Meta-Analysis of AI Research in Journalism

Shivani Patel* and Kumar Mausam

Uttar Pradesh, India

ABSTRACT

The use of artificial intelligence tools in newsrooms is revolutionary and controversial as well. Despite the promising opportunities provided by AI to enhance digital journalism practice, it also raises several legal, professional, and ethical considerations. Research about AI in Arab media is a promising area of interest that increasingly attracts scholars. However, there is a need for systematic and purposive growth in future research about AI and media, that considers the socio-cultural and economic contexts of countries and meets the priorities and needs of media organizations. Accordingly, this paper provides researchers with an overview of the main challenges and debates in the field of AI and journalism studies. This study applies a systematic review of a sample of English written studies from 2014 to 2022 about the implications, challenges and considerations of using AI in newsrooms. Based on the analysis, the study proposed a future research agenda about AI and journa

*Corresponding author

Shivani Patel, Uttar Pradesh, India.

Introduction

Artificial intelligence (AI) as a range of technologies including machine learning, automation and data processing is a significant part of journalism already but it is unevenly distributed [1, 3]. During the last two decades, using artificial intelligence tools increased in different newsrooms worldwide including news media outlets, while different newsroom started using automated artificial intelligence tools to help in editing process. An existing language-based divide had bounded news media outlets from adopting such AI tools and limited their implementation especially in newsroom routine work [4].

AI innovation paved the way for new types of news stories. The widespread adoption of AI in newsrooms made it an important topic for research. An increased number of studies were conducted to get deep insightful perspective of AI uses in different journalistic practice [5].

Nowadays computation and digital innovative tools support journalists by helping them generating news at higher speed using Big Data. From another point of view, news generated by algorithms will not be as quality as human-written news because algorithms do not have creativity, values, insights, and emotions [6].

Although Artificial intelligence was a result of several discipline efforts from engineering to computer sciences and linguistics, journalism practice benefits from this development in several ways [7]. Recently, AI played a curial role in enhancing journalists' skills and abilities. They can use AI with all types of data.

The increasing usage of AI applications in the field of journalism represents a shift in the journalism industry, which reflects an engagement between social and technological factors. At the same time, using AI in journalism also increasingly attracts researchers' attention. Scholars widely examined AI applications in the field of media practice under different research areas like algorithmic decision-making in respect with the algometric distribution of media content, computational journalism that focuses on how the advanced technologies support journalists' daily work and the newsroom automatization discipline that examines the usage of smart applications in news industry like platforms of distributing news on social media and data mining techniques, etc [8, 9].

Like data journalism and other innovative media practices, media organizations' usage of AI applications is still in its early stages [10]. In parallel, there is rapid growth of research about AI in journalism [11]. The sociocultural, economic, and political contexts in countries highlight serious challenges, problems, and considerations of the usage of advanced technologies in media. Bearing in mind the very limited analytical reviews available about AI and journalism in research, there is a need for systematic research to enhance future research outcomes for journalism. Accordingly, this study maps and analyzes the scientific production about challenges and opportunities of AI in media practice. It provides researchers with a review of debates that are occurring in AI and journalism research and suggests a roadmap for future journalism research.

Literature Review

Nowadays Artificial intelligence gained popularity as it interacts with different aspects of daily life. Integrating AI in news gathering allows using several features such as machine learning, computer vision, speech recognition to convert voice data into text data, natural language processing (NLP) to understand and respond to text or voice data, and robotics that refer to enabling computers and systems to perform regular human tasks [10].

Computational Journalism is a broad term that deals with journalism practices that use AI techniques and tools to dig into data and enable journalists to analyze data; identify patterns, trends, and insights from multiple sources, it can also track audience sentiments [12].

Computational journalism includes many detailed concepts such as automated journalism that refer to software that transform data into readable news stories [12]. Developing AI tools during the last decade paved the way and helped journalists in different countries to produce news stories. Mentions that it can help to tell new types of stories that lead to innovative practice of Journalism [13]. Fully automated and semiautomated forms of gathering, filtering, composing, and sharing news occupied a greater place in a growing number of newsrooms opening discussions about shifts in the norms, patterns, and routines of news production were happening, and at a more fundamental level, taken-for granted ideas about by who (or what) journalism was being challenged [7].

Research on journalism and computation as artificial intelligence – and the human–machine communication that it facilitates – becomes a more salient factor in the way people make sense of the world and create meaning, both with each other and in relation to machines. In addition, analyzing AI journalism initiatives and practices helped to understand AI journalism potential and limitations.

Implementing AI tools in newsrooms refers to a wide journalism usage such as finding and contacting sources, adjusting objects faces or colors, converting speech into text, editing audio and video, identify sentiment of readers in different platforms. Those tasks usually took time and efforts from journalists. Research predicts that AI tools will not substitute journalists, these technologies are more likely to complement human work by increasing its quality and efficiency.

The production of Automated news stories without human intervention was known as Automated Journalism and Robot Journalism. AI implementation will not elim inate jobs in the media industry but increase speed and efficiency of reporters and video producers through different tools that allowed machines to write different versions of one story and create videos of related footage out of keywords.

Digitization of news content production allow it spread in many digital platforms. it also allows personalization of news distribution to reach the target audience and open a variety of opportunities for collecting and analyzing large amounts of audience and consumption data. Recently, Automation in journalism has increased reader revenue for publishers, lowered costs and it has rapidly expanded coverage in any topic on which automated content can be produced.

Objectives
- What are the main trends dominant in the scholarly research on automated journalism recently.
- which areas are studied most and using which methodological approaches, and what are the gaps present in this research?

Research Methodology
The focus of this paper is to analysis the contributions of previous research about the use of AI applications in journalism to identify the main areas of interest, and then to propose a research agenda about AJ.

This paper applied a thematic and quantitative descriptive analysis to analyze the key features of a selected sample of academic contributions to provide researchers with a good understanding of the main debates about the potentials and challenges dominating in this growing research area, and to present suggestions for future research about automated journalism.

Data Analysis
The selection of the texts based on the existence of specific keywords ("algorithmic journalism", "automated journalism", "artificial intelligence" and "journal- ism", "big data" and "journalism") whether in the titles and/or abstracts or full text of manuscripts, through four scholar databases which are Google Scholar, Scopus, Research Gate and Dar Almandouma. The sample includes peer-reviewed theoretical and empirical journal articles, book chapters, reports, conference proceedings that were published in English. Overall, 35 texts were examined, covering a period from 2014 to January 2022. Figure 1 shows the increasing interest in research over time. The sample consists of (31) articles published in peer-review journals, (2) reports, (1) conference proceedings, and (1) book chapter.

After a thorough reading of the collected articles, we applied a quantitative and qualitative descriptive analysis to manually extract information about the following categories: Basic data: date of the publication, number of authors, title of the article, the keywords, type and scope of the study and the disci- pline(s), type of publication, main focus and secondary focuses (if applicable), the methodologies and research techniques, theoretical framework, the most important results, and limitations of the study (if applicable).
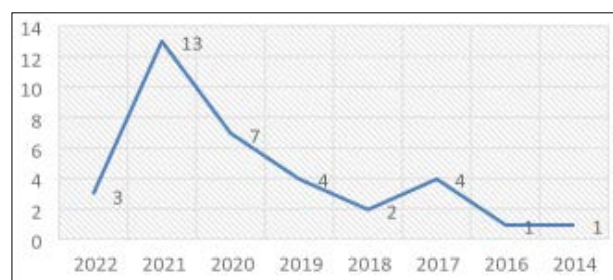

Figure 1: Distribution of the Sample from 2014 January 2022.

Sample Characteristics
Co-authored scholar research production represented 55% compared to 49% individually authored. English-published texts constitute 73% of the sample, while other texts constitute 31%. Total (10) texts of the sample cover either geographical inter- national scope or not specific, texts of the sample cover countries including: Egypt, Nigeria, China, South of Africa, Argentina, Spain, and UK, while only are of regional scope; Western Europe [13, 14].

The review showed that texts of the sample belong to the "Journalism and mass communication" discipline, while texts are interdisciplinary, including (6) belonging to Sociology and (4) belonging to Computer Sciences (Figure. 2) [15, 16]. This reflects that research about the challenges and consideration of using AI in journalism can better go for more interdisciplinary research.

The dominance of the qualitative method in the sample can be partially explained by the explanatory nature of most of the texts, which is understandable considering early stages of research in this field. Total (18) of the sample applied qualitative
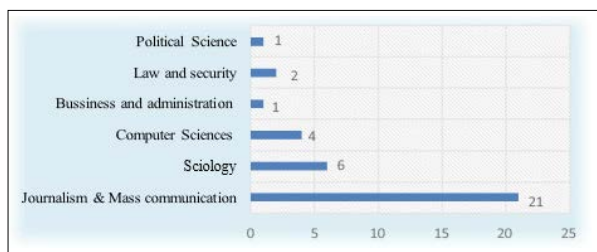
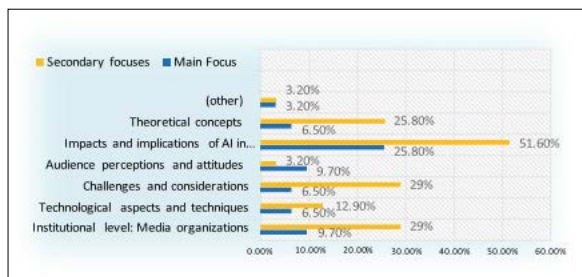**Figure 2:** Distribution of the Sample According to the Discipline.

Figure 3: Main and Secondary Focuses of the Research Sample.

Method applied mixed-method, and quantitative methods, most of them in studies.

Consistently, in-depth interviews were the most qualitative method applied; texts. used in texts, surveys were dominant in quantitative studies and were mainly applied to collect data from journalists or media students [5, 17]. Case studies represent media organizations that applied AI.

Impacts and implications of using AI applications in journalism topped as main focus in 26% of the sample, besides, even if the studies focus mainly on another topic, the impacts and implications comes first as secondary focus of 52%. Notably, challenges and considerations related to using AI in journalism comes as a main focus in just 7% of the sample and comes as a secondary focus in 29% of the sample. (Figure. 3).

The analysis of most-frequent keywords showed that English-written texts used more varied keywords than Arab-written texts, (Figure. 4). This result indicates the need to achieve better understanding of differences between the terms and how these differences could reflect different types of using AI in journalism [5].

Result

One of the biggest challenges for Automated journalism is the early stage of development of Natural Language Processing (ANLP). This is an application of AI and machine learning used to understand Modern Standard and dialects.
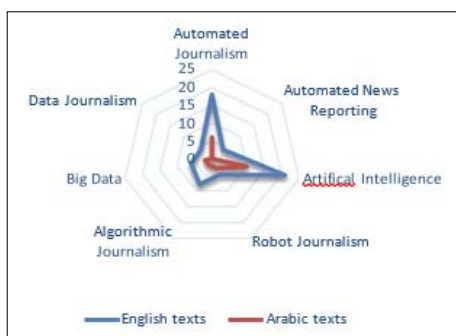

Figure 4: Most-frequent keywords used in the sample.

Despite the increasing research in this field more work is needed to effectively use it in Automated news production.

Research about using AI tools in journalism reflected researchers' perspectives about several ethical and professional challenges that should be carefully handled as long as increasing number of media organizations adopt using AI tools. Using algo- rithms in journalism can help overcome some ethical challenges that traditional media faced. It helps unburden journalists from daily extensive routine work, giving them an opportunity to focus on in-depth analysis and reporting, and enables journalists to consider moral requirements in their work like checking multiple news sources, giving more attention to human dignity and respect privacy, etc. [16]. However, previous research about AI in journalism highlighted several ethical and profes- sional challenges that emphasize the importance of the role of human journalists and the need for advanced skills in modern newsrooms.

In this regard, the meta-analysis, conducted by Graefe & Bohlken on readers' preferences of human-written versus automated news, revealed that human-written news stories were rated better than automated news with respect to quality. However, they pointed to a possible ethical challenge related to news organizations and how they could deal with readers' disapproval of automated news. Moreover, there is another concern in this regard as news organizations are more interested to adopt AI to avoid costs of human journalists' resources [18].

In his article, Ali concluded several professional challenges like undermining creativity and the absence of monitoring and bias, in addition to ethical challenges like missing transparency, insufficient fact-checking and data manipulation. Regardless of the technological development and the advanced tools used to collect and process data, journalism is still about critical thinking that answers the question "why" and help to make people better aware of events and important public issues. Biswal and highlighted professional concerns about data AI-driven journalism that could lack creativity, humor, and critical thinking which will remain forever in the field of journalism [18]. Another perspective about ethical considerations of using AI in media was provided by who discussed concepts of AJ ethics and differentiated between new media ethics, digital media ethics, cyberethics, and traditional media ethics [16]. According to them, algorithmic journalism's ethical implications are in the overlapping fields of digital media and cyberethics.

Research emphasized the danger of AI bias, and the hard work human journalists should do to highlight how they used AI to help their reporting or production [19]. The analysis revealed different views in this respect. While Thurman et al. supported the idea of "mechanical objectivity," or the belief that Algorithms, Automation, and News machine systems are capable of offering representations and outputs "that overcome the limits of human subjectivity, other researchers urged that algorithms may generate unbalanced news due to biased data obtained from biased sources [7]. Dalgali and Crowston pointed that data inputs could be created to manipulate readers' minds and attitudes towards current events according to the data providers' purposes, while readers perceive these manipulated stories as objective, since they are automatically generated.

In the same context, urged that the accountability of the automated news transmitted becomes more important in the political field if it reflects the public debate [20]. Readers should be clearly informed of how AI tools were used to collect data, their publicity, perform

an analysis, and whether the stories are auto-matically generated or human-written production [19]. If not, this is an ethical concern related to transparency. The question is if ethical rules are violated, errors occur, or collected data are misused, who will be responsible for such violations?

Obviously, the use of AI and big data provides opportunities to enhance reader engagement and content personalization and can contribute to the improvement of professional practice [21]. However, according to Hansen et al, production there is a challenge of achieving "a balance between personalized content focusing on individual interests and remaining committed to journalism's public service mission the public". Another concern arises due to the increasing role of the 'Big Tech' technological competitors, like Facebook and Google, in the news industry and their control of research and product development, urging a need for transparency, dialogue, and support for journalism from technology companies.

According to Santos and Ceron, most of the applications that use AI in the news industry rely on grants from big tech companies such as Google and Facebook, which rises serious concerns to the development of technological innovations in news media since "these 'Big Tech' decide who receives their money, when they receive it, and where it goes" [22]. Research also revealed other concerns as technological devel-opments have no solutions to legal problems emanated from algorithm-generated content about private citizens. The communication and knowledge gaps between journalists who use AI tools and programmers who design them, probably leads to journalistic malpractice.

On using artificial intelligence tools in journalism is still in its infancy. However, as this phenomenon has already changed many professional practices in journalism, researchers from different countries like United States and Western Europe provided some interesting academic work. Meanwhile, reviewing previous studies about AI and journalism revealed that only few of them suggested future research areas based on their findings.

Accordingly, this study aims to suggest future research agenda based on the thematic analysis of the available academic production. This will help Arab researchers to fill the gap and focus on research areas that meet media organi-zations' needs to develop their usage of AI, and to handle the possible ethical and professional challenges and considerations resulted from using AI in newsrooms.

Theoretical and Methodological Considerations

Although research of AI applications used by news organizations is still in its early stages, review of the ic sample reflected the emphasize on empirical research without providing sufficient theoretical contributions to study the new phenomena in the socioeconomic, cultural, and political contexts in countries. This is not a new concern in media research, according to, the introduction of mass media studies in countries was marked by strong Western influences, limiting the scope of several empirical studies to specific countries or languages, preventing generalization of results. studies about AI and journalism either repeatedly applied the same theoretical approach "Technology Acceptance Model" or the "Diffusion of Innovations" [23, 24].

We suggest future research to work on developing a theoretical approach that help to study and interpret journalism in a comprehensive context. The analysis also highlighted the ambiguity of definitions between Automated journalism, big-

data journalism, Robot journalism, AI journalism and algorithm journalism, as those terms were used interchangeably due to the vague boundaries between them. There are different types starting with Computer Assisted Reporting (CAR) where journalists use technology to access information, store it and process it, use data bases and algorithms in data analysis and processing, then produce a fully automated content. Some definitions focus on the automated content production as most important aspect of algorithmic journalism, while neglecting other applications of algorithmic technologies in the news production field.

Other definitions described the wider scope of applying algorithms in journalism, referring to the integration of algorithms technology, data, and knowledge from the social sciences to complement the accountability function of journalism. Although broad definitions include the various technological applications used in journalism and emphasize the contribution of human workers in these procedures, such definitions should be avoided, as they do not help to get better understanding of the exact focus of the subject matter. Accordingly, we suggest that future research should differentiate between fields of using technology in journalistic professional practices.

Audience Research

In this meta-analysis research, showed notable findings of users' preferences to automated compared to human- written news, while the direction of effects differed depending on the type of evidence of the study [25]. Studies also concluded that we still do not know what factors make users perceive automated and human-written news to be more or less credible or readable [15, 18, 23]. It is still not clear why automated news tend to be perceived as more credible but less readable than human-written news.

On another side, studies about AI applications usage in journalism haven't yet considered readers' perceptions and preferences of automated and human- written journalism [26]. Alternatively, they focused on examining journalists' attitudes towards using AI tools and what impacts resulted of this practice in newsrooms. This highlights the need to thoroughly study audience and readers' perceptions to automated news and content, and what factors affect their perceptions of quality and credibility of such content.

Conclusion

Although journalists face many problems in most countries to access information and obtain accurate and updated databases available as open source, we are talking about AI technology as a new actor in the newsrooms [10]. While journal ists still fight to get access to data, self-training on using open-source technologies, and practicing digital storytelling, introducing AI in newsrooms at this stage with no adequate preparation, raises several concerns and challenges. This critical situation mandates a clear agenda for academic research in this early phase.

Studies discussed AI in the field of journalism through various perspectives; technical (media as professional practices, values, and norms), ethical and legal perspectives, and social perspective. Other perspectives include media institutions, journalists, and users' preferences.

Many of the reviewed sample did not follow a theoretical framework, few of them focused on the conceptual basis of the new phenomenon. However, examining AI in a wider context requires considering micro and macro factors, and analyzing institutional, professional, and socioeconomic factors affecting the usage of AI applications in media.

Although studies pointed to the importance of AI and algorithmic technologies in making news more objective through working effectively in data collecting and data mining, however, journalists still hold the responsibility for selecting which stories to publish or to neglect. A controversial aspect about responsibility of journalists in comparison to robots is programmers; one of the most highlighted themes in the literature review. There are many aspects that previous research highlighted as priorities in future research including how the performance of human-written and automated news evolves over time [27]. Future researchers should investigate the new professional roles in newsrooms due to the influence of AI and the role of 'Big Tech' companies in enhancing or limiting innovations in newsrooms [28].

We suggest future research should identify which journalism fields AI can improve and produce innovations into with lower risk possible. Also, research should analyze challenges and best innovative practices of using AI in Arab journalism field to promote and encourage using AI as a work routine [29-37].

Developing curriculum to introduce AI skills in universities can support future generations of journalists with AI skills and tools. Meanwhile, organizing training sessions for AI practice in Journalism will improve its usage in newsrooms. Scholars should also consider developing new models for traditional theoretical approaches to study the impact of using AI in journalism on their audiences. Users' preferences, behaviors, and attitudes towards automated vs. human-written news content are still uncovered research area. This could be interpreted by the explanatory phase of AI in journalism. This primary stage allows researchers to conduct empirical studies to examine user's perception of credibility, quality, and interest in automated content. Additionally, there are no scholar contributions to educating media skills and requirements to upskill media students in the AI era. This is a research gap in the academic production about AI and Journalism. Finally, despite the limitations of this study it can help to crystalize the agenda for future research about AI and journalism.

References

1. Scholar, Makhanlal Chaturvedi national university of journalism & comm Bhopal.
2. Assistant professor at Quantum university Roorkee, Uttarakhand.
3. Beckett C (2019) New powers, new responsibilities, a global survey of journalism and artificial intelligence. London School of Economies and Political Sciences, London.
4. Jusoh S (2018) A study on NLP applications and ambiguity. J Theor Appl Inf Technol 96: 1486-1499.
5. Danzon-Chambaud S (2021) A systematic review of automated journalism scholarship: guidelines and suggestions for future research. Open Res Europe 1: 1-19.
6. Dalgali A, Crowston K (2020) Algorithmic journalism and its impacts on work. In: Computation journalism symposium. The national science foundation
7. Thurman N, Lewis SC, Kunert J (2019) Algorithms, automation, and news, Digit J 7: 980-992.
8. Matt C (2018) Automating judgment? Algorithmic judgment, news knowledge, and journalistic professionalism. New Media Soc 20: 1755-1772.
9. Bucher T (2017) Machines don't have instincts': articulating the computational in journalism. New Media Soc 19: 918-933.
10. Fahmy N, Attia MA-M (2021) A field study of Arab data journalism practices in the digital era. J Pract 15: 170-191.
11. Elgayyar S (2021) Recent trends of the research about the impact of artificial intelligence on the media product. J Public Relat Res 9: 10-77.
12. Lewis SC, Guzman AL, Schmidt TR (2019) Automation, journalism, and human-machine communication: rethinking roles and relationships of humans and machines in news, Digit J 7: 409-427.
13. Stray J (2019) Making artificial intelligence work for investigative journalism, Digit J 7: 1076-1097.
14. Abdel-Latif M (2021) Adoption of Egyptian press institutions to artificial intelligence tech- nology in producing and editing news and journalistic topics: experiences of some foreign newspapers. Egypt J Public Opin Res 20: 1-68.
15. Kotenidis E, Veglis A (2021) Algorithmic journalism current applications and future perspectives. J Media 2: 244-257.
16. Dörr KN, Hollnbuchner K (2017) Ethical challenges of algorithmic journalism. Digit J 5: 404-419.
17. Diakopoulos N (2019) Algorithmic accountability. digital. Journalism 3: 398-415.
18. Biswal SK, Gouda NK (2020) Artificial intelligence in journalism: a boon or bane? In: Optimization in machine learning and applications. Springe 155-167.
19. Hansen M, Roca-Sales M, Keegan J, King G (2017) Artificial intelligence: practice and implications for journalism. Tow Center for Digital Journalism, Columbia University 1-21.
20. Monti M (2018) Automated journalism and freedom of information: ethical and juridical problems related to AI in the press field. Opinio Juris Comparatione 1: 1-17.
21. Calvo ST, Vila P (2021) Exo journalism: a conceptual approach to a hybrid formula between journalism and artificial intelligence. J Media 2: 830-840.
22. Santos MFD, Ceron W (2022) Artificial intelligence in news media: current perceptions and future outlook. J Media 3: 13-26.
23. Ayish M (1998) Communication research in the Arab world: a new perspective. Javnost Public 5: 33-57.
24. Jia C (2020) Chinese automated journalism: a comparison between expectations and perceived quality. Int J Commun 14: 2611-2632.
25. Graefe A, Bohlken N (2020) Automated journalism: a meta-analysis of readers' perceptions of human-written in comparison to automated news. Media Commun 8: 50-59.
26. El-Khuly S (2020) Tendencies of Egyptian journalists towards employing artificial intelligence in developing journalistic content of informational richness: a field study. Egypt J Media Res 72: 101-173.
27. Haim M, Graefe A (2017) Automated news: better than expected? Digit J 5: 1044-1059.
28. Santos MFD, Salaverría R (2021) From data journalism to artificial intelligence: challenges faced by La Nación in implementing computer vision in news reporting. Palabra Clave 24.
29. Abdel-Hamid A (2020) Egypt and UAE mass communication students' acceptance of using artificial intelligence applications and its impact on their future careers: a study based on the technology acceptance model. Egypt J Public Opin Res 19: 341-409.
30. Al-Attar S (2022) Automated Journalism. Campaign 50.
31. Ali W, Hassoun M (2019) Artificial intelligence and automated journalism: contemporary challenges and new opportunities. Int J Media J Mass Commun 5: 40-49.
32. Aram A (2021) The future of journalists in the age of artificial intelligence (robot journalism model). J Media Res 4: 1673-1702.
33. Hamilton JT, Turner F (2009) Accountability through algorithm: developing the field of computational journalism. report from developing the field of computational journalism.

In: Center Advanced Study in the Behavioral Sciences summer workshop

34. Mousa E, Abdulfattah A (2020) Attitudes of journalists and leaders towards employing artificial intelligence technologies in newsrooms of the Egyptian newspapers. J Public Opin Res 19: 1-66.

35. Musleh Al-Sartawi AMA (eds) (2022) Artificial intelligence for sustainable finance and sustain- able technology. In: ICGER 2021. Lecture notes in networks and systems, Springer, Cham 423.

36. Parratt-Fernández S, Mayoral-Sánchez J, Mera-Fernández M (2021) The application of artificial intelligence to journalism: an analysis of academic production. Profesional de la Información 30: 1-12.

37. Trattner C, Jannach D, Motta E, Meijer IC, Diakopoulos N, et al. (2021) Responsible media technology and AI: challenges and research directions. AI Ethics 2: 585-594.