Spatial Information Research
https://doi.org/10.1007/s41324-023-00567-5

# How does ChatGPT evaluate the value of spatial information in the 4th industrial revolution?

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Received: 17 October 2023 / Revised: 26 November 2023 / Accepted: 30 November 2023


**Abstract**
Chat Generative Pre-trained Transformer (ChatGPT), developed by OpenAI, is a prominent AI model capable of understanding and generating human-like text based on input. Since terms and concepts of spatial information are contextual, the applications of ChatGPT on spatial information disciplines can be biased by the perceptions and perspectives of ChatGPT towards spatial information. Therefore, a thorough understanding of the real magnitude and level of comprehension of spatial information by ChatGPT is essential before exploring its potential applications in spatial information disciplines. This article aims to investigate how ChatGPT evaluates spatial information and its potential contributions to 4th Industrial Revolution (Industry 4.0). ChatGPT has summarized a notable perspective on evaluating and utilizing spatial information in the context of the Industry 4.0. The result of this study shows that ChatGPT has a good understanding on contextual concepts related to spatial information. However, it exhibits potential biases and challenges, as its responses lean towards the technological and analytical aspects. The results provide a crucial understanding on how to leverage ChatGPT's benefits to the fullest while recognizing its constraints, with the aim to enhance the efficacy from the perspective of applications linked to spatial information.

**Keywords** ChatGPT · Spatial information · Perception · 4th Industrial Revolution

## 1 Introduction

The initiation of transformer-driven large language models, along with associated chatbot platforms like Chat Generative Pre-trained Transformer (ChatGPT), has profoundly impacted researchers and proven beneficial across the educational spectrum, scientific disciplines and business, from computer sciences to marketing [1]. ChatGPT can assist the descriptive spatial analysis and algorithmic operations such as slope calculation, aspect determination, or neighborhood operations with raster imageries converted to structured format data (matrix or CSV) and vector data with given coordinates. Opinions from both academic and practical aspects vary, with some expressing concern and others urging

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Published online: 12 December 2023

acceptance of ChatGPT in spatial information disciplines. In recent years, spatial information has become more and more sophisticated with the development of cyber-physical systems (CPS) and the Internet of Things (IoT), along with the advent of the Fourth Industrial Revolution (hereinafter, Industrial 4.0) [2, 3]. Since terms and concepts of spatial information are contextual, terms are used interchangeably, covering the spectrum of sensors, technologies, and applications used for spatial data with location data [4]. The applications of ChatGPT on spatial information disciplines can be discriminated by the perceptions and perspectives of ChatGPT towards spatial information. Therefore, a thorough understanding of the real magnitude and level of comprehension of spatial information by ChatGPT is essential for investigating its potential applications in spatial information disciplines.

Since ChatGPT is not specifically designed for spatial information handling, it is required to demonstrate an implicit understanding of it through its expansive training data and adeptness in language understanding of spatial information. Suppose ChatGPT accurately comprehends the concepts of spatial information. In that case, it can generate contextually relevant and coherent responses or actions based on spatial information provided in the textual input, such as descriptions of locations, distances, or directions. The model can interact with spatial data through textual interfaces, enabling it to engage in tasks such as descriptive analytics, which might elucidate trends or patterns in spatial data described in the text. Furthermore, when provided with textual descriptions of spatial scenarios, ChatGPT can generate plausible drawings or explanations, which could be valuable in spatial decision-making processes.

Most studies have explored the applicability of ChatGPT in geographic information systems (GIS), remote sensing and geography. Agapiou and Lysandrou (2023) explored the possibility of a literature survey regarding remote sensing archaeology using the ChatGPT [5]. Nguyen et al. (2023) examine the potential of ChatGPT in Vietnamese geography education [6]. An OpenAI technical report examines the performance evaluation of GPT-3.5, mainly Advanced Placement (AP) tests in geography and GIScience [7]. Verstegen et al. (2023) question the substitutability of ChatGPT for higher-level learning in geography and GIScience [8]. However, it is very hard to find previous studies exploring the application potential of ChatGPT focused on spatial information. Quality assurance of the ChatGPT response to questions is a fundamental procedure for exploring the applicability of ChatGPT in spatial information areas of knowledge and levels of skills. For this reason, our article explores how ChatGPT evaluates spatial information's value in the 4th Industrial Revolution.

## 2 Methodology

### 2.1 GPT-4 model for ChatGPT

Generative Pre-trained Transformer 4 (GPT-4) is a language processing AI model developed by OpenAI, signaled by its capability to generate text with remarkable coherence and contextuality. It stands as a paradigmatic model, demonstrating profound capabilities in Natural language processing (NLP) tasks such as text generation, summarization, translation, and answering to question. Its intrinsic capacity to manage and manipulate language stems from its extensive training and a robust architectural foundation.

GPT-4 adheres to the Transformer architecture initially introduced by Vaswani et al. (2017) [9]. This architecture leverages attention mechanisms to handle sequence lengths, thereby mitigating the limitations of previous recurrent neural network (RNN) and long short-term memory (LSTM) models. The Transformer model consists of an encoder and a decoder, but GPT-4, being an autoregressive model, primarily utilizes the decoder mechanism for its tasks. The model is structured with numerous layers (exact number undisclosed) of Transformer blocks, each encapsulating multi-head self-attention and feedforward neural networks. The training of GPT-4 is divided into two pivotal phases: pre-training and fine-tuning. The model is trained on an enormous amount of text, encompassing diverse domains and topics, enabling it to learn linguistic structures, semantics, and contextual relationships. During pre-training, the model learns to predict the next word in a sentence, thus internalizing syntactic and semantic patterns prevalent in the training data. Subsequent to pre-training, GPT-4 is fine-tuned on specific datasets with supervised learning, enabling it to adapt its generalized knowledge to particular tasks or domains. This phase optimizes the model's parameters to yield precise, task-specific outputs [7].

### 2.2 Components of queries

In this study, we used the prompts with rules of thumb to craft clear and effective prompts, aiming to avoid jargon and ambiguity. Queries were composed of five prompts as follows: (1) Identification of purpose, (2) Instruction, (3) Role prompt (Act as~), (4) Few-shot (example) prompt [10, 11]. The identification of purpose are selected to ask about the definition of spatial information, Industrial 4.0, CPS, the role of spatial information in CPS, trendy issue of spatial information in the era of Industrial 4.0. These purposes and instructions are chosen to ask and evaluate the perceptions of ChatGPT for spatial information discipline. Role prompt is constrained as the well-educated, trained, and capable specialists or professors of spatial information. Few-shot

prompts are given with the definitions and concepts presented in the reference "Drones as Cyber-Physical Systems: Concepts and Applications for the Fourth Industrial Revolution" written by Jung-Sup Um [3]. Most textbooks regarding spatial information lean forward to the geographic information system and remote sensing. The perceptions of terms can be differentiated by which points and nature (applications, outcomes, value creation, technological and analytical aspects etc.) according to priority in describing the terms regarding spatial information. Giving the few-shot prompts with the various sources can derive fuzzy and imprecise replies from ChatGPT owing to contextual differences in sources. Thereby, we select the few-shot prompt based on the definition and concepts given in the reference.

## 3 Results

### 3.1 Perceptions of the spatial information in ChatGPT

ChatGPT describes spatial information as data tied to a specific location on the Earth's surface or within a 3D space. ChatGPT presents the key elements of spatial information: location, scale, projection and coordinate systems, attribute, temporality, data quality and metadata. ChatGPT recognizes spatial information as the embodiment of geographic information, representing the spatial relationships, attributes, and characteristics of objects, phenomena, and events in the physical world. This definition agrees well with the reference. In the reference, spatial information refers to data linked to particular geographic locations on Earth's surface or within its 3D space [12].

ChatGPT is also in line with reference regarding the key features of spatial information, such as the way to present data, data type, data type classification, overlay of data, and typical instruments to collect data. Reference highlights the key features of spatial information by comparing the non-spatial information. However, ChatGPT focuses on the technical and conceptual features of spatial information. Furthermore, ChatGPT concentrates on transferring the academic meanings of spatial information without using metaphors. In other words, ChatGPT interprets the querying regarding the key features of spatial information on the word "spatial information" itself. Nonetheless, ChatGPT understands the spatial information by reasonably acceptable quality.

### 3.2 Perceptions of the industrial 4.0 in ChatGPT

ChatGPT perceives the Industrial 4.0 (Fourth Industrial Revolution) as the term coined to describe the ongoing transformation of reshaping how information is exchanged, both among humans and between machines and systems, through the integration of digital technologies, advanced automation, artificial intelligence (AI), the Internet of Things (IoT), and big data. ChatGPT overviews the key features and components of Industrial 4.0: digitalization, connectivity, AI and Machine learning, automation, data analytics, and cyber-physical systems (CPS). Both ChatGPT and reference emphasize the key features of Industrial 4.0 as linking the real and cyber world using disruptive technologies such as AI, IoT, and big data. The reference also defines industrial 4.0 as the transformation of production systems by integrating and linking the real world to the cyber world.

However, there is a discrepancy between ChatGPT and the reference regarding the core product and communication aspects of Industrial 4.0. ChatGPT considers big data and data-centric models as the major features of Industrial 4.0. On the contrary, the reference emphasizes interconnectivity as the key point of Industrial 4.0. As a result, the given answer about core product and communication from ChatGPT is slightly off the perspectives of the reference. For example, from the question about the core product and communication of Industrial 4.0, ChatGPT answers the 3D printing, augmented and virtual reality (AR/VR) as the core

**Table 1** Comparison of perceptions of spatial information between ChatGPT and reference

| Category | ChatGPT | Reference |
|---|---|---|
| **Key elements** | Location, scale, projection and coordinate systems, attribute, temporality, data quality and metadata | Location, time, attribute, scale, coordinate system |
| **Way to present data** | Maps, 3D models, web maps & interactive dashboards, AR/VR | Map |
| **Data type** | Vector (Point, polyline, polygon), raster, temporal, network data, TIN (Triangulated Irregular Network) | Area-wide (macro) |
| **Overlay of data** | Simple, analytical, and weighted overlay | Possible if GIS database is constructed |
| **Typical instrument to collect data** | Remote Sensing, GIS, Global Positioning System (GPS), Surveys and Field Data | Remote sensing |
| **Data type classification** | Point, line, polygon, raster | Point, line, polygon |

**Table 2** Comparison of perceptions of Industrial 4.0 between ChatGPT and reference

| Category | ChatGPT | Reference |
|---|---|---|
| **The key feature of the fourth industrial revolution** | Cyber-physical System (CPS): Integrating digital and physical elements, enhancing precision in manufacturing and control. | CPS: blurring the physical and Mass digital divide such as AI |
| **Trend of society** | Interconnected and digitized society | AI society: smart factory, smart city, smart grid |
| **Means of production** | Automatic, decentralized, customized, personalized product, Smart manufacturing, Digital twins | Autonomic, decentralized production/individualized product |
| **Core product** | Digital Services and Platforms (cloud service, on-line marketplaces), Advanced Robotics, 3D Printing, Augmented and Virtual Reality (AR/VR), Autonomous Systems with Spatial Awareness (self-driving vehicles, drones, and robots) relying on spatial data and AI for navigation and decision-making | Drone, self-driving car |
| **Core technology** | AI, IoT, big data analytics, cloud computing | AI, IoT, big data, AR/VR, and 3D printing |
| **Communication** | IoT & services, Data Exchange with data analytics, machine learning & AI, Human-machine interactions | IoT & Services, Linking the virtual (on-line) to the physical world (off-line), O2O (On-line to Off-line) |

**Table 3** Comparison of perceptions of CPS between ChatGPT and reference

| Category | ChatGPT | Reference |
|---|---|---|
| **Measurement units of the fundamental component** | Standard units of distance/position, angle, time, temperature, light intensity, pressure, velocity/speed, acceleration, frequency, voltage (e.g., meters, degrees, lux etc.) | Atoms + bits |
| **Spatial perception** | Sensing without Touching, Intellectual Recognition, Adaptation and Response, Virtual Representation | Intellectually recognized space, even without touching |
| **Format of space** | Digital representation (e.g., 2D grids, 3D clouds) | Intellectually augmented reality |
| **Fundamental component** | Primary building blocks (e.g., sensors, actuators, processors) | Cyber system, physical system, network, sensor and actuator connected to real-life |
| **Example products** | Autonomous vehicles, drones, AR systems, | Self-driving car |
| **Major application** | Urban planning, transportation, disaster response, smart building, smart grid | Smart home, smart city, smart factory, smart grid |
| **Connection to physical system** | Bidirectional link between computations & and real-world | Integrating with the physical world in real-time (Linking off-line and online, analog & digital, production & service process) |
| **Real-time Processing** | Efficient algorithms for immediate responses | The physical system operates according to the real-time transition. |
| **Feedback among variables** | Adapting system behavior based on real-time data | Focused on dynamic causal relationships among variables characterized by interdependence, mutual interaction, information feedback, and circular causality |

products. Reference categorizes 3D printing and AR/VR as the core technologies. Additionally, ChatGPT recognizes the communication of Industrial 4.0 as the data exchange from human to machine and data to data. Even though the query for the definition of Industrial 4.0 includes spatial information, the answer of ChatGPT is inclined to the data exchange and business perspectives.

### 3.3 Perceptions of the CPS in ChatGPT

In ChatGPT, CPS is the system integrating computation, networking, and physical processes with feedback loops where physical processes affect computations and vice versa for creating intelligent and autonomous systems capable of self-monitoring, self-correction, and advanced functionality. In ChatGPT and the reference, the CPS comprises integrated components (cyber system, physical system, network, sensor and actuator) with bidirectional links between the real and virtual world in real time [13]. However, we found that ChatGPT has a tendency that does not consider the conceptual representation of the cyber and physical domains. In the case of major applications of CPS and measurement units of fundamental components, ChatGPT provides the answers diverged from superordinate concepts. For instance, ChatGPT explains the major applications of CPS with subordinate concepts. The given answer regarding major applications of CPS from ChatGPT was urban planning, transportation, disaster response, and smart building. These subsets are the subordinate concepts of the smart city. The answer of ChatGPT on measurement

units of the fundamental component of CPS was the standard units in measuring specific attributes in the physical world such as meters, celsius, lux, pascals meters per second and so on. On the other hand, ChatGPT answers the operational aspects or specific applications of CPS, making oversights of discussing broader philosophical or abstract concepts.

### 3.4 Perceptions of the role of spatial information on CPS in ChatGPT

Both ChatGPT and the reference conceive that spatial information is the cornerstone of CPS. Since location data is the hub for providing the critical linkage between the digital and physical domains, spatial information is pivotal in enabling CPS's intelligent, autonomous, and reliable operations. Spatial information expresses the size, shape, height, and depth of observable objects in either 2D or 3D based on data collected from diverse sensors and high-tech devices. The one-to-one connections between the physical and virtual world can be possible with the added value of spatial information by integrating AR or VR into the real-world map. This connection can represent the input and output data through CPS by integrating and analyzing the big data with data fusion collected from diverse sensors [14]. Spatial information helps to find the structures of common issues and interactions between cyber and physical space. Spatial information facilitates context-aware computing and semantic understanding of the environment for decision-making on specific issues without human interventions through machine learning and AI in real-time. Furthermore, spatial information plays a role as the milestones and reference data for ensuring the reliability and truthfulness of the information in relation to CPS space recognized intellectually.

The essence of spatial information in CPS is underscored in ensuring the synchronicity between the digital and physical realms. The reference concentrates on connectivity. Contrary, ChatGPT emphasizes that the connectivity is encompassed of "physical-digital boundary mediation" that goes beyond just establishing a link between physical and digital realms. ChatGPT mentioned that the role of spatial information in CPS for connectivity includes the accurate representation, synchronization, interaction, and semantic understanding between the physical and digital realms, allowing for coherent and meaningful interactions between the two. ChatGPT explains connectivity more comprehensively than reference.

### 3.5 Perceptions of trendy issue of spatial information in the era of industrial 4.0 from ChatGPT

Both the reference and ChatGPT have assumed unprecedented importance of spatial information as a central hub connecting vast datasets. The paradigm of spatial information is fundamentally distinct from earlier digital mapping, primarily because artificial intelligence now possesses the ability to perceive the surrounding context. In the context of the Fourth Industrial Revolution, there is a growing need to generate highly accurate map data through technologies like IoT, including drones. Reference and ChatGPT address that high-precision maps are an emerging issue to facilitate the deep learning capabilities of AI systems that autonomously search for maps essential for deep learning and take action accordingly. Consequently, autonomous systems integration is another issue for spatial information, particularly due to CPS applications such as self-driving cars. Nearly everything, from autonomous vehicles to smart cities within CPS, relies heavily on high-precision maps. Equally important is understanding how these artificial intelligence, with their digital sensors and deep learning models, intersect with cartographic intelligences in the realm of spatial information [15]. Building a high-precision digital twin at a diverse scale is a proliferating issue for AI to understand the spatial

**Table 4** Comparison of perceptions of the role of spatial information in CPS between ChatGPT and reference

| Category | ChatGPT | Reference |
|---|---|---|
| **Localization and Navigation** | Determining current location and path to a destination. | Determining the absolute or relative position |
| **Context-Aware Computing** | Adapting operations based on spatial context with Smart home and wearable devices | Real-time update of ubiquitous sensors such as smart device |
| **Semantic understanding of the environment** | Recognizing the meaning or context of spaces | Understanding the spatial situation |
| **Data fusion** | Combining data from multiple sensors for a comprehensive environmental view | Sensor fusion in relation to CPS space recognized intellectually extending to Cyber and Physical space utilizing ubiquitous big data |
| **Connectivity** | Physical-digital boundary mediation | Super-connectivity, Internet of Things such as traffic light |
| **Information diversity** | Big data obtained from multiple sensors for a comprehensive environmental view. | Big data from ubiquitous sensors extended to physical space. |
| **Cross-validation of information precision** | Ensuring the reliability and truthfulness of spatial data. | Cross-validation of information by sensor fusion in relation to CPS space recognized intellectually |

context based on digital sensors and deep learning models. Both perspectives are valid and provide different insights into the trendy issues of spatial information and Industry 4.0, reflecting the multifaceted nature of advanced geospatial analytics. ChatGPT's response leans towards the technological and analytical aspects, while "Reference" provides a more application- and outcome-oriented perspective.

The response provided by ChatGPT aligns with a technological and analytical perspective. It underscores the vital role of AI and machine learning in managing and interpreting spatial information, especially in the context of the fourth industrial revolution, which is heavily characterized by advancements in data analytics, machine learning, and interconnected technologies. Predictive modeling and real-time analytics are essential in various applications, such as smart urban planning, environmental monitoring, etc. On the contrary, the reference prioritizes application-oriented and outcome-focused aspects of spatial information and Industry 4.0, looking at how technologies like AI, machine learning, and crowdsourcing can be applied to achieve specific goals like risk reduction and process optimization.

## 4 Discussions

ChatGPT anticipates the visionary future of spatial information marked by the conception and realization of unprecedented ideas, methodologies, and applications that transcend contemporary boundaries. ChatGPT presents the possible futuristic paradigms of spatial information in perspectives of innovative exploration, integration with Industrial 4.0, multidimensional perspective, and conceptual fluidity. ChatGPT projects the conceptual shifts in spatial information as hyperdimensional spatial analysis, neural spatial integration, transpatial reality, quantum spatial computing, cognitive spatial systems, holographic spatial interaction and metaspatial networks.

Hyperdimensional spatial analysis is set to redefine spatial analysis, allowing for the conceptualization and investigation of spatial phenomena in dimensions beyond our current comprehension, thereby unveiling intricate spatial relationships and patterns previously unobservable [16]. There exist dimensions beyond our current comprehension where spatial phenomena can be analyzed in unprecedented detail and complexity. The hyperdimensional analysis will unveil previously unobservable spatial relationships and patterns, expanding our understanding of spatial phenomena. The fusion of neural networks with spatial information envisions the emergence of neuro-spatial interfaces, enabling direct interaction and manipulation of spatial data through cognitive processes, facilitating intuitive spatial understanding and unprecedented interaction paradigms. The human brain can directly interface with spatial information, bypassing traditional interaction mediums. Neuro-spatial interfaces will enable a new level of intuitive understanding and manipulation of spatial data, altering how we interact with and perceive spatial information. The emergence of transpatial realities explores the convergence of multiple realities, including virtual, augmented, and physical, creating a unified spatial continuum, allowing for seamless interaction and transition between diverse spatial realms. The convergence of realities will facilitate unprecedented interaction paradigms and redefine our conception of spatial boundaries and transitions. The advent of quantum computing is poised to revolutionize spatial data processing and analysis, enabling the exploration of multidimensional spatial phenomena and solving complex spatial problems that are currently intractable, thus opening new frontiers in spatial research and applications. The unexplored realms of Quantum Spatial Computing can redefine the fabric of spatial reality, enabling the simultaneous existence and interaction of multiple spatial dimensions and entities. Quantum Spatial Computing can decipher multidimensional spatial

**Table 5** Comparison of perceptions of trendy issue of spatial information in Industrial 4.0 between ChatGPT and reference

| Trendy issues of spatial information in Industrial 4.0 | ChatGPT | Reference |
|---|---|---|
| **Advanced Geospatial Analytics** | Enhanced AI and machine learning for predictive modeling, real-time analytics, and improved decision-making. | Reducing risk, optimizing processes and driving new forms of customer and societal value with crowdsourcing, AI and machine learning |
| **Digital Twins at Scale** | Proliferation of comprehensive digital representations of physical environments, objects, and systems. | Cloud-based virtual representations of physical assets to constantly verify the validity and usability of the proposed scheme at a diverse scale (digital factory or digital cities, digital person models of multiple linked digital twins) |
| **Autonomous Systems Integration** | Fundamental role of spatial data in the integration of autonomous vehicles, drones, and robots. | Building a high-precision map enabling the overall mechanism to work properly through continuous connections to all activities on the CPS network. |
| **Smart Infrastructure** | Dynamic and efficient smart infrastructure responding to changing conditions and reducing resource consumption. | Smart city, smart home |

phenomena and enable the computation of previously intractable spatial problems.

Developing cognitive systems integrated with spatial information will allow machines to understand and interpret spatial context intuitively, enabling autonomous spatial decision-making and fostering the development of truly intelligent and adaptive spatial systems. The intuitive understanding of spatial context by machines can lead to the emergence of autonomous entities capable of modifying their spatial surroundings and creating adaptive spatial constructs. Cognitive Spatial Systems can evolve to develop autonomous spatial reasoning and modification capabilities, adapting spatial constructs. The realization of advanced holographic technologies will facilitate immersive and interactive spatial experiences, allowing users to manipulate and analyze spatial data in three-dimensional space, thereby redefining spatial interaction and visualization [17]. Advanced holographic technologies could create spatial realms where the boundaries between physical and virtual realities blur, allowing for the existence of hybrid spatial entities. The convergence of physical and virtual realities through holographic spatial interaction can manifest hybrid spatial entities and realms.

Additionally, ChatGPT projects the integration of multiple dimensions with a convergence of spatial information technologies to create immersive, interactive, and interconnected virtual environments that extend beyond traditional computing paradigms. Several studies also address the futural potential of blurred boundaries between physical and digital realities, integrating diverse spatial dimensions [18, 19]. ChatGPT defines it as metaspatial networks, which are characterized by their ability to merge real and virtual environments, allowing for blending different spatial realities. The conceptualization of metaspatial networks envisions a seamless integration of multiple spatial dimensions, allowing the interaction and coexistence of diverse spatial realities, thus expanding the realms of spatial exploration and application. The conceptual integration of diverse spatial dimensions can create metaspatial networks where different spatial realities coexist, interact, and converge. Metaspatial networks can facilitate the convergence and interaction of diverse spatial realities, expanding the scope of spatial exploration and application. ChatGPT evaluates that the transformative capabilities of spatial information in the Fourth Industrial Revolution extend beyond mere technological advancements. ChatGPT expects that the convergence of spatial information with Industrial 4.0 technologies heralds a new era of spatial intelligence, enabling informed and innovative solutions to contemporary challenges, thereby reshaping our spatial perception and interaction.

Future integration of AI, such as ChatGPT, in spatial science research promises advancements and benefits in Natural Language Processing (NLP) in Geographic Information Systems (GIS), data analysis and visualization. ChatGPT can assist in creating, analyzing and visualizing more interactive and informative maps and spatial information in a more user-friendly manner. This facilitates better decision-making in urban planning, disaster management, and policy formulation by tailoring specific needs and scenarios. Some researchers point out issues of hallucination, fabrications and falsifications of ChatGPT in applying scientific analysis [20]. Since ChatGPT is a result of Reinforcement Learning from Human Feedback (RLHF), it is evaluated by how much humans like their answers and trained to give the most likely answer with the higher probability and scores. If the training data is rich, ChatGPT is more likely to give the correct answer, but if the data is scarce, it will give a plausible answer even if it is incorrect. Therefore, further study regarding ground truth validation of ChatGPT is required before applying it in handling spatial data and implementing spatial analysis. Albeit there are potential disadvantages and errors in ChatGPT, the integration of language models like ChatGPT, into spatial information disciplines would facilitate the user-friendly, customized and interactive GeoAI.

## 5 Conclusion

ChatGPT's responses lean towards the technological and analytical aspects, while the reference provides a more application and outcome-oriented perspective on spatial information. Since ChatGPT is built on a large amount of text from diverse sources, including technological and academic texts, which often emphasize technological and analytical aspects, ChatGPT, with its generalized, wide-ranging training, provides answers that explain or perceive spatial information. ChatGPT provides interpretable answers to a wide audience (given its generalized training), focusing on explaining technologies and analytics. Without a specific focus on applications or outcomes, ChatGPT explains the inherent analytics, particularly given the technological nature of spatial information. Nonetheless, ChatGPT perceives well not only the contextual definition and underground meaning of spatial information but also the importance and role of spatial information in the era of Industry 4.0. The results of this study are meaningful to preview the perspectives and level of understanding of ChatGPT in spatial information and to explore the applicability of ChatGPT in spatial information discipline.

**Funding** Open Access funding enabled and organized by Projekt DEAL. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT, NRF-2021R1F1A1051827).
Open Access funding enabled and organized by Projekt DEAL.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interests.



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