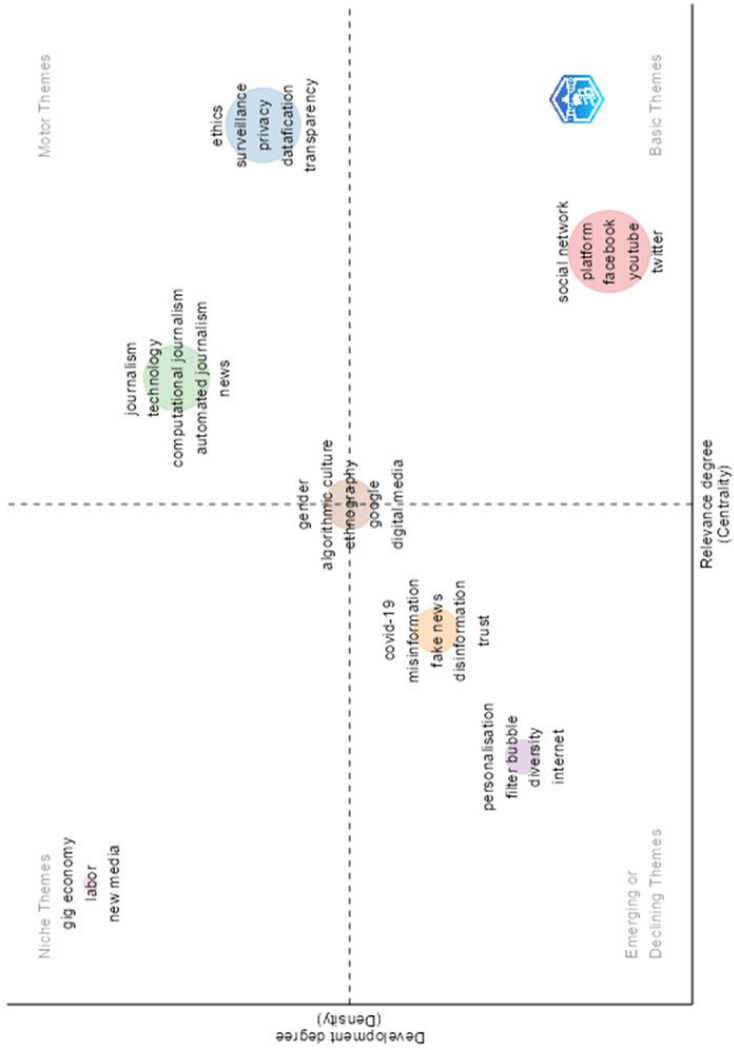
The red cluster, on the other hand, focuses on how algorithms influence the distribution of information, using less qualitative and theoretical approaches. In this sense, the interaction between human and human actors is less prominent, with the focus shifting primarily toward the management dimension.

The orange cluster, renamed “social network issues” and brown clusters, labeled “cultural reflections”, occupy an intermediate position in the semantic network, suggesting that they function as “bridges.” The orange cluster, composed of words like diversity, filter bubbles, personalization, and censorship, mirrors the themes of both the red and green clusters, connecting topics from both social networks and journalism. The brown cluster, meanwhile, includes terms like Google, gender, digital media, affect, and algorithmic culture. It thus refers to empirical dimensions found in the red cluster and more theoretical reflections present in the blue cluster.

In addition to the main clusters, there is a peripheral cluster. The pink cluster, represented by the two words sustainability and digitalization, is completely isolated from the rest of the network, suggesting that these

topics, although relevant, are not yet well integrated into the main debate on algorithms and AI.

Image 2. Thematic map of Authors' Keywords



Among the analyses proposed by Bibliometrix, the thematic map allows us to observe the evolution of the main research topics, dividing them into

four distinct quadrants based on their centrality and density. Centrality measures the importance of a theme in relation to other themes in the corpus. The more central a theme is, the more connections it has with other themes. Density measures the maturity of a theme, that is, how internally developed the theme is. A theme with high density is autonomous, well-defined, and robust (Aria and Cuccurullo, 2017). The output of this analysis is a map divided into four quadrants: driving themes, basic themes, emerging or declining themes, and niche themes.[6]

The motor themes, positioned in the upper right quadrant, are central and well-developed, indicating that they are fundamental to the field and the subject of extensive studies. In this quadrant, we find a group composed of ethics, surveillance, privacy, datafication, and transparency. These themes are crucial for the debate on algorithms and AI in the social sciences. In line with Zuboff's (2019) literature on surveillance capitalism, the theme of privacy is closely linked not only to surveillance but also to transparency and ethics. The fact that these are well-developed themes indicates that numerous studies and extensive debates have been conducted. Some authors, including Zuboff herself, argue that interest in the topics addressed in this work arose following the Cambridge Analytica scandal, which raised global concerns about the use of personal data and the algorithmic manipulation of public opinions (idem). If the debate on the topic opened because of such concerns, it has since become particularly stable.

The second group of words in this quadrant is composed of journalism, technology, computational journalism, automated journalism, and news. This cluster reflects a significant interest in the role of algorithms in journalism and news. Computational journalism (Coddington, 2015) refers to the use of algorithms to automate the collection and distribution of news, while automated journalism refers to the automation of writing without the need for direct human interaction (Diakopoulos, 2019). The field of journalism is thus undergoing significant changes, certainly of interest to the social sciences. The topic is undoubtedly related to the themes of ethics and transparency, belonging to the adjacent cluster, but it also tends to develop distinctly.

In the basic theme quadrant, in the lower right, we find highly relevant topics, but less developed compared to motor themes because they are less autonomous. The cluster composed of social network, platform, Facebook, YouTube, and Twitter is the only one in this quadrant. All the words refer to digital platforms, one of the preferred objects of study in

[6] Louvain was the clustering algorithm used. Repulsion strength = 0; minimum number of occurrences per cluster = 4.

the social sciences over the past decade, but almost never in an autonomous way: platforms are studied extensively but often in relation to other concepts in digital sociology.

In the lower-left quadrant, known as emerging or declining themes, we find two clusters: the first composed of COVID-19, misinformation, fake news, disinformation, and trust; the second composed of personalization, filter bubble, diversity, and internet. Regarding the first, these topics related to AI and algorithms emerged strongly during the pandemic, when digital platforms played a key role in spreading disinformation - even about the pandemic itself - opening numerous debates about how algorithms function as factors in the dissemination of fake news (Bianchi, 2023). The second cluster refers to the effects of algorithms on the visibility of online content and the creation of filter bubbles through recommendation algorithms. Diversity is an important theme in this context, reflecting concerns about how algorithmic personalization can reduce the variety of content (Bruns, 2019). It is plausible to consider the themes present in this quadrant as declining rather than emerging, since COVID-19 is no longer an emerging and central event, thus taking away the strong interest in misinformation and filter bubble topics.

The only niche theme, present in the upper-left quadrant, consists of the words gig economy, labor, and new media. This theme is well-developed but not central, meaning that it represents a well-explored research area but with few connections to other topics. The gig economy appears because of the launch of platforms like Uber, Deliveroo, or Bolt—relatively new media—prompting part of sociology to study how these use algorithms to manage workers (Scholz, 2016). This theme, although having developed a strong theoretical framework to the point of being a stand-alone theme, likely does not use references similar or equal to the other themes related to algorithms and artificial intelligence.

It is curious to observe that at the center of the map, there is a word cluster composed of algorithmic culture, ethnography, gender, Google, and digital media. These themes are in an intermediate position, connected to motor themes as well as emerging themes, to niche themes as well as basic themes, making interpretation difficult.

This bibliometric overview highlights a significant gap in the adoption of approaches rooted in the Latourian perspective, a limitation that is evident in both theoretical reflections and empirical investigations. The absence of theoretical engagement suggests a missed opportunity to explore the socio-technical entanglements and networked relationships that define algorithms and AI. On the empirical side, there is a noticeable lack of methodological innovation inspired by Latour's insights. Furthermore,

the review also reveals a broader disinterest in developing or applying specific techniques to study algorithms and AI. There is a complete absence of specific interest in the techniques employed in studying algorithms and AI, regardless of the underlying theoretical inspiration.

5. STUDYING AI: THE APPROACHES USED

This paragraph aims to identify the approaches employed in empirical research that can be directly or indirectly associated with the perspective of ANT on AI and the human-AI relationship. This body of research can be categorized into two main strands: those that focus on the data produced by AI, and those that focus on the human actor. Specifically, 29 studies have been identified that explicitly focused on AI. In this approach, the data is generated by prompts on various topics, aiming to uncover the embedded logic within algorithms. A significant portion of this research deals with algorithmic bias, which remains a central issue in AI discussions. Studies on bias examine algorithmic outputs to identify discriminatory logic, often affecting specific groups such as people of color or women. It is also worth noting that some studies have analyzed AI-generated outputs to assess technology's ability to contribute to qualitative research. A notable example in this field is the study by Ulloa and colleagues (2024), who systematically queried four search engines (Google, Bing, Baidu, and Yandex) from three different locations, using two browsers and conducting the queries in two waves. They used both gender-neutral terms (e.g., "person," "intelligent person") and gendered terms (e.g., "woman," "intelligent woman," "man," "intelligent man") to access the top 100 image results. The findings confirmed that, similar to other forms of media, search engine images perpetuate biases to the detriment of women. Within this strand of research, there is a notable tendency to apply experimental design. In the aforementioned study, it is evident that the control variable is represented by gender. It is also worth noting that some studies have analyzed AI-generated outputs to assess technology's ability to contribute to qualitative research. These studies have attempted to understand how AI-generated content can be leveraged to provide insights or assist in research across various domains (De Paoli, 2024; Rice et al.,2024). Regarding the approaches, it can be said that the vast majority of studies within this strand adopt an auditing perspective (Aragona and Felaco, 2020), analyzing the algorithms through third-type content analysis tools. This type of analysis involves interrogating the output of AI (as a cultural product) using analysis grids, similar to questionnaires.

Seventy-one studies were identified with reference to the second line of research. The first notable aspect is that qualitative approaches dominate this field. Many studies have employed interviews, observations, or ethnographic methods. Regarding quantitative approaches, the most commonly used tool is a questionnaire, which is occasionally incorporated into experimental research designs. In other words, the methodologies employed in most of these studies align with traditional research tools. However, innovation in these procedures emerges in contexts in which data are produced. Some studies, for instance, have utilized walkthrough or scroll-back methods to generate research-relevant data. In one study, data collection involved automated tracking authorized by the students themselves.

6. CONCLUSIONS

The study aimed to understand (a) which macro-themes the social sciences are focusing on and to what extent themes are inspired by the Latourian perspective, (b) which empirical approaches are emerging in the study of algorithms and if there are innovative approaches. Referring to the first research question, the growing interest in this topic within the social sciences reflects a profound transformation in how we study contemporary digital society. In particular one of the most evident research interests concerns social networks, particularly in relation to phenomena such as disinformation, filter bubbles, and information gatekeeping, especially during significant events like the COVID-19 pandemic. These platforms act as critical sites for understanding the dynamics of information flow and their impact on public perception and behavior. Another major theme that has emerged involves the ethical use of algorithms and the study of algorithms to uncover the contents of "black boxes" (Pasquale, 2018). This reflects a growing need within the social sciences to achieve greater control and transparency from those employing algorithms and artificial intelligence. Overall, the bibliometric analysis suggests a significant diversification in terms of the themes related to AI and algorithms within the social sciences, leading us to reflect on an increasing interdisciplinarity in the field. Despite this significant diversification, there does not appear to be a strong influence of the ANT theory, except in relation to the topics "algorithm and journalism" and "ethics of algorithms", which partially prompt a reflection on algorithms as socio-technical objects. This observation should encourage social scientists to engage more deeply with socio-technical perspectives, as they provide

valuable tools for unraveling the complexities of algorithmic systems and their embedded power dynamics. The ANT approach can have significant applications both within and beyond the academic sphere. For instance, as highlighted in the "ethics of algorithms" cluster, this perspective would encourage deeper reflections on algorithmic discrimination, fostering a more interdisciplinary approach to algorithm design. Bringing together social scientists, humanities scholars, and developers in the construction of algorithms would help move beyond a neutral or purely technical view of these systems (Aragona & Felaco, 2020). Furthermore, adopting an ANT perspective to analyze the feedback loop (Mansoury et al., 2020) between algorithms and users could be particularly valuable for designing more informed regulations on algorithmic governance. Algorithms should not be regarded as neutral entities, and citizens must be made aware of the continuous and reciprocal influence that exists between them and algorithmic systems (Zarouali et al., 2021).

In answer to the second question it can be said the techniques used in the analyzed research revealed a predominance of classic social science tools such as interviews, observations, and questionnaires. However, within this body of research, there has also been an increasing use of experiments, which is particularly effective in analyzing AI because of the possibility of isolating and testing specific variables in controlled environments. An element of innovativeness is not so much in the techniques analyzed as in the context of data production. Technique such as walk-through or automated tracking, as well as the observation of interactions between humans and machines, represent new frontiers for data collection. These approaches make it possible to capture social phenomena in situations where artificial intelligence actively intervenes, generating new opportunities for the study of socio-technical dynamics and showing how social research maintains strong ties to its traditional roots but, at the same time, is enriched by innovative approaches that exploit the peculiarities of human-AI interaction.

Beyond their application in AI studies, these methodological advances offer valuable insights for broader social research. Techniques such as automated tracking, walk-through methods can be applied to various social phenomena beyond automated systems. For instance, automated tracking can be used in ethnographic research to analyze movement patterns in urban spaces, educational settings, or workplaces, offering insights into how individuals interact with infrastructures, learning environments, or hybrid work models. Similarly, walk-through methods, traditionally used for digital platforms, can be adapted to narrative research, helping investigate experiences with bureaucratic processes such

as housing applications or access to social services. By extending these methodologies beyond AI studies, social research can uncover new dimensions of human behavior, institutional dynamics, and socio-political transformations. This demonstrates how social sciences can integrate innovative data collection strategies to explore a wide range of issues beyond automation and artificial intelligence.

It is crucial to acknowledge the limitations of this study. First, there may be inconsistencies in the results if reproduced. The database was compiled on October 1, 2024, meaning the data reflects that specific date. For instance, by the time a reader accesses the information, the article count might have changed, as some contributions may be retracted for various reasons, such as data manipulation, incongruent results, plagiarism, or copyright infringement. Another limitation of bibliometric analyses that must be highlighted is the inability to fully capture a topic due to the absence of a perfect query capable of encompassing the entire subject under investigation. The query terms used may not cover all relevant publications, leaving gaps in the analysis. This research can be seen as a first step, and future studies could include a more robust analysis using the PRISMA framework (Page et al., 2021), along with deeper qualitative investigations. In addition, it would be valuable to extend the analysis of techniques used in AI and algorithm studies to previous years, rather than limiting the scope to the most recent year. This would provide a more comprehensive view of the evolution of methods over time.

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