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Artificial intelligence and human communication: A systematic literature review

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Abstract

The advancement of artificial intelligence has enhanced communication and contributed to the flow of information in recent years. This review attempts to report on the findings of a systematic literature review on artificial intelligence and human communication. The review focused on four databases— Elsevier, Google Scholar, Oxford and Sage. In order to refine the results, inclusion and exclusion criteria were defined with the purpose of eliminating all publications which came across as clearly irrelevant. After applying the protocol and the analysis model, a corpus of 21 papers was obtained between May and June, 2023. The results show that with the increasing availability of monitoring data and the recent advances in computing platforms, artificial intelligence has become a tool for network operators to automate communication. In addition, artificial intelligence-based technologies such as machine learning, human machine communication and computer mediated communication have demonstrated superhuman capabilities in solving some real world problems.

Keywords: Artificial intelligence; Communication; Machine learning; Technology; Computer; Human

1. Introduction

Technology has been the main engine of an improved standard of living throughout history. Cloud computing, Internet of Things (IoT), big data, data science, artificial intelligence (AI), and block chain are the rising technologies in recent years [1]. However, the advancement in AI has been the heart of all other technologies and the evolution of Industry 4.0. There is sufficient evidence available in literature that proves that AI technology offers new opportunities that can lead to notable transformation in the communication industry [2, 3, 4, 5, 6].

AI can be tracked back to the mid-1950s, when the US-American computer scientist and AI pioneer John McCarthy used the label in a grant application for a conference. Nils John Nilsson from Stanford University, one of the founding researchers of the AI discipline, declares that AI is concerned with intelligent behaviour in artifacts, which comprises perception, reasoning, learning, communicating, and acting in complex environments [7]. AI is a computational agent that act intelligently [8]. AI is the study of intelligent machines and software that can reason, learn, gather knowledge, communicate, manipulate and perceive objects [9]. In other words, AI focus on intelligence in simple language and computations that makes it possible to perceive, reason and act.

It is claimed that AI is playing an increasing role in the research of human communication [10]. Some consultants in the communication industry highlights a broad variety of possible AI applications in the field, ranging from analytics to targeting, from content creation to chatbots and from evaluation routines to strategy development and crisis

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management [10]. The professional discourse frame AI technologies mostly as an addition to professional activities, emphasising its opportunities but also claiming that humans cannot be replaced or mimicked by technology.

The term AI is polysemous, encompasing efforts to understand human intelligence by recreating a mind within a machine and to develop technologies that perform tasks associated with some level of human intelligence [11, 12]. Examples of AI technologies in communication include conversational agents, social robots, and automated-writing software. These technologies have primarily developed out of advances within the AI subfields of Natural Language Processing (NLP) and Natural Language Generation (NLG). At their most basic level, NLP and NLG have the intertwined goals of processing human communication well enough to enable machines make sense of messages presented in human language, rather than machine language [3]. For example, voice-based assistants evolved out of efforts in NLP, while automated-writing programs are underpinned by NLG [13].

One of the most pervasive AI applications to date is personalized reply suggestions in text-based communication, commonly known as "smart replies" [14]. As of 2017, algorithmic responses constituted 12% of all messages sent through Gmail [15], representing about 6.7 billion emails written by AI on our behalf each day [16]. Smart reply systems aim to make text production more efficient by drawing on general text corpora to predict what a person might type and generating one or more suggested responses that the person can choose from when responding to a message. Rapid adoption of this type of AI in interpersonal communication has been facilitated by a large body of technical research regarding various methods for generating algorithmic responses [17].

In recent years, the study of AI and communication have proceeded along separate trajectories [3]. Research regarding AI has focused on how to reproduce aspects of human intelligence, including the ability to communicate, within the machine [12]. Nevertheless, studies conducted so far rather focused on AI and its application in communication [3, 5, 10], with no systematic examined literature reviews. In view of the above, we conducted an updated, comprehensive, and systematic literature review to report recent research findings in relation to the use of AI in communication.

Literature review was performed in Google Scholar, Scopus (Elsevier), Oxford and Sage Journals for papers with empirical data concerning AI and communication. The systematic literature review (SLR) will address the following research questions:

- What are the AI technologies used in enhancing human communication?
- What are the methodologies used in AI and human communication related papers?
- What is the yearly distribution of AI and human communication related papers?
- What is the country distribution of AI and human communication related papers?

2. Methodology

2.1. Manuscript selection process

In order to answer the four research questions stated above, SLR was conducted. SLR can be broadly defined as a type of research synthesis that are conducted by review groups with specialised skills, who set out to identify and retrieve international evidence that is relevant to a particular question or questions and to appraise and synthesise the results of this search to inform practice, policy and in some cases, further research [18, 19]. The literature search was conducted between May and June, 2023. According to the Cochrane handbook, a systematic review uses explicit, systematic methods that are selected with a view to minimising bias, thus providing more reliable findings from which conclusions can be drawn and decisions made [20].

To make the literature search as transparent as possible, the review process was undertaken following PRISMA guidelines [21]. Along these guidelines, certain inclusion and exclusion criteria were identified. To be included, a study had to be an original research contribution and had to be peer-reviewed. During the process; book chapters, book reviews, magazines and editorials were excluded. The language of the study had to be English. Other languages were excluded due to the lack of language skills. Only studies published between 2019 and 2023 were included in the SLR. Literature searches should be viewed as open-ended iterative processes, whereby the topic or research question of interest is honed over time as the nature of evidence becomes more apparent for the researcher [22]. Four comprehensive databases were selected: Google Scholar, Elsevier, Sage and Oxford. In order to virtually find out all relevant research on AI and Communication, a single descriptor was used, without including any Boolean operators: "AI and Communication" placed in quotation marks, so that the results presented corresponded to the term composed of

the two words together and not two separate words. At this stage of the research, there were no restrictions regarding language, type of publication or document, or even time.
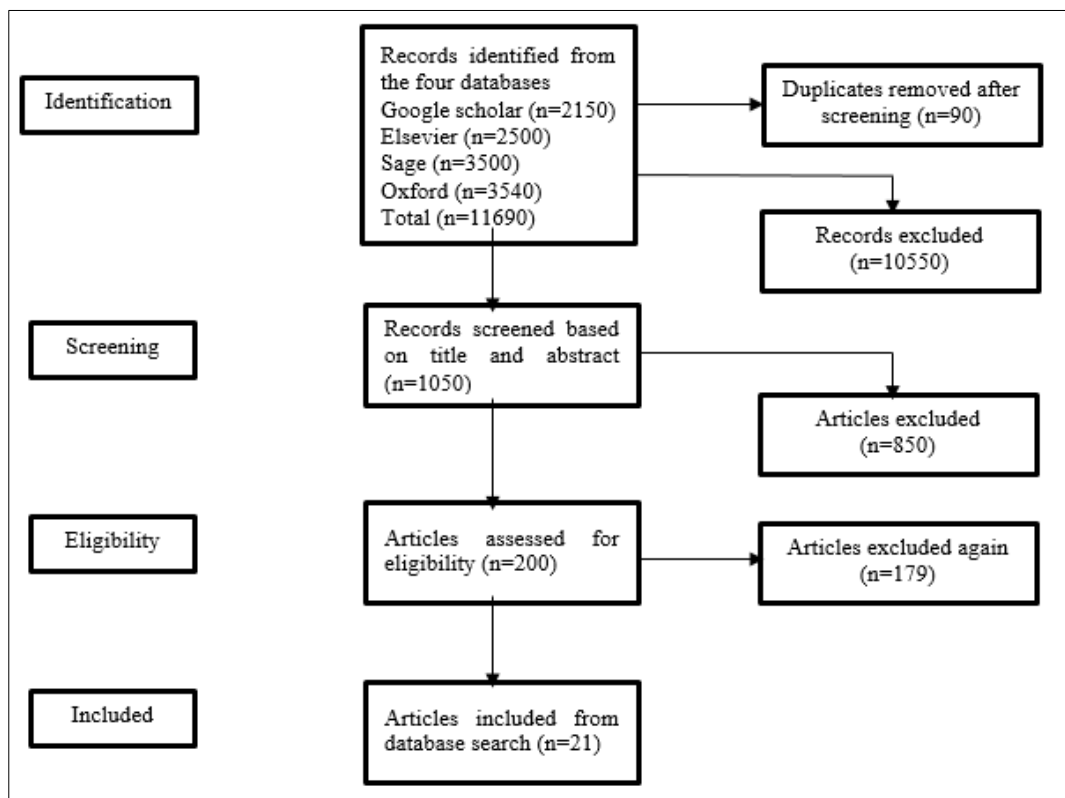
2.2. Data cleaning

In order to refine the results, inclusion and exclusion criteria (Table 1) were defined with the purpose of eliminating all publications which came across as clearly irrelevant when it came to answering the research questions [23].

**Table 1** Exclusion and inclusion criteria

Exclude if	Include if
The language used is not English. For example, Portuguese, Spanish, French, among others	The language is English
The article was published before 2019	The article was published between 2019 and 2023
Article was a conference paper, dissertation, thesis, magazine, book or book chapter	Research article was peer-reviewed
Article was a duplicate text or the translation of a title, text already included in the sample	The expression "AI and communication" showed in the abstract or keywords
The concept was applied to another study such as anthropology, sociology and did not explore issues on AI and communication	The text fitted AI and communication

Selection and data extraction involved the researchers screening and assessing all titles and abstracts to arrive at a selective decision. Argumentative issues relating to disagreements on final inclusion were settled by discussion and consent with all the authors of this study. The work flow diagram for data selection and cleaning is summarized in Figure 1.


Figure 1 Flow chart of data cleaning

The researchers identified 11,690 articles published between 2019 and 2023 from Google Scholar, Elsevier, Sage and Oxford databases using the criterion indicated above. Google Scholar constituted (18.39%, n = 2,150), Elsevier (21.39%, n = 2,500), Sage (29.93%, n = 3,500) and Oxford (30.29%, n = 3,540). Figure 2 give details of distribution of articles from the database.
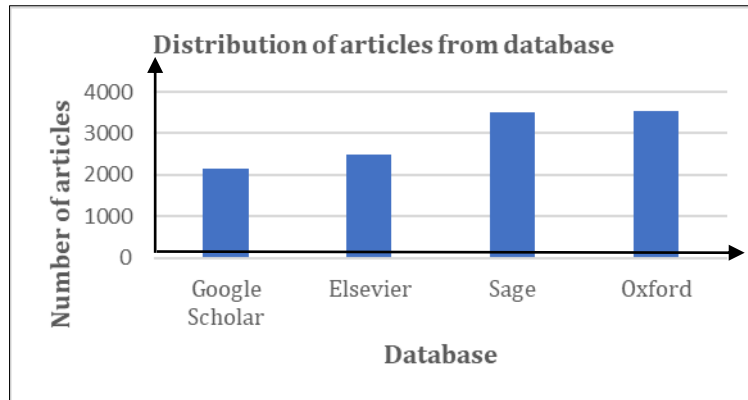
Figure 2 Distribution of articles from database

During data cleaning, there were 0.77% (n = 90) duplicates removed, and 99.23% (n = 11,600) remained. The duplicates were different versions of the same document. The selected 11,600 articles were further screened according to the inclusion and exclusion criteria out of which 90.94% (n = 10,550) were eliminated. From the 1,050 articles assessed for eligibility and inclusion, 80.95% (n = 850) were again excluded because they were review articles according to the criterion for inclusion. The remaining 19.05% (n = 200) articles were further screened eliminating 89.5% (n = 179). The workflow shows that 10.5% (n = 21) articles passed the criterion for inclusion. These articles were published between 2019 and 2023, and they used an empirical methodology, written in English and were published in scholarly peer-reviewed journals. The articles that met the selection criterion focused on AI and communication. **Figure 3** give details of the inclusion analysis.
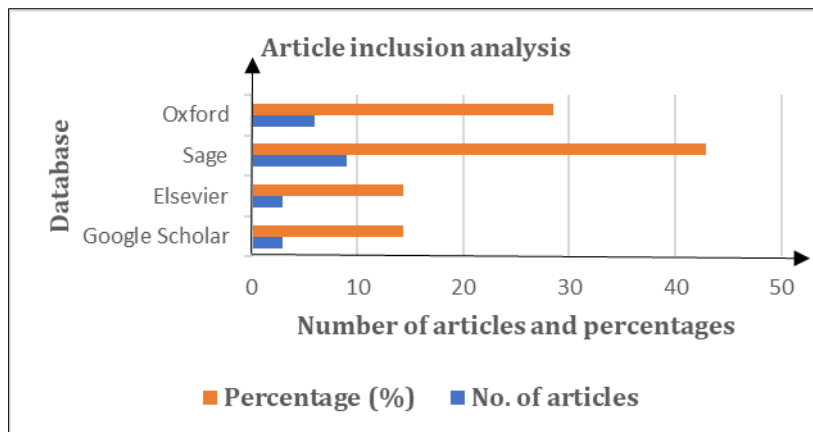
Figure 3 Article inclusion analysis

3. Results and Discussion

This SLR intends to provide an overview of research on AI and human communication. Before the four research questions are discussed, this SLR has provided a short general overview of the studies that were included.

Table 2 Summary of previous studies

Arthur(s)	Title of article	Country	Year of publication	Journal	Methodology	AI technology
Ayoub et al.	Explainable artificial intelligence in communication networks: A use case for failure identification in microwave networks.	UK	2022	Computer Networks	Quantitative	XAI, SHAP, ML
Liaw et al.	Artificial intelligence in virtual reality simulation for inter-professional communication training	UK	2023	Nurse Education Today	Mixed methods	AI-VRS, ML
Butow & Hoque	Using artificial to analyse and teach communication healthcare	UK	2020	The Breast	Quantitative	CN-LOGIT, SCCAP, ML, RIAS, L-LDA
Chowdhury et al.	6G wireless communication systems: Applications, requirements, technologies, challenges	Korea	2020	Communications Society	Quantitative	VR, VLC, 3D, M2M, H2H, uMUB, mMTC
Viswanathan & Mogensen	Communications in the 6G era	USA	2020	IEEE	Quantitative	MIMO, ML, XAI
Nawaz et al.	Quantum machine learning for 6G communication networks: State of the art and vision for the future	UK	2019	IEEE	Quantitative	ML, QC, QML, nMTC, MIMO
Zerfass et al.	Artificial intelligence in communication management: A cross-sectional study on adoption and knowledge, impact, challenges and risks	UK	2020	Journal of Communication Management	Quantitative	ML, XAI, M2M, CMC
Endacott & Leonardi	Artificial intelligence and impression management: Consequences of autonomous conversational agents communicating on one's behalf	USA	2022	Human Communication Research	Qualitative	AICTs, ML
Sundar & Lee	Rethinking communication in the	USA	2022	Human Communication Research	Quantitative	AIMC, CMC, HAII, HCI, ChatGPT

	era of artificial intelligence					
Natale	Communication through or communication with: Approaching artificial intelligence from a communication and media studies perspective	UK	2021	Communication Theory	Quantitative	HMC, CMC, ML, ChatGPT
Hohenstein et al.	Artificial intelligence in communication impacts language and social relationships	USA	2023	Science Reports	Quantitative	ChatGPT, LLMs, smart replies
Hankock et al.	AI-mediated communication: Definition, research agenda and ethical considerations	USA	2020	Journal of Computer-Mediated Communication	Quantitative	AI-MC, CMC
Brewer et al.	Media use, interpersonal communication and attitudes towards artificial intelligence	USA	2022	Science Communication	Quantitative	Pandora box, robots, ML, automation
Guzman & Lewis	Artificial intelligence and communication: A human machine communication research agenda	USA	2020	New Media & Society	Quantitative	HMC, NLP, NLG, HCI, HRI
Hermann	Artificial intelligence and mass personalization of communication content: An ethical and literacy perspective	Germany	2022	New Media & Society	Quantitative	ML, CMC, XAI
Kerr et al.	Expectations of artificial Intelligence and the performativity of ethics: Implications for communication governance	Ireland	2020	Big Data & Society	Qualitative	ML
Luttrell et al.	The digital divide: Addressing artificial intelligence in communication education	USA	2020	Journalism and Mass Communicator	Quantitative	ML
Naidoo & Dulek	Artificial intelligence in business communication	USA	2022	International Journal of Business Communication	Quantitative	ML
Shrivastava & Mahagain	Influence of social net-working sites in scholarly	India	2021	Journal of Libranship and	Quantitative	ML, ChatGPT

|	Communication: A study literature in artificial intelligence			Information Science		
Sundar & Liao	Calling BS on ChatGPT: Reflections on AI as a communication source	USA	2023	Journalism and Communication Monographs	Quantitative	ChatGPT, CMC, CAS, CAM, HCI
Tham et al.	Extending design thinking, Content strategy and artificial intelligence into technical communication.	USA	2022	Journal of Technical Writing and Communication	Quantitative	UX, TPC NLP ChatGPT

Table 3 Definition of abbreviations on AI technology

Abbreviation	Meaning
XAI	eXplainable Artificial Intelligence
SHAP	Shapley Addictive Explanations
ML	Machine Learning
AI-VRS	Artificial Intelligence Virtual Reality Simulation
RIAS	Rackmount Integrated Application Server
VLC	Visible Light Communication
3D	Three Dimensional Media
M2M	Machine-To-Machine
H2H	Human-To-Machine
uMUB	Ubiquitous Mobile Ultra Broadband
mMTC	Massive Machine Type Communications
MIMO	Multiple-Input Multiple-Output
QC	Quantum Computing
QML	Quantum Machine Learning
AICTs	Artificial Intelligence Communication Technologies
AIMC	Artificial Intelligence Mediated Communication
CMC	Computer Mediated Communication
HMC	Human Machine Communication
LLMs	Large Language Models
NLP	Natural Language Processing
HCI	Human Computer Interaction
HRI	Human Robot Interaction
CAS	Content Addressed Storage
CAM	Computer Aided Manufacturing
UX	User eXperience

TPC	Technical Professional Communication

3.1. AI technologies used in human communication

With regards to AI technologies used in communication (research question one), previous studies examined these technologies according to their characteristics and frequency of use **(Figure 4)**
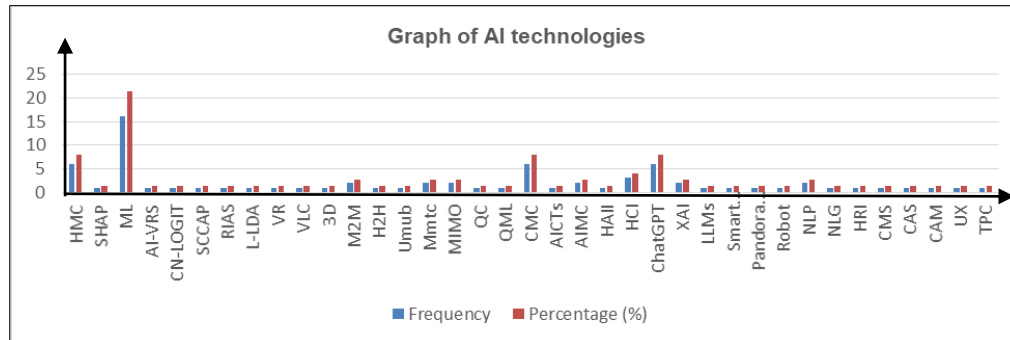
Figure 4 AI technologies used in human communication

With the increasing availability of monitoring data and the recent advances in computing platforms, AI has become a tool for network operators to automate communication. AI-based technologies have already demonstrated superhuman capabilities in solving a wide range of real world problems leading to widespread adoption in communication. The advent of AI technologies has revolutionised interpersonal communication, providing individuals with a host of formats and channels to send messages and interact with others across time and space [24]. The introduction of AI technologies has transformed how people communicate, upend assumptions around agency and mediation, and introduce new ethical questions. Since its emergence in the mid-20th century, the field of research and application has always entertained a close relationship with communication, affecting virtually all areas of our lives over the past decade.

From **Figure 4**, the SLR identified 37 AI technologies used in communication. The SLR revealed that out of the 37 AI technologies, four are widely used in enhancing human communication. They are HMC (8%, n=6), ML (21%, n=16), CMC (8%, n=6) and ChatGPT (8%, n=6).

HMC is an emerging area of communication research which focuses on the study of the creation of meaning among humans and machines [25] and the refinement and development of theory related to people's interactions with technologies such as agents and robots [26]. Findings of the SLR indicate that HMC has evolved out of the increasing efforts by communication scholars to better understand people's interactions with robots (HRI) and agents (HAI) in addition to research that has already taken place within HCI. For this reason, HMC is described as encompassing aspects of HCI, HRI, and HAI. However, Guzman and Lewis [3] hold a conflicting view of the above findings indicating that even though HMC draws from other areas of scholarship, such as HCI, HRI and HAI, it does not encompass their every aspect. Furtherance to the above, Grudin [27] affirms the view of Guzman and Lewis [3], indicating that HMC is an interdisciplinary field that focuses on multiple facets of interactions, beyond questions of communication, with technologies designed to mediate and communicate. The findings indicate that what sets HMC apart is its focus on people's interactions with technologies designed as communicative subjects, instead of mere interactive objects.

Findings of the SLR revealed that ML is embedded in everyday communication services. ML is the area of computational science that focuses on analysing and interpreting patterns and structures in data to enable communication, learning, reasoning, and decision making. Findings of the SLR indicates that with the increasing availability of monitoring data and the recent advances in computing platforms, AI and ML are becoming key tools in communication which is mostly used by network operators to automate network management. In support, Kerr et al [28] affirm the above findings by indicating that ML is at the centre of an immense positive, and future orientated discourse disseminated by national research programmes, consultancy reports and corporate statements.

CMC is classified as AI technology that can be used between people using network-connected digital devices to exchange messages such as email, text messaging, social network site interactions, and videoconferencing [24]. In other words, CMC is a mediated communication between people in which a computational agent operates on behalf of a communicator by modifying, augmenting, or generating messages to accomplish communication or interpersonal goals. The SLR revealed that CMC is widely used in interpersonal communication. This finding agrees with Hancock et al. [24]

study which affirms that CMC has advanced text-based communication from auto-correct, predictive text, and grammar correction to smart replies, auto-completion, and auto-responses used in Gmail and mobile phones. For example, in Gmail's smart replies, an email recipient can select one of several responses produced by CMC. This trend is equally, if not more, advanced for nonverbal CMC, such as the auto-insertion of emoji. In confirmation, Statt [29] also corroborates the above findings indicating that CMC technologies will be able to wholly generate messages on behalf of a sender, including creating online profiles, or even generating messages in synchronous communications.

ChatGPT was first pre-trained based on a vast corpus of human-generated text, and further extensively fine-tuned on specific tasks. ChatGPT is excellent at using natural language, trained to guess the next word, generating highly human-like text, or performing other human language tasks like having a dialogue [30]. Findings from the SLR indicates that ChatGPT serve as a source of communication. ChatGPT is simply stringing words together based on their co-occurrence in the vast corpus of human-produced text. This is the reason why the end result is almost, but not quite, meaningful. However, Sundar and Liao [31] disagree with the above findings. They indicate that although ChatGPT is good at mimicking human writing style, it lacks a real understanding of the object or phenomenon that it is describing. Explaining further, Sundar and Liao [31] indicate that ChatGPT showcases the danger of relying solely on AI-generated content, which can propagate false information in a seemingly trustworthy manner. Therefore, AI writers should prominently disclose that the information is AI-generated, so that users can be more cautious and critical in evaluating the credibility of information and possibly verify its accuracy by seeking corroboration in search engines and other sources that they trust.

3.2. Methodologies in AI and human communication related papers

The SLR for research question two revealed that scholars employ qualitative, quantitative and mixed methods in their studies on AI and communication. See **Figure 5** below for the graphical representations of the methodologies in AI related papers.
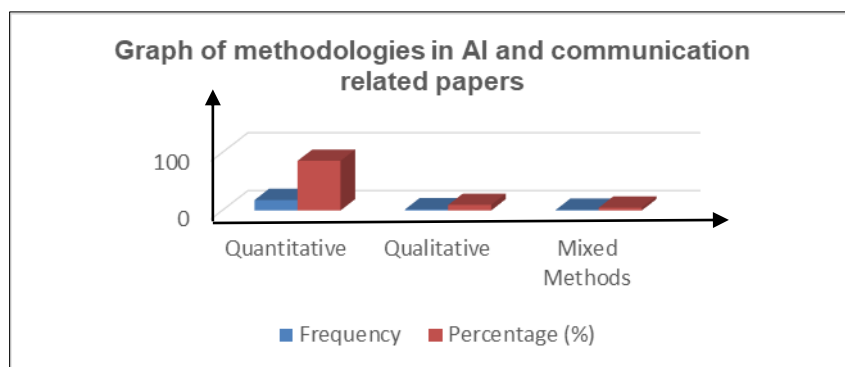
Figure 5 Methodologies in AI and human communication related papers

The SLR indicates that majority (86%, n=18) employed the quantitative research approach using survey and questionnaire to test objective theories by examining the relationship among variables. This finding corroborates Creswell [32] view that quantitative research is most suitable when examining the relationship among variables so that numbered data can be analysed using statistical procedures. This will help in building inquiry based on assumptions about testing theories deductively, building in protections against bias, controlling for alternative explanations, and being able to generalise and replicate the findings.

The SLR further revealed that scholars also used qualitative research approach in the study of AI and communication. This approach represents (10%, n=2) out of the 21 papers reviewed.

Findings from the SLR revealed that out of the 21 research papers reviewed, 10%, n=2 used the qualitative research methodology to collect data through interviews, online survey and content analysis from participants' settings and inductively derived general themes. This SLR findings affirm the view of Creswell [32] who avers that qualitative studies collect data from participants' settings, inductively analyse data building from particulars to general themes, and researcher making interpretations of the meaning of the data.

Findings from the SLR shows that 5%, n=1 out of the 21 research papers used mixed methods for their study to provide a more complete understanding of the research problem. As affirmed by Creswell [32], this research approach implies

collecting and analysing first quantitative and then qualitative data in two consecutive phases within one study. The main logic behind this approach is that the quantitative data and their subsequent analysis contribute to a general understanding of the research problem. On the other hand, the qualitative data and their analysis distill and explain those statistical results by investigating participants' views in more depth [32]. Focus group discussions (FGD) and interviews were the data collection methods for the qualitative studies while survey and questionnaire were used for the quantitative studies.

3.3. Yearly distribution of AI and human communication related papers

Results from the SLR (research question three) indicate that there were more research publications in the year 2020 [3, 5, 10, 24, 28, 33, 34, 35] and 2022 [36, 37, 38, 39, 40, 41, 42]. See **Figure 6** below for the graphical representations of the yearly distribution of AI related papers.
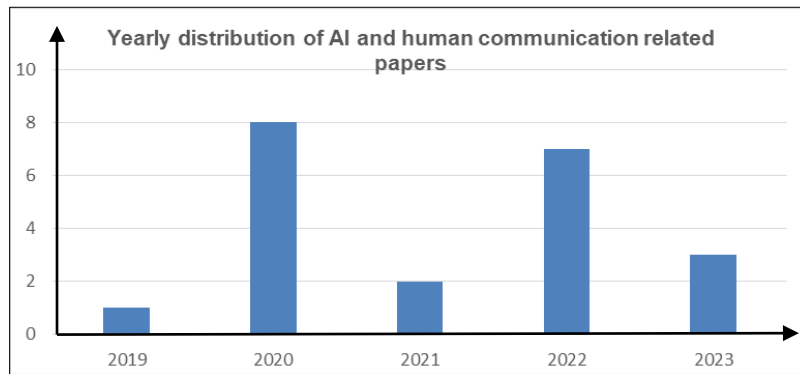
Figure 6 Yearly distribution of AI and human communication related papers

It is evident from the SLR that AI has seen significant growth and utilisation in communication in recent years, including 2020 and 2022. The results of the SLR indicates that even though AI has been in use for decades, it has recently started to trend in 2020 and 2022 due to advances in technology, such as faster processors and more powerful algorithms. This has enabled AI to become more efficient and accurate, allowing it to take on more complex tasks. This finding is in line with the study of Hohenstein et al [4] who found out that one of the most pervasive AI applications to date is personalized reply suggestions in text-based communication through the generation of algorithmic responses which constitutes 12% of all messages sent. The results of the findings also indicate that in 2020 and 2022, there was enhanced customer experiences which focused on AI-powered technologies, such as recommendation systems and personalized marketing. In support to Hohenstein et al [4] study, in 2020 and 2022, businesses utilised AI algorithms to understand customer preferences and behaviour, enabling them to deliver personalized experiences, targeted advertisements, and tailored recommendations. The yearly distribution of AI and communication related papers for 2019, 2021 and 2023 were 1, 2 and 3 respectively.

3.4. AI and human communication related papers per country
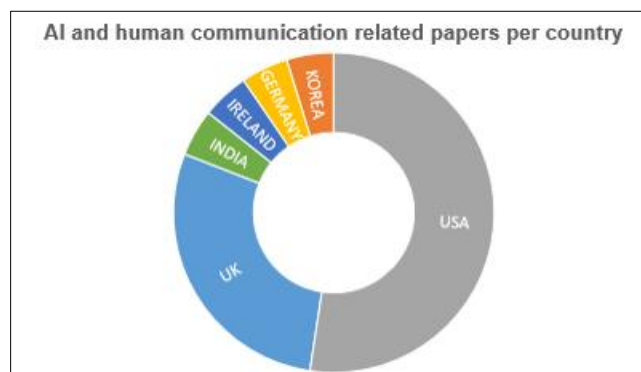
Figure 7 AI and human communication related papers per country

The SLR for research question four revealed that UK, Korea, USA, Germany, Ireland and India published papers related to AI and communication. See **Figure 7** below for the graphical representations of the AI and communication related papers per country.

Findings from the SLR revealed that USA (52%, n=11) and UK (29%, n=6) are prominent contributors to the field of AI and are known for publishing a significant number of research papers on the concept. This SLR finding is in line with Maslej et al [43] study on AI index 2023 annual report which was published by Stanford University. Results by Maslej et al [43] study on the AI index annual report indicate that the number of AI research collaborations between the United States and UK have increased tremendously. The results further indicate that USA and UK have strong research institutions that have history of excellence in scientific research. Institutions like MIT, Stanford University, Oxford University, Cambridge University, and Imperial College London have made significant contributions to AI research. USA and UK also have robust academic environment that fosters innovation and encourages research in emerging technologies like AI. These countries have well-established programs and departments dedicated to computer science, ML and AI. They attract top talent from around the world, including researchers and students who contribute to the publication output.

The SLR indicates that USA and UK provide funding opportunities for AI research. Government agencies, such as the National Science Foundation (NSF) in the USA and the Engineering and Physical Sciences Research Council (EPSRC) in the UK, provide grants and funding to support research projects. Additionally, private companies, venture capital firms, and philanthropic organisations in these countries invest heavily in AI research. This finding is supported by IPO [44] who indicates that UK's government is dedicated to advancing the UK's AI sector, which is estimated to add £630bn to the UK economy by 2035. Further, IPO [44] avers that AI is one of the four grand challenges forming the UK government's industrial strategy which aims to boost the productivity and earning power of people, and to increase the level of investment in Research and Development (R&D) from 1.7% to 2.4% of GDP by 2027.

From the SLR, countries such as Korea (5%, n= 1), Germany (5%, n=1), Ireland (5%, n=1) and India (5%, n=1) are also instrumental in supporting AI activities.

4. Conclusion

This SLR provides an overview of research about AI and human communication by providing important insights for empirical based research. According to the SLR, the growing availability of monitoring data and advancements in computing platforms have enabled network operators to use AI as a means of automating communication. AI-based technologies have proven their superhuman capabilities in addressing a diverse array of real-world challenges, which has resulted in their widespread adoption in communication. The SLR identified 37 AI technologies used in communication. The SLR revealed that out of the 37 AI technologies, four are widely used in enhancing human communication. They are HMC, ML, CMC and ChatGPT. The results of the SLR indicates that even though AI has been in use for decades, it has recently started to trend due to advances in technology, such as faster processors and more powerful algorithms.

It is evident from the SLR that AI in human communication has the tendency to transform the way people communicate with each other. By developing intelligent systems that can understand, generate and respond to natural language, researchers can work on the underlying principles of human communication. In terms of application, AI technologies can be used to improve human communication. For example, chatbots can be used to promote customer support and help people navigate difficult systems. AI can be used to analyse human communication patterns and provide feedback in assisting people to improve their communication skills. It is important for researchers, practitioners and policymakers to work together to ensure that AI is developed and used in a responsible and ethical manner.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

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