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Assessing Sentiments Towards Artificial Intelligence in the Croatian Media Using the ChatGPT Artificial Intelligence Tool

Ivana Erceg Matijašević*
Martina Baričević Debelec**
Ljerka Luić***

ABSTRACT

Algorithms and artificial intelligence (AI) tools are crucial for digital literacy and competitiveness in today's high-tech environment, transforming jobs across various sectors, including the media. The history of journalism is closely linked with technological development; from Gutenberg's printing press to radio, television, the internet and AI tools. This paper aims to determine the perception of AI in the Croatian media and its alignment with Croatian journalists' opinions, as well as assess ChatGPT's effectiveness in sentiment analysis. The insights gained should improve the understanding of the impact of AI on public opinion and its ethical implications for journalism. The research methodology combined AI-driven sentiment analysis (ChatGPT Plus) with qualitative content analysis. A total of 45 articles about AI published in the Croatian media between April and September 2023 were evaluated. Two hypotheses were tested: H1, that ChatGPT's sentiment analysis matches human assessment, and H2, that the Croatian media generally express a positive view of AI. The results confirmed H1, with ChatGPT's sentiment analysis corresponding to

*Ivana Erceg Matijašević, PhD Student of Media and Communication, University North; iematijasevic@unin.hr

**Martina Baričević Debelec, PhD Student of Media and Communication, University North; mabaricevic@unin.hr

***Ljerka Luić, Full Professor, University North; ljluic@unin.hr

human assessment in 44 out of 45 cases. H2 was partially corroborated; sentiment distribution pointed to neutral (42%), positive (36%), and negative (22%) views of AI. Positive articles highlighted the benefits of AI in areas such as healthcare, while negative articles raised privacy and employment concerns. The results point to a balanced perspective on AI in the Croatian media, recognising advantages and risks alike. Future research can expand on these findings by examining long-term sentiment trends in domestic media and comparing them with global trends. Improved AI tools for independent data collection and more accurate sentiment interpretation can further support this endeavour. Additionally, this paper paves the way for further sentiment analysis of media articles, exploring the implications of AI application on readers' perception and reception of information.

Keywords: artificial intelligence, ChatGPT, digital competitiveness, digital intelligence, journalism, sentiment

Introduction

In recent years, there has been a surge in technological advancements, with algorithms, applications, and digital tools becoming an integral part of everyday life for individuals and businesses alike. The knowledge and skills required in today's dynamic environment change and evolve at an unprecedented pace. Accepting and fostering innovation, with special emphasis on curiosity, agility, and experimentation (Baričević and Luić, 2023), is crucial for developing the competences necessary for functioning in such an environment. The development of digital intelligence as a set of technical, social, emotional, and cognitive competences related to the digital environment, represents a way to bridge the digital and knowledge gaps caused by fast-paced advancements (Škoda and Luić, 2019). Moreover, digital tools, especially artificial intelligence (AI), offer a way to attain and maintain digital competitiveness. "Being competitive means being different from others, innovative, flexible, resilient, and adaptable to changes in the environment" (Martinčević, 2022, p. 542). Currently, competitiveness – aka digital competitiveness – is impossible to achieve without using new digital technologies. Digital competitiveness refers to the ability to use digital technologies to improve performance, efficiency, and innovation, and is therefore related to the effective use of data and AI literacy. The latter includes data analysis and information literacy needed for informed decision-making, understanding and applying AI technologies, algorithm literacy, data security awareness, lifelong

learning and adaptation to new technologies, applying ethical standards to the usage of data and AI, as well as cooperation and dialogue about the digital environment.

The current technological advancement introduces novel opportunities across several areas, with the media not lagging behind. The history of journalism is inextricably intertwined with technological advancements; from Gutenberg's printing revolution through the eras of radio and television, the advent of the Internet, and the contemporary surge in artificial intelligence. Due to its abilities to solve a wide range of tasks, as well as conduct analysis and interact, which are all traditionally linked to human intelligence (Beckett, 2019), artificial intelligence is often referred to as cognitive technology (Noain-Sánchez, 2022), and, as such, is becoming a key figure in the media environment, transforming the way media content is created, distributed and consumed (Bebić, 2023). In a way, the launch of ChatGPT at the end of 2022 can be considered the beginning of the widespread AI-driven innovation in journalism. Before that, media content was created exclusively by individuals, whereas today various languages, images, voices and videos are produced by artificial intelligence. It seems that artificial intelligence not only reduces the workload, but more importantly, influences the interaction between the media, content, audience and operation, improving its quality and speed (Bebić, 2023). On the other hand, there are some considerations about a possible replacement of journalists with generative artificial intelligence, raising the question of whether artificial intelligence tools pose a threat to or an opportunity for journalism. Previous research has shown that a spectrum of sentiments is present among journalists regarding artificial intelligence, and although the profession recognises the transformational potential of technology, there are still concerns about the risks arising from its use, as well as the possible challenges associated with its implantation.

In consideration of the insights derived from literature review and previous research, the need for further research on artificial intelligence in journalism has been recognised. In accordance with this, various questions are being raised, such as: Are the sentiments of Croatian journalists towards artificial intelligence, as expressed in previous research, reflected in articles written about artificial intelligence? And what concepts would be associated with positive and negative sentiments towards artificial intelligence? Also, could a sentiment analysis be performed with the help of the ChatGPT AI tool, and would a qualitative content analysis be aligned with the results provided by ChatGPT?

Sentiment analysis of media announcements can contribute to understanding the media's general perception of artificial intelligence and its influence on the formation of public opinion on this matter. Furthermore, the results of this research contribute to the current discourse on the future of artificial intelligence in journalism,

and can facilitate an understanding of artificial intelligence's diverse application, challenges and future directions in the ever-changing media environment.

In order to answer the research questions, the following hypotheses were put forward:

H1: The sentiment analysis of articles conducted with ChatGPT aligns with the results of the qualitative content analysis of the articles.

H2: The sentiment analysis of articles in the Croatian media on artificial intelligence will show a predominantly positive tone.

The research was conducted online, using the ChatGPT Plus platform as the artificial intelligence tool, which analysed a sample of newspaper articles on the subject of artificial intelligence written from April to September 2023.

This study aimed to research the sentiment in the Croatian media communications about artificial intelligence. The research specifically took into account the views of Croatian journalists and editors derived from previous research (Grmuša and Prelog, 2020), in which the respondents emphasised the importance of human engagement in journalism, and expressed doubts about the ability of AI tools to replace the human aspect in the recognition, analysis, and communication of complex information. Through the research conducted for this paper, journalistic articles were analysed using the ChatGPT artificial intelligence tool, and the results have been validated by means of a quantitative analysis performed by the authors.

The present article contains primary and secondary data derived from the research and the available literature. In the following sections, after a review of literature on artificial intelligence, AI tools, ChatGPT, and AI in journalism, there is a discussion on the methodology, results, and challenges of the research, followed by a conclusion.

Literature Review

The statement that artificial intelligence is a current topic is supported by the fact that, according to the Scopus database, more than 30,000 papers have been written on the subject in the last year alone. Artificial intelligence opens up numerous possibilities in a variety of fields. There is an increasing number of researchers exploring ways to harness the capabilities artificial intelligence has shown in dealing with big data. The application of artificial intelligence tools as research tools has been considered in a number of fields, such as education (Cooper, 2023; Labadze et al., 2023; Milana et al., 2024), law (Lowly et al., 2018), finance (Ullah et al., 2024), archaeology (Agapiou and Lysandrou, 2023; Lapp and Lapp, 2024), taxonomy (Davinack,

2023), medical research and scientific research in general (Alkaissi and McFarlane, 2023; Khlaif et al., 2023; Yoo, 2023), to name a few. Artificial intelligence has the potential to make research easier (Zhitomirsky and Suissa, 2023), but given that it is still an evolving technology, it needs to be used responsibly and with caution (Alkaissi and McFarlane, 2023). Despite the current excitement around it, possible shortcomings and adverse side effects associated with technological advancements are not being ignored; thus, there is literature containing considerations on issues such as trust, bias and reliability (Lowly et al., 2018; Matthews et al., 2022; Zhan and Kitchin, 2022). The challenges present in the technology are being addressed and, as was pointed out in a 2022 paper, "current AI architectures and applications are increasingly designed taking into account ethical issues, so as to support the educational role of advanced research tools in improving the interaction between individuals, and ultimately, in the betterment of society" (Biondi et al., 2022, p. 15).

The popularity and widespread usage of AI tools have particularly increased with the public release of ChatGPT in late 2022, which, at the present moment, is readily available, intuitive, and easy to use. According to a study on public opinion performed soon after its release, "ChatGPT is an extraordinary technological milestone, even if it makes mistakes" (González-Arias and López-García, 2023, pp. e320524, 1). ChatGPT, short for Generative Pre-trained Transformer chatbot, is a large language model (LLM) generative AI capable of machine learning (ML) that can enter natural language conversations with people to generate human-like responses (Milana et al., 2024). Given its accessibility, the possible use of ChatGPT as a research tool is a current topic in academic discussions, with papers being written in areas spanning from social sciences to business, arts and humanities, computer science and engineering. Authors have used ChatGPT to generate research articles (Khlaif et al., 2023), as a research tool for assistance with editing and making the research narrative clearer (Cooper, 2023), to write comprehensive summaries (Juanda and Afandi, 2024), as a research tool for compiling, categorising, describing and identifying cultural artefacts (Lapp and Lapp, 2024), as well as to take technological research to the next level (Rice et al., 2024)OpenAI made a groundbreaking entrance with the release of ChatGPT, a new online chatbot that allows users to interact with the GPT-3.5 language model. Users can ask questions and converse with ChatGPT by typing into a text field similar to direct messaging software. Then, ChatGPT will generate a response. Users can then either respond to ChatGPT, regenerate the previous response, or "like" the response and give feedback. OpenAI improved the program on March 14th, 2023, with the release of GPT 4, which promised better reasoning ability. Both these iterations of ChatGPT have attracted significant attention from researchers due to the software's remarkably enhanced capabilities compared to earlier versions. Due to its inherent value as a research tool, ChatGPT will likely

become a permanent fixture, so a thorough evaluation of ethical and professional boundaries is crucial. In this opinion paper, we explore ChatGPT 4.0 by addressing: a. The outcomes varied; in certain cases, "ChatGPT outperformed almost every aspect of the assessment" (Juanda and Afandi, 2024, p. 64), while some concluded that the AI tool has potential but needs improvement in a number of areas, e.g. the literature review (Khlaif et al., 2023). Caution, critical thinking, and responsible use of the technology have been advised, with Cooper pointing out, among other concerns, that "ChatGPT runs the risk of positioning itself as the ultimate epistemic authority, where a single truth is assumed, without a proper grounding in evidence or presented with sufficient qualifications" (Cooper, 2023, p. 449). As for any other tool, ChatGPT's usefulness depends on the way it is being used. In the case of information verification, ChatGPT can optimise contextual information collection, but, on the other hand, it increases the complexity of falsehoods, calling for greater transparency and reliability in the use of its sources, as well as more rigor and profusion in the responses generated (Cuartielles et al., 2023). Fact-checking is only one of the possible ways AI tools, ChatGPT in particular, can be used in journalism.

Journalism has progressively incorporated AI into several professional processes, such as information analysis, content extraction, audience research and automated copywriting. (González-Arias and López-García, 2023). According to Beckett, as a range of technologies including machine learning, automation and data processing, artificial intelligence is already a significant part of journalism (Beckett, 2019). However, with the risk of biased algorithms and dissemination of misinformation, there are concerns about the loss of public trust in information, as well as the loss of trust in journalistic practices (Cuartielles et al., 2023; Newman, 2024). Global research and interviews with experts have shown a wide spectrum of media professionals' attitudes and opinions towards artificial intelligence. On the one hand, AI brings about new market opportunities for media companies while also improving the working conditions of journalists; on the other, with media professionals' distrust of technology, AI tools deepen the journalists' antagonism and fear, resulting in sensationalist headlines, thus reinforcing the said fears (Noain-Sánchez, 2022). Research points to a discrepancy between the use of AI and the level of actual understanding among journalists, who used "guesswork and imagination in place of accurate conceptions of these technologies" (Jones et al., 2022, p. 1731), as well as a lack of consensus among key stakeholders on the impact of artificial intelligence on journalism (Brennen et al., 2018; Moran and Shaikh, 2022)we analyse eight months of reporting on artificial intelligence (AI. According to experts, the antagonism is a result of "limited knowledge, the possibility of being made redundant by a robot or because of a lack of skills, and the belief that AI tools will erode the essence of journalism" (Noain-Sánchez, 2022, p. 116).

Personal feelings aside, research results point to the fact that artificial intelligence adds value to journalism; it has a growing influence on how the news is organised, produced and distributed (Ali and Hassoun, 2019; Parratt-Fernández et al., 2021; Siren-Heikel et al., 2021; Thurman et al., 2019), and AI technologies will enhance, rather than replace, journalists' work, thereby increasing the journalists' skills and improving the news product (Ali and Hassoun, 2019; Tejedor and Vila, 2021)this, study aims to (1. Lifelong learning and AI literacy are imperative, which has been voiced in numerous papers for professional journalists and journalism students alike, with some suggesting specialised courses or the introduction of AI in journalism education (Abdulmajeed and Fahmy, 2023; Deuze and Beckett, 2022; Jones et al., 2022; Lopezosa et al., 2023; Parratt-Fernández et al., 2021). Finally, experts stress the importance of understanding the tools, risk awareness and caution, as well as the need for journalists to become actively involved and participate in the development of AI tools and standards (Noain-Sánchez, 2022; Parratt-Fernández et al., 2021). Given the resources available to the media organizations, such as text data that can be used for training models or ethical principles to create reliable systems, media and communication experts could be valuable participants in the current technological transformation, with the potential to make a disruptive change.

When it comes to sentiments towards artificial intelligence, an extensive international survey was performed (Beckett, 2019) regarding artificial intelligence and associated technologies in 71 news organizations from 32 countries, with 116 journalists from several different departments making their contribution. The respondents (most of whom were so-called 'early digital adopters') tended to be familiar with AI and had a positive attitude towards its adoption, while still pointing out the technology's limits and challenges. The respondents voiced a strong belief that the presence of AI would make journalists more efficient, allowing them to do better journalism, and at the same time help the public cope with a world of news overload and misinformation. However, to accomplish the said goals, a large number of prerequisites need to be met (Beckett, 2019).

The sentiments of Croatian media professionals towards artificial intelligence were investigated through in-depth interviews with 20 journalists and editors from 13 media outlets (Grmuša and Prelog, 2020). The respondents emphasised the need to implement new tools and adapt to the digital media environment, highlighting challenges such as the incongruence of educational programs with the media industry's needs, and pointing out a lack of resources and a delay in recognising the need for more advanced media practices. Although the potential benefits of process automation were recognised, doubts were expressed regarding the ability of AI to replace journalists in more complex tasks, giving priority to the importance of the creative

process of journalists in identifying, shaping and conveying stories. (Grmuša and Prelog, 2020).

Methodology

In order to take a step further, research was conducted using articles written by Croatian journalists and editors on artificial intelligence, published online from April to September 2023. Based on Reuters' annual survey on the state of the digital media business in Croatia (Peruško, 2023), web addresses from specific media were selected as focal points for the article retrieval process: www.index.hr; www.24sata.hr; www.dnevnik.hr; www.jutarnji.hr; www.net.hr; www.tportal.hr; www.vecernji.hr; www.dnevno.hr; www.rtl.hr; www.slobodnadalmacija.hr; www.telegram.hr; www.hrt.hr; www.direktno.hr; www.n1info.hr; www.novilist.hr.

Considering the subject matter, the decision was made to conduct research utilising artificial intelligence tools. Therefore, ChatGPT Plus, equipped with the GPT-4 model and boosted with multiple plugins, was selected to serve as the preeminent platform for the comprehensive analysis and structured display of data. The conceptual framework aimed to acquire valuable information with minimal human intervention. Using the ChatGPT AI tool, a sentiment analysis was performed. Sentiment analysis (or opinion mining) is a natural language processing technique for determining whether data is positive, negative or neutral (Kovačević and Kovačević, 2021). Algorithms recognise the emotional tone of the text based on language characteristics and convert them into numerical values that enable further quantitative and qualitative research.

Sentiment can be broken down into different categories. For example, emotion detection recognises specific emotions, such as happiness or concern. It classifies them in a positive, negative or neutral context. Due to the complexity of human expression, the context in which a particular language is used has been considered, given the cultural, social and technological aspects mentioned in the articles. Articles emphasising tone recognition through keywords were analysed, and algorithms such as ChatGPT were used to detect emotions and classify texts into those with positive, negative and neutral tones.

The research was conducted on articles written in Croatian and published on specific media sites that contained keywords about artificial intelligence, such as AI or LLM, from April to September 2023. The initial research parameters were later broadened to include all sites with a .hr domain and keywords such as ChatGPT, Bard, or BingAI.

The result of the research was a table containing the analysis of a section of the most visited media in Croatia, according to Reuters (Peruško, 2023). Due to the challenges and limitations encountered while using the AI tool, a large amount of the media content which had been analysed was entered manually. The manually added content was found using the Google search engine. The term "artificial intelligence" was entered, and, among the displayed results, articles were selected from media websites included in the Reuters report on the most visited online media in Croatia, using criteria such as date of publication and the pluralism of topics in article titles.

After a comprehensive manual scrutiny of each hyperlink, five results were excluded from the finalised list of 50 articles – two because they led to entirely irrelevant links unrelated to the designated topic, and the other three because they were not published within the indicated timeframe. The research results are displayed in Table 2 (appendix). The authors added columns indicating the source and date of the articles upon verification of the hyperlinks provided.

The majority of the articles are from the Index.hr portal, which has been the most popular media outlet in Croatia for the second year in a row (2023, 2024), according to the Reuters Institute for the Study of Journalism ("Reuters", n.d.). More than 50% of Croatian citizens keep up with the Index.hr portal's content, and one of the reasons behind its popularity is that all the articles are accessible to readers in full, unlike the news portals of national media publishers, such as Jutarnji.hr.

Finally, a qualitative analysis of the content was carried out in order to identify emotions and attitudes in the texts by means of manual evaluation. The text was then tokenised and separated into smaller units, such as keywords or terms.

Results

The study aimed to research sentiments about artificial intelligence in the Croatian media communications and evaluate the effectiveness of artificial intelligence tools, specifically ChatGPT, as research tools. A total of 45 articles published from April 9 to September 14, 2023, were analysed by ChatGPT and humans. A detailed list of the analysed articles, indicating the authors, title, sentiment and concepts used is displayed in the appendix (*Table 1*).

Within the analysed content, 13 articles were signed with the author's name and last name, i.e. their initials, and the rest were signed with pseudonyms or names of media companies such as Novac.hr, Index Magazin, HINA – Croatian News Agency, Index Vijesti, Magazin.hr, Vijesti SD, Index Native, Promo, and Sponsored Articles.

Table 1. Sentiment Analysis: The Most Common Concepts

Tablica 1. Analiza sentimenta: Najčešći koncepti

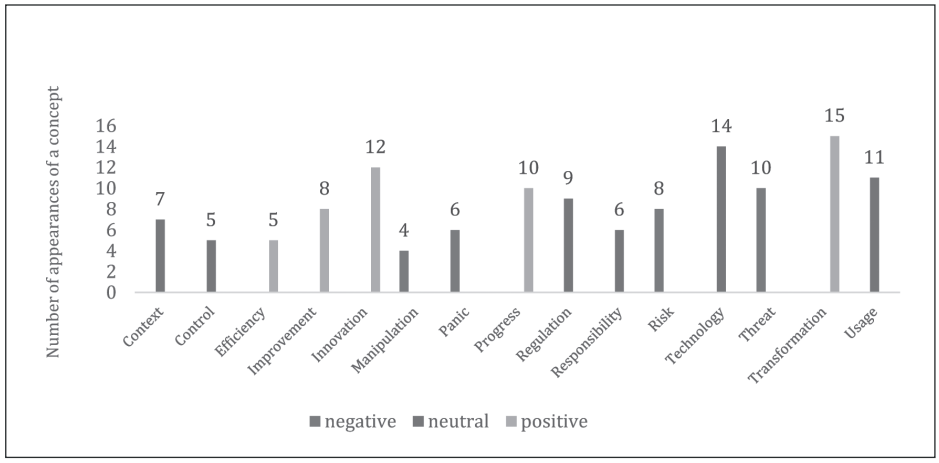
The most common concepts in the analysed articles:			**Sentiment**
Concept	**Concepts in the original language**	**Number of appearances**	
Transformation	*Transformacija*	15	Positive
Technology	*Tehnologija*	14	Neutral
Innovation	*Inovacija*	12	Positive
Use	*Upotreba*	11	Neutral
Progress	*Napredak*	10	Positive
Threat	*Prijetnja*	10	Negative
Regulation	*Regulacija*	9	Neutral
Improvement	*Poboljšanje*	8	Positive
Risk	*Rizik*	8	Negative
Context	*Kontekst*	7	Neutral
Panic	*Panika*	6	Negative
Responsibility	*Odgovornost*	6	Neutral
Efficiency	*Efikasnost*	5	Positive
Control	*Kontrola*	5	Neutral
Manipulation	*Manipulacija*	4	Negative

Source: Author's research

The central topic of all the articles was **artificial intelligence**, presented in the context of innovation and society's **transformation** according to today's needs. The articles often emphasised **the enormous potential** of artificial intelligence, which could improve many areas of human life, from medicine to transport. In doing so, **technological developments were** mentioned as key to understanding the constant progress in artificial intelligence. Concerning its application, an increasing emphasis was placed on **data security**, stressing the importance of information protection in the digital environment. At the same time, **ethical dilemmas** were increasingly present in discussions about the application of AI, especially concerning fairness and accountability. The texts also mentioned **process automation** as a way for AI to enable tasks to be performed more efficiently, thus increasing productivity, reducing costs and making some jobs obsolete.

The **regulatory framework** was mentioned as necessary in order to set legislative boundaries to ensure the technology's safe and responsible use. The articles also

highlighted innovative solutions that illustrate the AI applications' creative, practical and entertainment aspects. However, the rapid progress of **technology was also often highlighted,** indicating the constant expansion and increasing deployment of artificial intelligence into everyday life. At the same time, the authors warned of **the potential dangers** that artificial intelligence could bring, including risks to security, privacy, and employment.



Source: Author's research with the assistance of ChatGPT

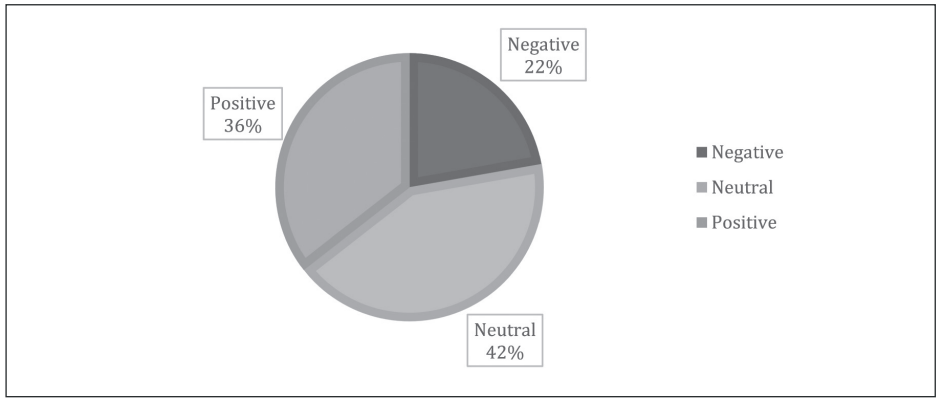
Graph 1. Number of Appearances of a Concept, Displayed by Sentiment

Grafikon 1. Broj pojavnosti koncepata prikazanih kroz sentiment

The analysis of the articles has shown that the media content created with the help of AI tools was dominated by a positive or neutral tone towards artificial intelligence. Human perception of sentiment during content analysis in a total of 45 selected articles coincided with the results of ChatGPT's analysis. There was but one exception, an article on the Index.hr portal: *„Najjezivije web mjesto:* Ova stranica može naći svaku vašu sliku na internetu", which describes the PimEyes website that uses artificial intelligence to search for images on the internet, allowing users to find photos of other people. Despite emotionally charged terms that dramatise fear and concern ("terrifying results", "bank account hacking" and "every stalker's dream" ...), ChatGPT marked the content of that article**** as "neutral". Within the article, there was a poll via which the readers expressed their divided opinions about the

content: out of 3,544 votes, 70% of respondents rated technological innovation as disturbing, while 30% rated the tool as useful. The article* „Rijetko tko je predvidio ovakav tehnološki napredak, a stručnjak tvrdi: *Taj koncept sada postaje besmislen*" has a negative tone when it talks about AI as an unregulated area that threatens jobs and reduces the cost of labour for creative industries, but it becomes balanced through talking to an expert.

According to the ChatGPT analysis, the majority of the articles displayed a positive or neutral sentiment towards artificial intelligence. Out of the 45 articles considered, 16 articles (36%) displayed a positive sentiment towards artificial intelligence, 19 articles (42%) displayed a neutral sentiment, and 10 articles (22%) displayed a negative sentiment, as shown in Graph 2.

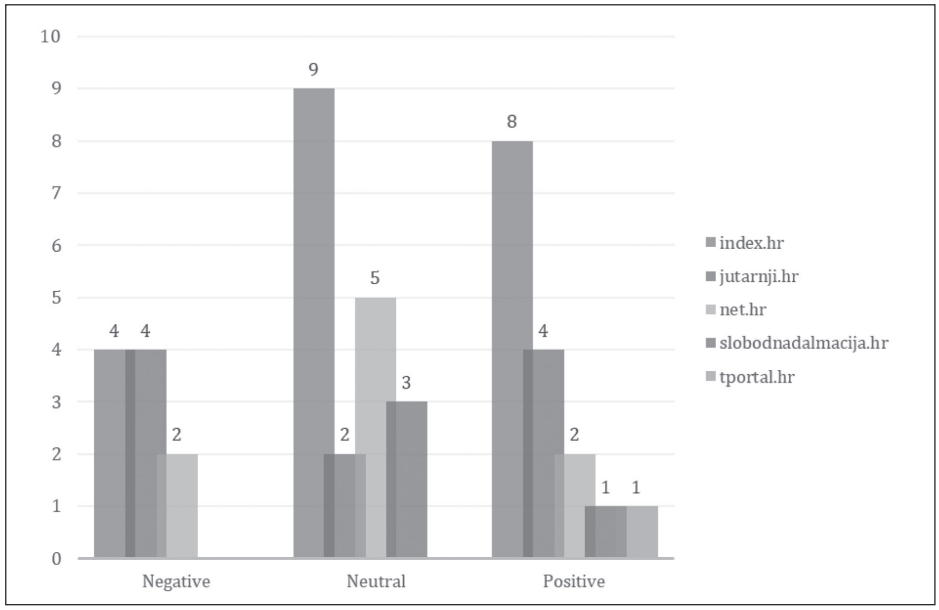


Source: Author's research

Graph 2. Sentiment Analysis of 45 Articles on AI in the Croatian Media from April to September 2023, by Percentage (ChatGPT Analysis)

Grafikon 2. Analiza sentimenta 45 medijskih članaka o umjetnoj inteligenciji, od travnja do rujna 2023. u postocima (ChatGPT analiza)

Many positive articles highlighted AI technology's benefits in various fields, such as medicine, security and education. Keywords included concepts like "transformation", "innovation", "progress", "improvement" and "efficiency". Specific examples contained concepts such as "great potential", "efficiency improvement", "advances



Source: Author's research

Graph 3. The Analysis of Sentiments Towards Articles on AI in the Croatian Media from April to September 2023, by Media Outlet (ChatGPT Analysis)

Grafikon 3. Analiza sentimenta o napisima o umjetnoj inteligenciji u hrvatskim medijima od travnja do rujna 2023. godine prema mediju (ChatGPT analiza)

in medical diagnosis" and "safety". Articles with a neutral tone usually simply described AI technology, emphasising its functionality and technical aspects without expressing any extremely emotional points of view. Typical concepts included "technology", "use", "regulation", "context" and "responsibility". These articles often dealt with technical specifications, application in everyday life or legal issues related to AI. Articles with a negative tone discussed the risks, ethical challenges and potential threats that AI could bring, especially regarding labour, copyright and private markets. Some examples are concerns about algorithm biases, job losses and the like. Overall, most articles had a positive or neutral attitude towards AI, suggesting that journalists recognise and acknowledge AI technology's benefits and practical application while being aware of potential challenges and risks.

Discussion

This study examined the portrayal of artificial intelligence (AI) in the Croatian media, and whether it aligned with the views of Croatian journalists, as well as assessed ChatGPT's effectiveness in sentiment analysis. In accordance with this, the following research questions were raised: Are the sentiments of Croatian journalists towards artificial intelligence, as expressed in previous research, reflected in articles written about artificial intelligence? And what concepts would be associated with positive and negative sentiments towards artificial intelligence? Also, could a sentiment analysis be performed with the help of the ChatGPT AI tool, and would a qualitative content analysis be aligned with the results provided by ChatGPT? Addressing these three research questions, the study has explored the role of media sentiment in the shaping of public opinion and conducting debates on AI in journalism.

Based on the results, it can be concluded that the first hypothesis has been confirmed, while the second one has been partially confirmed.

Regarding the first hypothesis (H1 = The sentiment analysis of articles conducted via ChatGPT matches the results of the qualitative content analysis), ChatGPT's sentiment analysis indeed matched the authors' qualitative assessment in 44 out of 45 articles, demonstrating the tool's high accuracy in identifying sentiment within media content. However, ChatGPT occasionally overlooked nuanced emotional tones, particularly when it came to content that conveyed subtle negative sentiment through emotionally charged terms. One discrepancy highlighted ChatGPT's difficulty detecting subtle negative tones in complex topics, underscoring the continued need for human insight. The study has highlighted AI's role and limitations in sentiment analysis, showing that even though tools like ChatGPT can effectively analyse big data, human agency remains essential. This corresponds to prior research emphasising the irreplaceable role of human insight in journalism, and underscoring the value of combining AI-driven analysis with human assessment to capture complex sentiments in sensitive content more accurately.

With respect to the second hypothesis (H2 = The sentiment analysis of articles in the Croatian media on artificial intelligence will show a predominantly positive view of AI), the analysis has revealed that the Croatian media has a neutral to positive sentiment towards AI. Out of the 45 articles that had been analysed, 36% expressed a positive sentiment, 42% were neutral and 22% were negative. This distribution indicates that media narratives recognise both AI's potential benefits – often highlighted in positive articles discussing fields such as medicine – and the risks, with negative articles addressing concerns over privacy and employment. Positive con-

cepts like “transformation”, “innovation” and “efficiency” frequently appeared in the articles recognising AI’s potential in areas such as healthcare and public safety. Conversely, concepts such as “risk”, “control” and “threat” were more common in articles expressing concerns about AI’s implications for privacy, ethics and employment. This contrast in terminology illustrates how language influences the public’s perception of AI’s benefits and risks.

The existing insights suggest that while there are some concerns, AI is widely regarded as beneficial for journalism, in that it enhances efficiency through automation, data processing and content creation (Ali & Hassoun, 2019; Beckett, 2019). International surveys have indicated that journalists familiar with digital tools generally adopt a positive outlook, valuing AI for its potential to boost productivity and improve content quality (Beckett, 2019). This is reflected in the context of Croatia as well, where interviews with journalists have pointed to an appreciation of AI’s potential to streamline workflow and bolster digital competitiveness (Grmuša & Prelog, 2020). However, the cautious approach remains prevalent due to the perceived limitations of AI in handling complex, human-centred tasks.

Thus, while the Croatian media narratives reflect a positive view of AI’s potential for progress, they also incorporate a significant degree of neutrality, acknowledging ethical concerns and risks associated with AI’s impact on privacy and job security. Consequently, the hypothesis has been only partially confirmed, as the sentiment is positive but largely neutral, highlighting a balanced stance that aligns with international and Croatian perspectives on AI’s role in journalism.

This research has laid the foundation for understanding sentiments towards AI in the Croatian media and the ongoing need for balanced AI and human collaboration in journalism.

Conclusion

In today’s highly dynamic environment, the need for innovation assumes unprecedented significance, and digital intelligence emerges as key for achieving and sustaining digital competitiveness in an increasing number of fields, with journalism being no exception. Even though the possibilities of artificial intelligence in journalism are evident, it is necessary to temper enthusiasm with prudence and warn against using AI tools without human input, as well as stress the importance of education about new technologies, risk awareness and the need for journalists to participate in the development of AI tools.

To explore the topic in depth, research was conducted using the ChatGPT Plus platform as the artificial intelligence tool. The results have provided a better under-

standing of sentiments towards AI in the Croatian media, and contributed to the discourse on AI's impact and ethical considerations in journalism. The results of the research have pointed to significant alignment between the media portrayals of AI and the sentiments expressed by Croatian journalists, showcasing both the potential benefits and the inherent challenges that AI technologies pose. While the research has demonstrated the effectiveness of AI-driven sentiment analysis tools such as ChatGPT, it has also highlighted their limitations, particularly in capturing nuanced emotional tones that require human interpretation. In addition, the results have shown that the Croatian media has a positive to neutral attitude towards artificial intelligence and, while still offering a critical and sometimes opposing point of view, they do not negatively influence the shaping of public opinion on this matter. Therefore, it has been concluded that the results of the sentiment analysis of media articles on artificial intelligence do not deviate significantly from the attitudes of journalists and editors towards artificial intelligence expressed in previous research.

The limitations of the conducted research have appeared in the form of unintentional bias encountered during data collection, considering that it was not possible to include all web portals and articles written in the selected time frame, as well as data generalization – since individual sentiments of specific journalists and editors may, to various degrees, deviate from the generalised conclusion. As for future studies, it is recommended to use a larger and more complete sample, as well as apply both qualitative and quantitative research methods in order to make both a general overview and examine borderline and individual attitudes. One further limitation of the present paper is the speed of AI advancement since introducing new features can make specific findings obsolete. At the time the research was performed, at the end of 2023, the ChatGPT 4 model had entered widespread use, while it was no later than the first quarter of 2024 that the public was eagerly awaiting the new and improved ChatGPT 5 model.

Looking forward, future research can expand upon these findings by focusing on longitudinal studies that track changes in sentiment over time, reflecting AI's evolving role in the media, examining long-term sentiment trends and geographic nuances, as well as improving AI tools for independent data retrieval and more accurate sentiment interpretation.

The study has contributed to the current discourse on the impact of artificial intelligence on journalism by enhancing comprehension of the perception of artificial intelligence in the Croatian media, and emphasising the need for further research aimed at comparative analysis of the said parameter with global trends. Additionally, it has paved the way for further sentiment analysis of media articles, where the implications of the application of artificial intelligence can be investigated.

Author Contributions

Conceptualization, I.E.M.; Data curation, I.E.M.; Formal analysis, I.E.M.; Funding acquisition, L.L.; Investigation, I.E.M.; Methodology, I.E.M.; Project administration, I.E.M. Resources, L.L.; Supervision, L.L., Validation, M.B.D., Visualization, M.B.D., Writing – original draft, I.E.M., M.B.D., Writing – review & editing, L.L. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Procjena sentimenta o umjetnoj inteligenciji u hrvatskim medijima korištenjem alata umjetne inteligencije ChatGPT-a

Ivana Erceg Matijašević
Martina Baričević Debelec
Ljerka Luić

SAŽETAK

Algoritmi i alati umjetne inteligencije postali su ključni za digitalnu pismenost i konkurentnost u današnjem visokotehnologiziranom okruženju, transformirajući poslove u raznim sektorima, uključujući medije. Povijest novinarstva neraskidivo je povezana s tehnološkim razvojem, od Gutenbergova tiskarskog stroja, preko radija, televizije, interneta do današnje pojave alata umjetne inteligencije. Cilj je rada utvrditi percepciju umjetne inteligencije u hrvatskim medijima i njezinu usklađenost s mišljenjima hrvatskih novinara, te procijeniti učinkovitost ChatGPT-a u analizi sentimenta. Dobivene spoznaje trebale bi pridonijeti boljem razumijevanju utjecaja umjetne inteligencije na javno mnijenje i etičkih implikacija njezine primjene u novinarstvu.

Metodologija korištena u istraživanju uključuje kombinaciju analize sentimenta koju provodi AI (ChatGPT Plus) i kvalitativne analize sadržaja. Istraženo je 45 članaka o umjetnoj inteligenciji, objavljenih u hrvatskim medijima između travnja i rujna 2023. godine.

Testirane su dvije hipoteze: H1, prema kojoj analiza sentimenta ChatGPT-a odgovara ljudskim procjenama, i H2, prema kojoj hrvatski mediji uglavnom izražavaju pozitivan ton prema umjetnoj inteligenciji.

Rezultati istraživanja potvrdili su H1, pri čemu je ChatGPT-ova analiza sentimenta odgovarala ljudskim procjenama u 44 od 45 slučajeva. H2 je djelomično podržana; distribucija sentimenta pokazala je neutralne (42 %), pozitivne (36 %) i negativne (22 %) tonove. Pozitivni članci naglašavali su prednosti umjetne inteligencije u područjima poput zdravstva, dok su negativni članci isticali zabrinutosti vezane uz privatnost i zapošljavanje. Dobiveni rezultati sugeriraju uravnoteženu perspektivu

u hrvatskim medijima o umjetnoj inteligenciji, s jasno detektiranim prednostima i rizicima. Buduća istraživanja mogu proširiti ove nalaze ispitivanjem dugoročnih trendova sentimenta u domaćim medijima i njihovom usporedbom s globalnim trendovima, čemu *dodatno mogu pridonijeti unaprijeđene verzije alata umjetne inteligencije za neovisno prikupljanje podataka i točniju interpretaciju sentimenta. Osim toga, ovaj rad otvara prostor za daljnje analize sentimenta medijskih članaka, gdje se mogu istraživati implikacije primjene umjetne inteligencije na percepciju i prijem informacija kod čitatelja.*

*Ključne riječi***:** ChatGPT, digitalna inteligencija, digitalna konkurentnost, novinarstvo, sentiment, umjetna inteligencija

Notes

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Appendix

Table 2. Content Analysis – Human Perception

Tablica 2. Analiza sadržaja – ljudska perspektiva

Article number	Author	Title	Sentiment	Concepts
1	Nenad Jarić Dauenhauer (Journalist and Editor, Index.hr)	Umjetna inteligencija se munjevito razvija. Ovo je najbolje što nam donosi munjeviti razvoj umjetne inteligencije	Positive	Transformation, Innovation, Improvement, Safety, Medicine, Education, AI Benefits
2	Novac.hr (The Business Section, Jutarnji list)	Umjetna inteligencija sastavni je dio mreže HT-a	Neutral	Data Transfer, Improvement, Ethical Issues, AI Application, Telecommunications
3	Gojko Drljača (Journalist and Editor, Jutarnji list)	Počeo veliki rat za tržište koje će definirati budućnost: Opća opasnost i panika proglašeni u Googleu	Negative	Panic, Market Race, Google, DeepMind, Microsoft AI
4	Novac.hr (The Business Section, Jutarnji.hr)	Ivan Zubak: Tehnologija će ubrzati tranziciju na električna i autonomna vozila	Positive	Transition, Autonomous Vehicles, Safety, AI and Traffic, Driving
5	Novac.hr (The Business Section, Jutarnji.hr)	Disrupcija nas tjera da evoluiramo. Moćne tehnologije brišu granice digitalnog i biološkog svijeta	Positive	Digital Transformation, the Fourth Industrial Revolution, Evolution, Technology and Society
6	Karla Zupičić, (Journalist, Jutarnji.hr)	Stvoren je novi AI model koji može čitati misli i pretvoriti ih u tekst koristi metode skeniranja magnetom	Positive	Thought Decoder, Technology, AI in Medicine, Ethical Implications

7	Karla Zupičić, (Journalist, Jutarnji,hr)	Budućnost je već tu, samo moramo pronaći način kako ju iskoristiti: Prvi dan obilježilo predavanje o budućnosti zdravstva	Positive	Digitalisation, The Future of Healthcare, Transformation
8	S.K. (Journalist's Initials, Slobodna Dalmacija)	Umjetna inteligencija zakazala na pitanju na koje zna odgovoriti skoro svaki Sinjanin, pošto je kilo teletine	Neutral	Humorous Tone, Limits of AI, Possibilities, Public Interest, AI Limitations
9	Luka Benčić, (Journalist Jutarnji.hr)	Lovro Mraović: 16-godišnjak iz Rijeke ima jači kod od Facebooka, ali MORH ga ipak ignorira	Negative	Cybersecurity, Innovation, Privacy, Insufficient Recognition
10	Anna Danés (Guest Columnist, Jutarnji.hr)	Inženjeri i voditelji proizvoda su etički iscrpljeni	Negative	Ethical Exhaustion, AI Impact on Society, Manipulation, Disinformation, Burnout
11	Karla Zupičić (Journalist, Jutarnji.hr)	Revoluciju umjetne inteligencije treba gledati oprezno kao prijetnju nuklearnog rata	Negative	Risks Of AI, Threat to Human Survival, Global Security
12	Vijesti SD (News, Slobodna Dalmacija)	Srbi lude: Umjetna inteligencija (AI) Teslu proglasila etničkim Hrvatom; na ponovljeno pitanje rekla: 'Nije Srbin'	Neutral	Ethnic Debates, Tesla, AI Answers
13	Scena SD (Lifestyle, Slobodna Dalmacija	Umjetna inteligencija rekla je svoje; ovako bi Plenki, Milanović, Kolinda i RTL-ova Kraljica izgledali u Barbie svijetu!	Positive	AI, Entertainment, Politicians, Viral
14	Danas.hr (News Section, net.hr)	Je li Plenković dobar političar? Umjetna inteligencija nam je dala konačnu presudu, a usporedila ga je i s Milanovićem	Neutral	Political Correctness, AI in Politics, Plenković-Milanović Comparison
15	Ivan Trajković (Journalist, net.hr)	Hoće li umjetna inteligencija postati 'bolja' od fotografa? Snimatelj otkrio što misli o tehnologiji koja napreduje velikom brzinom	Neutral	AI and Photography, Speed of Progress, Improvement
16	Index Native	Pokušao sam prevariti ChatGPT, odgovor me iznenadio	Neutral	Digital Transformation, Privacy, AI Trustworthiness, Trends
17	Promo	Kako umjetna inteligencija može kušati i mirisati napitke	Positive	Predictive Intelligence, AI Taste and Smell, Innovation, Sensor Data
18	HINA (Croatian News Agency on index.hr)	Scenariji katastrofe: upozorenja dolaze sa svih strana - evo kako bi strojevi mogli izbrisati čovječanstvo	Negative	AI Threat, Superintelligence, Control

19	Ivan Trajković (Journalist, net.hr)	Umjetna inteligencija naišla na dostojnog protivnika? Pokreće se sudbonosni postupak koji može rezultirati obustavom razvoja	Negative	AI Regulation, Judicial Process, National Security, Jobs
20	Magazin.hr (Lifestyle, net.hr)	Milla nije obična djevojka i ima na tisuće obožavatelja: Napravila me umjetna inteligencija	Neutral	Virtual Influences, Virtual Person, AI and Social Networks, Futuristic Style
21	Magazin.hr (Lifestyle, net.hr)	Polugole influencerice UI zapalile društvene mreže, njihovi kreatori imaju jedan cilj: Izvući lovu od muškaraca…	Neutral	Digital Influencers, Manipulation, Entertainment
22	Maja Mahovlić (Journalist, net.hr)	Rijetko tko je predvidio ovakav tehnološki napredak, a stručnjak tvrdi: 'Taj koncept sada postaje besmislen'	Neutral*	Intellectual Property, AI Copyright Infringement, Creative Industries, Education
23	Promo	Dionice Googlea dosegle rekord zbog razvoja AI-a	Positive	Success, AI Progress, Income, Investment
24	HINA (Croatian News Agency on index.hr)	Papa: Umjetna inteligencija ima remetilačke mogućnosti i ambivalentne učinke	Negative	Ethical Responsibility, Protection of Vulnerable Groups, Potential Dangers
25	HINA (Croatian News Agency on index.hr)	Što će svijetu donijeti AI? Evo što kaže povijest razvoja važnih tehnologija	Neutral	Techno-Optimism, Productivity, Inequality, AI and Jobs
26	Index Magazin	Ovako hrvatski političari izgledaju na godišnjem prema umjetnoj inteligenciji	Positive	Entertainment, Satire, AI Visualisation, Croatian Politicians
27	Index Magazin	Bizarna AI aplikacija nudi dopisivanje s Isusom: Neki je nazivaju bogohulnom	Negative	Controversy, Religion, Ethics, Communication
28	Index Magazin	Nova opcija na WhatsAppu koja bi mogla biti popularna među korisnicima	Positive	Entertainment, AI Functionalities, Applications
29	Index Vijesti	Istraživanje: ChatGPT pokazuje značajnu i sustavnu ljevičarsku pristranost	Negative	Bias, Political Attitudes, AI, Concern
30	Index Magazin	Ovako bi domaći političari izgledali s brkovima prema AI-ju: Kome najbolje stoje?	Positive	AI Visualisation, Entertainment, Physical Appearance
31	HINA (Croatian News Agency index.hr)	Američki sud: umjetnost stvorena AI-em ne može se zaštititi	Neutral	Copyright, Generative AI, Intellectual Property

32	HINA (Croatian News Agency on index.hr)	Američki sud: AI umjetnost bez zaštite autorskih prava	Neutral	Same content as the previous article.
33	Index Magazin	Ova cura je nestvarna. Doslovno	Neutral	Virtual Influencer, Unreal Beauty, Followers
34	Karla Zupičić (Journalist, Jutarnji.hr)	AI nikad neće preuzeti sve: Najveće posljedice umjetne inteligencije osjetit će žene, i to u ovim poslovima	Neutral	Jobs Threatened by Automation, Social Impacts Of AI, Gender Inequalities
35	HINA (agency news on index.hr)	Nvidia udvostručila prihode zbog razvoja AI-a	Positive	Revenue, AI Development, Technological Progress, Euphoria
36	Sponsored Article (tportal.hr)	Umjetna inteligencija već je dio naših života - čak i kad to ne znamo	Positive	Utility, Everyday Life Facilitation, AI in Healthcare and Finance
37	M.I. (Journalist's Initials, Slobodna Dalmacija)	Koreja isporučila prvi trgovački brod pod AI upravljanjem	Neutral	Automatic Navigation, Safety, Stability, Adaptability
38	Index Magazin	U BiH je opet drama oko Kralja Tvrtka. Evo kako bi on izgledao prema AI-ju	Neutral	Historical Visualization, Drama, Entertainment
39	Index Magazin	Ovaj kviz općeg znanja sastavila je umjetna inteligencija. Znate li odgovore?	Neutral	Quiz, Entertainment, ChatGPT
40	Index Magazin	Moja slika vrijedna je milijarde: Netko je AI-jem stvorio Trumpovu rap pjesmu	Positive	Entertainment, AI Audio Creation, Political Satire
41	Index Magazin	Najjezivije web mjesto: Ova stranica može naći svaku vašu sliku na internetu**	Negative	Privacy, Risk, Scary, AI Image Search
42	Index Magazin	FOTO: U Zagrebu otvorena prva izložba slika koje je stvorila umjetna inteligencija	Positive	Virtual Art, Innovation, Auction, AI Potentials
43	Index Magazin	Umjetnom inteligencijom stvorila verziju sebe kakva želi biti, zarađuje bogatstvo	Positive	AI Clone, Virtual Art, Earnings, Perfect Version
44	HINA (Croatian News Agency on index.hr)	Od punjača do dječjih podataka: Kako je EU zauzdao Big Tech	Neutral	Privacy, Regulation, Digital Markets Act, EU
45	Index Vijesti	Sreli se Musk, Gates i Zuckerberg „Ako AI ode po krivu, otići će jako po krivu"	Neutral	Regulation, the Power of AI, Potential Dangers, Collaboration with Scientists

Source: ChatGPT and authors