

Artificial Intelligence in Communication Technology

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Abstract

Humans have an evolving need to communicate with one another and artificial intelligence can facilitate this process. This research paper evaluates human beings need to communicate and the integral role played by AI technologies in enabling those communications. The findings indicate that the development of mobile and networked computing systems with superior video, camera, and audio recording capabilities have improved people's ability to convey large volumes of structured and unstructured information about their personal lives. However, they lack the means needed to view, analyze, and interpret the collected data. Using machine learning applications, AI-based technologies address this modern-day communication need by reading, identifying patterns, and providing timely and accurate big data interpretations. This development has proved effective in addressing healthcare communication needs, traffic flow communication needs, and individual consumers' big data communication needs.

Introduction

From Amazon Alexa to Cortana, artificial intelligence (AI) tools and applications are blossoming and evolving at a fairly rapid rate. Past and current science fiction films and texts have predicted that the development of AI-based bionic humans with human-like features and mannerisms would represent the peak of that evolution. However, recent advancements have shown that AI is a broad category of technologies that can encompass many things, including IBM's Q&A Watson Assistant technology, Google's e-commerce and consumer behavior forecasting technology, and Facebook's *DeepFace* facial recognition technology. These AI tools and applications can outperform humans specialized tasks like driving cars, undertaking internet searches, recognizing minute differences in facial features, solving equations, playing chess and other strategy games, and predicting consumer behavior. In the future, the AIs will move from specific capabilities (like dialogue response, speech recognition, or image recognition) to general skills that replicate the intellectual functionalities of the human brain. In the coming years, AI technologies will outstrip human beings in general cognitive activities like self-control, self-motivation, self-consciousness, self-awareness, inventing, looking, listening, thinking, talking, sensing, and moving.

As the case with the rapid evolution of AI tools and applications, human beings' need to communicate is changing rapidly. Tens of thousands of years ago, establishment of connections with relatives and acquaintances in neighboring villages was human beings' primary communication need. Therefore, they relied on their vocal capabilities and stored information as their primary means of communication. Archaeological data suggests that early humans used their vocal capabilities, cliffside carvings, cave paintings, fire, smoke, flag semaphores, light beams, and nautical signal flags to convey information that they regarded as useful

(Montgomery, 2002). As civilization advanced, the communication distance increased, and their communication needs became more complex, human beings conceived and adopted a new method of transmitting information (Montgomery, 2002). They fashioned new symbols and developed new techniques to engrave them onto portable stone tablets or papyrus reeds (Montgomery, 2002). As communication needs evolved, humans realized that they would need to develop copies of their messages to ease communication (Montgomery, 2002). However, they could not rely on stones and reeds because etching messages into stones and reeds was a tedious, time-consuming, energy-sapping endeavor. To address this problem, they developed the printing technique. They would apply ink to the medium and transfer the original message to the new surfaces that would represent copies of the original.

These advancements led to a 200-year period (1800 to the present day) in which rapid changes in human beings' communication needs led to massive advancements in communication technologies. The development of the printing press led inventors, scholars, and innovators to develop new systems of transmitting communication signals through space via electromagnetics, electrical conductance principles, and the telephone. Thereafter, the development of vacuum tube rectifiers and amplifiers made radio reception and transmission affordable and ubiquitous. Between 1975 and 1990, advancements in satellite microwave communication came in to satisfy human beings and business enterprises' increased need for rapid, long haul communication. By the year 2000, satellite microwave became the primary basis for the transmission of television, business voice, business data, and other forms of long-haul communication. In recent years, human beings' need to instantaneously convey large volumes of structured (text and numbers) and unstructured data (images and videos) has led to the development of fiber optic cables.

As these communication needs continue to evolve, human beings will become increasingly reliant on AI tools and applications. Humans have an evolving need to communicate with one another and artificial intelligence can become a useful tool for facilitating this process. In this regard, the overarching aim of the current research paper is to evaluate current human communication needs and the role that AI applications can play in supporting them. The paper will satisfy this overall aim in two ways. First, it will analyze the contemporary evolution in human beings need to communicate. Second, it will offer a detailed account of recent and future AI developments in the field of communication and the role they will play in addressing the documented communication needs.

Limitations of Study

While the research paper seeks to evaluate the role that existing and future technologies will play in addressing human beings' evolving need to communicate, readers ought to note certain limitations. First, the researcher will base his arguments on secondary data drawn from previously published studies. As the researcher has not attempted to replicate findings in those studies, it is highly probable that biases, errors, and omissions in those treatises might move to the present study and contribute to the publication of erroneous, misleading, or biased findings. Second, the researcher is unable to make an independent verification of the connection between the evolution of human beings need to communicate and recent AI advancements. In this respect, it is impossible to verify whether technology firms considered the evolving needs of human beings prior to the development of AI-based communication tools and applications. Third, the research paper aims to study the role of AI in supporting human beings' need to communicate, but this will not extend to an analysis of the role of AI in supporting the communication needs of business enterprises. The researcher believes that an assessment of the role of AI in augmenting

business communication requires a separate research paper. Therefore, the research will focus on human-to-human communication.

Methodology

This is a qualitative research study in which the author will rely exclusively on secondary data drawn from published information closely related to the topic. The secondary data will consist of textbooks, peer-reviewed journals, and reports that are relevant to the topics on the evolution in people's need to communicate with each other and the role of AI-based technologies in addressing those needs. The researcher used online databases to identify the studies undertaken in general and specific aspects of the researcher's topic. Thereafter, he eliminated the texts by focusing solely on studies published after 2014. In this respect, the researcher will limit himself to publications published after 2014. However, he decided to include a text published in 2002 because it provided a piece of crucial information on the changes in the ways in which human beings have been communicating with each other and the factors that have been driving those changes.

Literature Review

Scholars have published extensive texts on the role that AI plays in addressing human beings' evolving need to communicate. An analysis of existing publications shows that some of the studies have focused exclusively on human beings' evolving need to communicate. In line with this, the studies have analyzed the evolution of human communication from the time human beings used scrolls, reeds, and smoke signals to convey messages to the present time when are using smartphones and other mobile computing systems to transmit messages. The studies suggest that the need for better means of transporting, storing, analyzing, and conveying information has been the primary driver of technological advancements. They suggest that this

evolving communication need is the main factor that has led to the increased utilization of AI technologies to support the collection, storage, transmission, analysis, and interpretation of the large quantities of structured and unstructured information generated by smartphones, CCTVs, and other forms of mobile and networked computing systems. In addition to the evolution of people's need to communicate and the role AI, other studies have focused on the role of AI in revolutionizing human communication. These studies highlight how advancements in the machine learning applications used in modern-day communication technologies will increase the ease with which people disseminate and interpret vast amounts of personalized data. The final category of study focus on the impact of AI on human communication needs in the health sector. These peer-reviewed journals evaluate the role that AI plays in addressing patients' changing need to communicate about their health statuses.

Whereas the studies have undertaken a comprehensive analysis of the role of AI in human communication, all of them have been piecemeal. None of the reviewed publications has analyzed human beings evolving need to communicate and the role that AI can play in facilitating those communications. This literature gap has made it extremely difficult for readers to understand the correlation between people's evolving need to communicate and the advancements in machine learning or deep learning capabilities in AI technologies. The present research paper will bridge this gap by highlighting the link between human beings' evolving communication needs and recent AI advancements. Subsequently, it will analyze the AI applications developed to boost or address human beings' changing communication needs. The findings will be instrumental in enhancing readers' understanding of the changes in human beings need to communicate and how AI applications can provide opportunities for facilitating the process.

Artificial Intelligence and Communication

Evolving Communication Needs

Throughout the evolution of human beings' need to communicate, the desire for more reliable systems of storing and transmitting structured and unstructured data has always been the trigger for change. When human beings shifted from carving symbols in stones and reeds to the printing press, the desire for improved methods of storing and conveying messages was the primary trigger for change. Inscription of messages on stones and reeds required between 1 to 7 days and transmission of the scroll to the intended recipient generally required a lot more time (weeks to months) (Montgomery, 2002). Even with the development of the printing press, the human society's desire for better storage and transmission modes led to the switch to satellite microwave (Montgomery, 2002). This mode of communication proved effective in storing and transmitting information over large distances, but it was prone to disruptions. Further, it could not withstand the heavy traffic that has arisen from the recent move to digitize all aspects of human interaction and transactions. Consequently, the need for a system that would instantaneously transmit large volumes of data over long distances led to the development of glass fiber optics. Glass fiber optics gave human beings the power to use light pulses to convey large volumes of data. The light pulses transport the information along fiber optic cables with hundreds of thin plastic or glass strands. The improvement in human beings' ability to transmit voluminous information has addressed people's need for a system that can send information with minimal interruption.

In the process of addressing this need, it has created a new problem that necessitates the utilization of AI tools and application. The development of fiber optics technology and the improvement in people's ability to transmit data have created a situation in which human beings'

successful achievement of daily activities will hinge on their ability to interpret the clusters big data they encounter from time-to-time (Chen & Kharabsheh, 2018). With every human interaction with a person, computer, or organization, an opportunity arises for measuring, recording, analyzing, and transmitting data. Experts have developed systems that can collect, store, and process information that completely describes a person's past, present, and future (Horne, 2018). At present, large corporations and the ruling elite are the chief beneficiaries of this data-driven lifestyle. Individuals and small organizations are still at a disadvantage (Domenico, 2019). Economically disadvantaged members of society are facing hardship in their quest to navigate through and communicate within their data-driven social environments (Chen & Kharabsheh, 2018). Some scholars have argued that the development of legal regulations is the most effective approach for addressing the needs of the underprivileged (Chen & Kharabsheh, 2018). Nonetheless, recent technological advancements increasingly indicate that AI will be the primary resource that will improve their ability to receive, send, store, interpret, and visualize big data.

AI Applications to Address Human Beings Communication Needs

A high level of congruence exists between people's evolving need to communicate and AI-based machine learning. Through deep learning or machine learning applications, AI-based technologies can study patterns or changes in human beings' need to communicate, learn about them, and change in accordance with the observed changes. Machine learning is an AI concept that denotes the ability of AI-based machines or technologies to automatically improve its capabilities through experience (Lv, et al., 2015). In relation to AI-based communications technologies, machine learning denotes their ability to improve and become better in response to identified changes in human beings' evolving need to communicate (Jordan & Mitchell, 2015).

Developers “train” the AI-based communication systems by exposing them to illustrations of anticipated input-output behavior (Jordan & Mitchell, 2015). The creation of machine learning AI applications will be beneficial to the data-intensive aspects of human communication like consumer services, traffic flow communication, and healthcare communication (Jordan & Mitchell, 2015). The technology has also had a substantial effect on technologies that are critical to human communication (Jordan & Mitchell, 2015). These technologies include autonomous vehicle control technologies, robotics technologies, natural language processing technologies, speech processing technologies, neuroscience research technologies, object recognition annotation technologies, and computer vision technologies (Jordan & Mitchell, 2015). As the machine learning applications continue to learn about the changes in human beings’ need to communicate, people will witness a significant improvement in the capabilities of AI-based technologies developed to address those needs.

In their quest to learn about and predict human beings’ evolving need to communicate, the AI-based deep learning applications have led to the development of ancillary technologies with superior big data collection, analysis, interpretation, and dissemination capabilities. In the past decade, the massive spike in networked and portable computing systems’ capacity to retrieve and convey vast amounts of data has forced engineers, corporations, and scientists to turn to machine learning based communication support technologies for solutions on the generation of useful decisions, forecasts, and insights from the collected and transported datasets (Jordan & Mitchell, 2015). Using the machine learning communication support technologies scientists can now obtain useful predictions and insights on the volumes of granular, personalized data drawn from smartphones and other mobile computing systems (Jordan & Mitchell, 2015). Algorithms in the technologies can evaluate, learn from the data, and help

technology firms to customize solutions based on the communication needs of each individual citizen (Jordan & Mitchell, 2015). Additionally, the AI-based technologies have networked the customized services in a way that permits the delivery of an overall communication framework that takes advantage of the diversity of information generated by individual consumers (Jordan & Mitchell, 2015). As these arguments show, machine learning capabilities have led to the development of smart communication support technologies that evolve with every evolution in human beings' need to send and receive information.

Various sectors have benefited from the technologies' ability to retrieve large quantities of data, study them, and develop customizable solutions that address human communication needs. Healthcare communication is one of the sectors that have benefited from AI learning advancements. AI applications have eliminated the healthcare communication challenges that plagued the traditional systems of communication. Prior to the development AI, public health experts, hospital, and other stakeholders conveyed their messages through generic, one-way, expert posters, press releases, and other mediums that were inconsistent with the information preferences of target audiences. As a consequence, the conveyed information generated disappointing results. However, advancements in AI have led to the development of healthcare communication systems that are aligned with the social contexts, culture, language, and literacy levels of the target audience. AI innovations have also led to the development of healthcare communication mediums that are legible, interactive, accessible, engaging, and easy to understand. Further, the innovations have created an opportunity for the development of communication mediums that can deliver messages to all members of a given community. In particular, the AIs have supported the personalization of healthcare messages and information to reach different members of society. The move to customize the information has made it easier

for practitioners to customize healthcare communications in a way that addresses the unique needs of individual members of society.

An assessment of the design of eHealth communication offers crucial insight into the role of AI in addressing human communication needs. Based on AI, e-Health communication is an application that gives healthcare stakeholders unparalleled opportunities for avoiding many of the historic challenges that undermined the transmission of healthcare information. With the aid of machine learning technology, the eHealth application delivers complex communications by mimicking human intelligence. The application uses AI to develop avatar health coaches, user-friendly human-computer interfaces, blood glucose monitors, exercise monitors, and sleep monitors. These AI-based features collect, analyze, interpret, store, and disseminate the information to doctors and patients via text messages. The conveyed data helps patients, social workers, nurses, and physicians to appreciate the factors that are undermining patients' wellbeing.

The AI-based eHealth application has been particularly useful in addressing the healthcare communication needs of US veterans. The US Veterans Health Administration's National Care Coordination (HANCC) program has incorporated the eHealth application into its Telehealth program. Through an eHealth-based smart healthcare communication and monitoring system, the HANCC can now track and assess US veterans' daily healthcare needs (Neuhauser, et al., 2013). From a remote location, healthcare experts at HANCC can identify when individual veterans are facing healthcare challenges and deliver the support programs that veterans and their caregivers need to make reasoned health judgments (Neuhauser, et al., 2013). Investigations into the effectiveness of the application have shown that it has been effective in improving veterans' self-care capabilities and reduced hospital visits (Neuhauser, et al., 2013). This positive outcome

has benefited American taxpayers by reducing the funds expended in the provision of healthcare services to Veterans.

Similarly, technology companies have developed *ChronologyMD*, an AI-based healthcare communication technology, to address the healthcare communication needs of Crohn's disease patients. Crohn's disease is a chronic, incurable disease affecting more than 600,000 American citizens. Whenever the disease flares up, patients cannot work, maintain social relationships, and control their mental health. To compound the problem, treatment depends on the severity of the disease and each patient's specific symptoms (Neuhauser, et al., 2013). In this regard, physician-patient communication is critical to successful management of the symptoms (Neuhauser, et al., 2013). To address this communication need, technology firms developed the *ChronologyMD* application (Neuhauser, et al., 2013). The application utilizes AI functionalities to assist patients in identifying and implementing the daily living practices needed to improve their behaviors, attitudes, thoughts, and feelings (Neuhauser, et al., 2013). The subsequent improvements mitigate Crohn's disease flare-ups (Neuhauser, et al., 2013). Without AI functionalities like machine learning and machine intelligence, it would have been impossible for these patients to address their unique communication needs and manage the symptoms of this debilitating disease. The positive outcomes associated with AI underscore the essence of AI in addressing human beings' need to communicate.

As well as *ChronologyMD*, ICT firms have created ambient assisted living (AAL) systems to address senior citizens' healthcare communication needs. AAL is an AI-based platform that offers an ecosystem of software, wireless networks, computers, and medical sensor applications used in monitoring the health of elderly persons (Memon, Wagner, Pedersen, Beevi, & Hansen, 2014). AAL systems use advancements in ICT and AI to enhance senior citizens'

ability to lead an independent life (Memon, et al., 2014). The technology utilizes interconnected software applications, computer networks, computers, adaptive learning systems, interactive systems, ambient intelligence systems, automatic decision-making systems, wireless sensor and actuator networks (WSANs), medical sensors, and databases to give elderly people the information they need to monitor their personal health, reduce hospital visits, and maintain an independent lifestyle (Memon, et al., 2014). Within the AAL systems, medical sensors and actuators linked to home gateways and AAL applications transmit each patient's personal health information to the health monitoring systems with the aid of the WSANs. The application conveys information related to the elderly patient's pulse rate, blood pressure, and blood sugar to the health monitoring systems. Subsequently, a physician or caregiver monitoring the patient from a remote location responds with the appropriate intervention when necessary (Memon, et al., 2014). These AI-based technologies have been so effective in addressing elderly people's need to communicate about their health that experts suggested that AAL and other self-monitoring health devices increased the number of households using the devices from 420,000 in 2010 to 570,000 in 2011 (Memon, et al., 2014). Forecasts suggested that more than 2.47 million households in the US would use AAL and other AI-based technologies by 2016 (Memon, et al., 2014). The development of AAL and the resultant surge in demand underline the effectiveness of AI in addressing the communication needs of the elderly.

In addition to healthcare communication, AI applications have been instrumental in addressing communication needs related to the flow of traffic. Intelligent transportation systems (ITS) are among the AI applications developed to address human beings' desire to communicate about the flow of traffic. Prior to the development of the technology, consumers experienced immense challenges in their quest to obtain traffic forecasts and real-time information on traffic

flow (Lv, Duan, Kang, Li, & Wang, 2015). Increased reliance on road transport had ushered a new era of big data transportation. The advent of this era elevated human beings' need to send and receive accurate and timely forecasts on the flow of traffic, but existing technologies could not satisfy this need (Lv, et al., 2015). Nonetheless, ITSs are satisfactorily addressing that need by delivering communications that aid road users in making better travel choices, improving the operational efficiency of traffic, reducing carbon emissions, and mitigating traffic congestion (Lv, et al., 2015). The technology relies on deep learning, a machine learning technique that uses deep architectures and algorithm-based multi-layer architectures to identify traffic flow patterns from large volumes of structured and unstructured data (Lv, et al., 2015). Without prior knowledge on the traffic flow situation in a given location, the technology's deep learning algorithms can identify features in the movement of vehicles that may signal the possibility of gridlock (Lv, et al., 2015). By predicting the movement of vehicles, AI technology improves individual travelers' ability to communicate about traffic. It gives them accurate and timely forecasts on the flow of traffic in the same way that satellites provide accurate and timely weather predictions. In this way, individual travelers can plan their movement several hours before the commencement of their journey. This positive outcome underscores the significant role that AI plays in facilitating human beings' evolving need to communicate.

Beyond traffic flow, AI-based support technologies have addressed communication needs associated with the collection, interpretation, and dissemination of vast amounts of images, videos, and other categories of unstructured data. The development of smartphone and other mobile computing technologies with superior camera, voice, and video applications has made it easier for humans to collect and disseminate large volumes of unstructured data (Jordan & Mitchell, 2015). The recipients' inability to interpret the data has been a major hindrance to the

conveyance of messages with unstructured data (Jordan & Mitchell, 2015). However, recent advancements in AI-based supervised learning systems will enhance the ease with which human beings collect, disseminate, and interpret video, image, and audio files (Janis, Deyu, Yuewei, & Anatoly, 2017). The technology uses learned mapping to identify patterns in the unstructured data and give the recipient of the message a brief summary of its contents (Jordan & Mitchell, 2015). If a person sends an hour-long video of birds flying over a large forested area, the recipients will not go through the tedious process of viewing the whole video to understand its content. The supervised learning system will use the convolutional neural network to read through the video, interpret key features, and use its recurrent neural network to generate a caption to summarize the content. With the aid of this knowledge, the recipients will decide whether they need to view the video to get a better grasp of its content. In a collaborative environment, the technology would become useful in increasing the speed with which members communicate. It would also reduce the time spent by members of the group in reviewing vast amounts of data. In the long-term, collaborative teams would become extremely efficient.

Conclusion

Communication is fundamental to AI theory, AI practice, and AI applications and tools. Communication, whether understood as a concept, a means of conveying messages, or a discipline as in the case of communication studies, has played a central role to the development of AI technologies and AI-related practices that address human beings need to communicate with one another. In line with this, communication is one of the core aspects of many of the existing AI technologies and applications. The foregoing analysis has suggested that an inextricable connection exists between communication and AI. The studies suggested that human beings switched from one communication medium to another because of their evolving needs. Their

desire for a fast and efficient system of conveying messages led them to switch from signals and scrolls to the printed press. Their desire to send, receive, analyze, and interpret large volumes of structured and unstructured data was the primary influence behind their decision to change from satellite microwave communication to fiber optics. Their wish for a mode of communication that could facilitate the transmission, analysis, and interpretation of complex and bulky data is now the factor that has led to the development of AI. Today, healthcare, transportation, and mobile computing have drawn immense benefits from AI communication support technologies.

References

- Chen, S., & Kharabsheh, R. (2018). The link between innovation and prosperity: How to manage knowledge for the individual's and society's benefit from big data governance? In S. Kruger, & S. Moses, *Big data governance and perspectives in knowledge management* (pp. 200-217). New York, NY: IGI Global.
- Domenico, T. (2019). *Big data and the computable society: Algorithms and people in the digital world*. New York, NY: World Scientific.
- Gunkel, D. (2012). Communication and artificial intelligence: Opportunities and challenges for the 21st century. *Futures of Communication*, 1(1), 1-25.
- Horne, J. (2018). Visualizing big data from a philosophical perspective. In R. Segall, & J. Cook, *Handbook of research on big data storage and visualization techniques* (pp. 809-851). New York, NY: IGI Global.
- Janis, T., Deyu, L., Yuewei, L., & Anatoly, F. (2017). Supervised machine learning-based determination of three-dimensional structure of metallic nanoparticles. *The Journal of Physical Chemistry Letters*, 8(20), 5091-5098.
- Jordan, M., & Mitchell, T. (2015). Machine learning: Trends, perspectives, and prospects. *Science*, 349, 255-260.
- Lv, Y., Duan, Y., Kang, W., Li, Z., & Wang, F. (2015). Traffic flow prediction with big data: A deep learning approach. *IEEE Transactions on Intelligent Transportation Systems*, 16(2), 865-873.
- Memon, M., Wagner, S., Pedersen, C., Beevi, F., & Hansen, F. (2014). Ambient assisted living healthcare frameworks, platforms, standards, and quality attributes. *Sensors*, 14, 4313-4341.

Montgomery, J. (2002). History of fiber optics. In C. DeCusatis, *Fiber optic data communication: Technology advances and futures* (pp. 3-31). New York, NY: Academic Press.

Neuhauser, L., Kreps, G., Morrison, K., Athanasoulis, M., Kirienko, N., & Brunt, D. (2013). Using design science and artificial intelligence to improve health communication ChronologyMD case example. *Patient Education and Counseling*, 92, 211-217.