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## Introduction

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### 1.1 Background

In the technological wave of the twenty-first century, artificial intelligence (AI), as a transformative technology, is rapidly reshaping our society, economy, and daily life. Since the concept of AI was first proposed, this field has experienced many technological innovations and application expansions. Artificial intelligence has experienced three booms in the past half century and has developed rapidly. In the 1960s, marked by the Turing test, the application of knowledge reasoning systems and other technologies set off the first boom. Computer scientists at that time began to explore how to let computers simulate human intelligence. Early AI research focused on rule systems and logical reasoning. The rise of expert systems and artificial neural networks brought a second wave of enthusiasm (McDermott, 1982). The third boom is marked by deep learning and big data, especially the widespread application of artificial intelligence-generated content represented by ChatGPT. During this period, AI technology shifted from traditional rule systems to methods that relied on algorithms to learn patterns from data. The rise of deep learning enabled AI to achieve significant breakthroughs in areas such as image recognition and natural language processing.

The rapid development of AI not only improves the efficiency of data processing, pattern recognition, and automated operations, but also brings unprecedented convenience, and its application scenarios are also constantly expanding. In the medical field, AI can assist doctors in diagnosis and treatment through big data analysis and machine learning algorithms, thereby improving the quality and efficiency of medical services. For example, AI can analyze medical images to detect diseases such as cancer early and provide patients with more timely treatment. In the field of education, AI

uses personalized learning systems to provide customized teaching plans based on students' learning progress and interests, thereby improving students' learning effects. In the financial field, AI helps financial institutions conduct risk management and investment decisions through risk analysis and intelligent investment advisory and improves the safety and profitability of financial services. As it develops today, artificial intelligence is largely oriented by commercial needs and integrated with industry. It covers all aspects of human life and plays an important role in society, which has also triggered a series of thoughts.

As AI is widely used in all aspects of human society, especially in high-risk, high-impact fields such as autonomous driving (Muhammad et al., 2021), criminal justice, and medical diagnosis (Park & Han, 2018), there is an increasing demand for transparency in the development and application of AI-related technologies (Zhu et al., 2018). Most users, especially the general public, do not have enough knowledge to understand the mechanisms behind AI decision-making, which has a negative impact on the credibility of AI systems (Xu et al., 2019). As early as 1991, Buckland and Florian discussed "intelligent systems" and "artificial intelligence." They noted that human expertise and task complexity may be a substitute or supplement for the use of artificial intelligence. They also discussed "computer-entrusted" and "computer-assisted" systems and argued that systems and human intelligence should enhance each other. The information field has long been interested in the social changes associated with rapidly growing technological capabilities.

Human-Computer Interaction (HCI), as an important branch of computer science, studies how to design and optimize the interaction between humans and computers. Initially, human-computer interaction research mainly focused on command line interface and graphical user interface (GUI) designs. With the advancement of technology, the field of HCI has gradually expanded to emerging interaction technologies such as touch screens, voice recognition, virtual reality (VR), and augmented reality (AR). Especially in recent years, with the development of natural language processing technology, the modes of human-computer interaction have become more natural and intuitive. For example, the emergence of intelligent voice assistants such as Siri, Alexa, and Google Assistant allows users to communicate with devices through voice, lowering the threshold for technology use. Human-computer interaction not only focuses on the implementation of technology but also pays attention to user experience and psychological factors in the interaction process. Researchers are committed to understanding user needs and optimizing interaction design to improve system ease of use and user satisfaction.

On the other hand, Human–AI Collaboration (HAIC) describes the cooperation model between humans and AI systems when they jointly complete tasks. This collaboration model emphasizes that humans and AI systems leverage their respective strengths to jointly solve problems. For example, in the medical field, AI systems can analyze large amounts of medical data and provide diagnostic suggestions to doctors, who in turn provide clinical experience and patient background information. Effective human–machine collaboration can give full play to the computing power of AI and human expertise, thereby improving the accuracy and efficiency of decision-making.

The development of artificial intelligence technology has brought new challenges to human–computer interaction (HCI) and AI collaboration (HAIC). A major challenge is ensuring that AI systems are designed with human users in mind. This involves not only making AI systems technically proficient, but also ensuring that they are user-friendly, ethical and able to build trust with their users. As AI systems become more ubiquitous and influential, addressing these challenges becomes increasingly important to achieve successful and beneficial human–machine collaboration. In *Human–AI Interaction and Collaboration*, we explore the multifaceted dynamics between individuals and artificial intelligence. The potential applications of human–machine collaboration are endless, from increasing productivity in the workplace to revolutionizing healthcare, education, and entertainment. However, these opportunities come with ethical considerations, transparency issues, and the need for responsible designs.

The first is the issue of ethics and responsibility. Whether AI systems can treat all users fairly and equitably during the decision-making process and whether its decision-making mechanism is transparent are issues that directly affect users' trust in AI (Xu et al., 2019). For example, in the field of criminal justice, AI systems are used to predict crime risks and sentencing decisions but, if their algorithms are biased, they may lead to unfair sentences. Secondly, there are privacy and security issues. When AI technology processes large amounts of data, how to protect user privacy and avoid data leakage are also issues that need to be solved urgently. For example, in fields such as smart homes and smart medical care, a large amount of user data is collected and analyzed. If this data is abused or leaked, it will pose a serious threat to user privacy.

In order to deal with these challenges and problems, researchers have proposed many new methods and theories. For example, the concept of human-centered artificial intelligence (HAI) emphasizes that the design and application of AI should be aimed at enhancing and empowering humans (Shneiderman, 2022). By incorporating user needs and experiences into the

design and development process of AI systems, the acceptability and user satisfaction of AI systems can be improved. In addition, the development of explainable AI (XAI) technology also provides new ideas for solving the transparency and trust issues of AI systems. By providing clear and understandable explanations, users can understand the decision-making process of the AI system, thereby increasing trust in the AI system.

Although HAI is a relatively new field in artificial intelligence, it has attracted considerable attention around the world. The next frontier of AI is not only technological but also humanistic, as AI aims to augment and empower humans rather than replace them (Shneiderman, 2022). HAI is considered multidisciplinary and interdisciplinary, but it is ultimately achieved through human–AI interaction (Wang et al., 2019), which is fundamentally an information processing task. Since information and interaction are the basic elements of human–AI interaction, experts in related fields have begun to explore the research perspective of information science in HAI (Liao et al., 2020). By efficiently processing and analyzing large amounts of information, artificial intelligence technology has great potential in supporting knowledge management and the development of next-generation decision support environments (Olan et al., 2022). AI technology will also impact health information management professionals (Stanfill & Marc, 2019).

Exploring the interaction between artificial intelligence and information science is beneficial because the exchange of knowledge brings technological changes and breakthroughs to both parties. For example, intelligent systems such as search, recommendation, and analysis and prediction can achieve human-centered contexts by considering humans' information behavior in acquiring, managing, and utilizing information in more new contexts (Konstan & Terveen, 2021). At the same time, HAI has deeply affected the present and future of information science and human information society (Bryson & Theodorou, 2019). In the information age, by further exploring the new role of users and information ethics in HAI situations, we will create more efficient and intelligent human–AI interactions and develop artificial intelligence that is more transparent, better able to solve human problems, and serve the human information society, making a contribution (Shneiderman, 2020). This also points to the question: To what extent can/should we “hand over” intelligence to technologies that process information and build knowledge? Where is the line between human-centered information processing and AI-based information processing?

This book aims to explore the challenges and ethical considerations related to privacy in artificial intelligence. We also envisioned a pattern where information flows seamlessly and enhances collaboration between humans and

machines. In this dynamic landscape, the need for explainable AI becomes a key factor. The need to demystify complex algorithms and decision-making processes increases user trust and promotes a deeper understanding of AI systems. Furthermore, as we explore this complex field, trustworthiness assessment becomes critical – establishing benchmarks to assess the reliability and completeness of AI-generated information. The book also highlights the important role of artificial intelligence in scientific research and knowledge discovery, as well as its impact on social media.

## **1.2 Research Implications**

This book is dedicated to systematically exploring the complex interaction and collaboration dynamics between humans and artificial intelligence (AI), revealing its potential and challenges in different application fields. Through in-depth research on these topics, we expect to provide new perspectives and methods for academia and industry to promote the development and application of AI technology. This book is designed for a diverse audience, including researchers, practitioners, and students interested in the fields of artificial intelligence, human–computer interaction, and related disciplines. Academics will find valuable insights and methodologies for future research, while industry professionals can gain practical knowledge to enhance the design and implementation of AI systems. Additionally, students will benefit from the comprehensive overview of current trends and challenges in human–AI collaboration, equipping them with the necessary tools to engage in this evolving field.

First of all, the research significance of this book is to deepen the understanding of human–AI interaction and collaboration. The advancement of AI technology has made the complexity of the human–machine relationship more and more prominent, involving many aspects such as user experience, technology applications, privacy protection, and ethical issues. In today’s digital era, User Experience (UX) has become a key factor in measuring the success of technology systems. Good human–AI interaction design can significantly improve user satisfaction and efficiency. By studying user needs and behavior patterns, a system can be designed that better meets user expectations. For example, in a smart home system, users may want to control home appliances through natural language rather than through cumbersome interface operations. In-depth user research can help design a system that is more in line with actual needs and improve the overall user experience. By systematically exploring the theory and practice of human–AI interaction, this book provides

a valuable reference for designing more humane and efficient AI systems. For example, studying user needs and behavior patterns can help design systems that meet user expectations, thereby improving user experience. Traditional AI systems tend to focus on technical implementation and ignore user experience. However, this book provides strategies on how to optimize the interaction process through in-depth analysis of user interaction behavior. This will not only improve user satisfaction, but also increase the frequency of system use, thereby promoting the popularization and application of technology.

Secondly, this book focuses on the important role of AI in scientific research and knowledge discovery. AI technology does not only accelerate the scientific research process and promote the dissemination and sharing of knowledge, but also helps researchers discover new research directions and methods. For example, in the field of natural language processing, AI can discover new research hotspots and trends by analyzing a large amount of literature and data, and guide researchers to conduct innovative research. The application of AI in social media has also had a profound impact on information dissemination and user behavior. Social media is an important platform for information dissemination, and its data analysis and processing are of great significance for understanding user behavior and information flow. Through specific case analysis, this book explores the applications and challenges of AI technology in these fields and puts forward corresponding countermeasures and suggestions, thereby promoting the further development of scientific research and knowledge discovery.

Privacy protection and information credibility are another important research area of this book. Although the application of generative AI technology has brought many conveniences, it has also caused serious privacy leak issues. When users interact with generative AI systems, they inevitably share data, which may be used for model training and leaked in future outputs. The book delves deeply into how to protect user privacy in the design and application of AI systems, including strategies such as privacy classification and identification, optimizing training data, and limiting generated content. In addition, the assessment of information credibility is also a key issue in AI applications. By examining system properties (such as transparency, explainability, and user feedback mechanisms) and user-related factors (such as algorithm literacy, sociocultural background, and prior experience), this book provides methods and techniques for improving information credibility assessment to ensure the reliability and accuracy of information generated by AI systems provide theoretical support and practical guidance.

Research on human-machine collaboration is of great significance to a wide range of fields and applications. In fields such as healthcare, education,

finance, and more, effective collaboration between humans and AI systems can significantly improve outcomes and productivity. For example, in healthcare, AI systems can assist doctors by analyzing medical data and providing diagnostic recommendations, while doctors can provide clinical expertise and patient background. By optimizing the human–machine collaboration model, more efficient medical services can be achieved. In the financial field, AI can analyze market trends, provide investment advice, and help decision-makers make strategic decisions, and human managers can use this information to make strategic decisions. Understanding how to optimize these collaborations can help achieve more efficient problem solutions and drive practical applications of technology and social progress, which is critical to realizing the full potential of artificial intelligence technology.

At the same time, research on human–AI interaction and collaboration is critical to solving ethical and social issues related to artificial intelligence. This book focuses on the potential of AI technology to solve ethical and social issues. With the widespread application of AI technology, ethical issues such as privacy, data security, and algorithm fairness have gradually emerged, and concerns about privacy, fairness, and transparency have become increasingly important. How to embed ethical considerations in system design to ensure the fairness and transparency of AI systems is an important issue at present. This book studies how to prevent bias in algorithms and reduce possible unfairness in the actual application of AI systems, and explores how to protect user privacy and ensure data security, thereby ensuring the trustworthiness of AI systems. These research results are of great significance in ensuring that AI technology is used in a responsible and ethical manner and in cultivating public trust and acceptance of AI.

In addition, this book also explores the role of AI technology in promoting technological innovation. Research on human–AI interaction and collaboration can open up new research areas and market opportunities. For example, the application of AI technology in fields such as autonomous driving, smart homes, and virtual reality has achieved technological progress through continuous optimization of human–AI interaction and collaboration models. Continued research in this area contributes to a broader understanding of how AI technologies can be used to enhance human capabilities and improve quality of life. By exploring how AI systems can complement and enhance human capabilities, researchers can uncover new opportunities for innovation and advancement. Therefore, this research not only contributes to technological progress but also to promoting social change and improving human well-being.

Finally, the research significance of this book also lies in improving complex decision-making processes. In complex decision-making scenarios, such

as emergency management, human–machine collaboration can combine the computing power of AI and human judgment to improve decision-making quality and efficiency. For example, AI systems can analyze large amounts of data and provide real-time decision support, while human experts can make judgments and adjustments based on actual conditions. Studying the optimization of human–machine collaboration models can significantly improve the decision-making process and increase the timeliness and accuracy of responses.

To sum up, this book not only reveals the application potential and challenges of AI technology, but also provides new perspectives and methods for solving these problems. By systematically exploring the multi-dimensional dynamics of human–AI interaction and collaboration, this book provides valuable reference for academia and industry and promotes the development and application of AI technology. These research results have a profound impact on improving user experience, promoting technology applications, solving ethical and social issues, promoting technological innovation, and improving decision-making processes.

### 1.3 Structure of the Book

This book consists of twelve chapters, each of which revolves around different aspects of human–AI interaction and collaboration. The logic is rigorous and progressive, so as to comprehensively explore the multi-dimensional dynamics of this complex field (Figure 1.1).

Chapter 1, as an introduction, first introduces the background and importance of human–AI interaction and collaboration and analyzes the current application status of AI technology and the challenges it faces. Through a literature review, we explore the application and impact of AI in different fields and put forward the research significance and objectives of this book. The introduction lays the foundation for the whole book, so that readers can have a comprehensive understanding of the basic concepts and research status of human–AI interaction and collaboration.

Chapter 2 focuses on the design principles and application scenarios of user interaction and human–AI collaboration. From the user’s perspective, the basic theories and methods of human–AI interaction and collaboration are explored. By analyzing the design principles and methods in different application scenarios, it is revealed how to improve the efficiency and effectiveness of human–AI collaboration by optimizing the user interaction experience.

Chapter 3 explores the privacy identification problem in generative AI interaction in depth. With the development of generative AI technology,



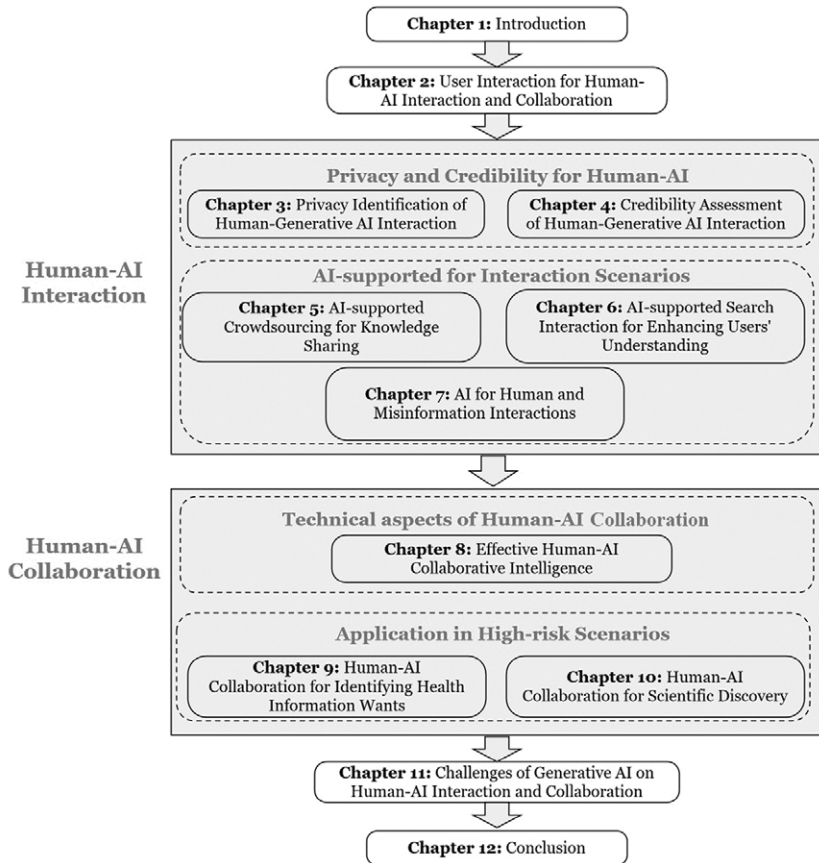


Figure 1.1 Structure of the book

privacy and security issues have become more prominent. In this chapter, we will analyze the challenges faced by generative AI in privacy leakage and explore solutions to identify user privacy. For example, in the fields of smart home and smart healthcare, the application of generative AI technology requires processing a large amount of user data. If the data is abused or leaked, it will pose a serious threat to user privacy. Therefore, studying how to identify user privacy in different interaction scenarios and providing support for avoiding data leakage is an important content of this chapter.

Chapter 4 discusses the credibility assessment methods of generative AI information and the challenges it faces. With the widespread application of generative AI technology, the credibility assessment of information has become particularly important. In this chapter, we will analyze the credibility

assessment methods of generative AI information and explore its actual effects in different application scenarios. For example, in the field of news, generative AI technology can be used to generate news reports, but how to ensure the authenticity and accuracy of the generated news reports is an urgent problem to be solved. By exploring the credibility assessment methods of generative AI information, we hope to provide new ideas and methods for improving the credibility of information.

Chapter 5 describes the application of AI in enhancing crowdsourcing knowledge sharing and explores the role of motivation in it through case studies. Crowdsourcing knowledge sharing is one of the important application areas of AI technology. By bringing together the wisdom and power of a large number of users, many complex problems can be solved. In this chapter, we will analyze the application of AI in crowdsourcing knowledge sharing and explore how to motivate users to participate in crowdsourcing knowledge sharing activities through motivation design. For example, on crowdsourcing knowledge sharing platforms such as online encyclopedias and question-and-answer platforms, by designing a reasonable incentive mechanism, users can be motivated to contribute high-quality content and improve the efficiency and quality of knowledge sharing on the platform.

Chapter 6 studies how AI can improve users' understanding ability through search interaction. Search is one of the important ways to obtain information, and the development of AI technology has brought new possibilities for search interaction. In this chapter, we will explore the application of AI in search interaction and analyze how to improve users' understanding ability by optimizing the search experience. For example, by designing an intelligent search engine, personalized search results can be provided based on users' search behavior and preferences to help users quickly find the information they need. By exploring the application of AI technology in search interaction, we hope to provide new ideas and methods for improving users' search experience.

Chapter 7 analyzes the role of AI in the spread of misinformation and explores strategies to effectively deal with the spread of misinformation. With the popularity of social media and the Internet, the spread of misinformation has become a serious problem. The role of AI technology in the spread of misinformation has both positive and negative effects. In this chapter, we will analyze the role of AI in the spread of misinformation and explore how to effectively deal with the spread of misinformation through technical means and strategies. For example, by designing an intelligent filtering system, we can identify and filter misinformation and reduce its spread; by designing an intelligent recommendation system, we can recommend reliable information sources to users and improve their information literacy.

Chapters 8–10 focus on effective human–AI collaborative intelligence and its practical applications in different fields. Chapter 8 explores the technology and application of human–AI collaborative intelligence and evaluates its actual effect in improving work efficiency and solving complex problems. For example, in the manufacturing and service industries, human–AI collaborative intelligence technology can improve production efficiency and service quality; in the field of scientific research, human–AI collaborative intelligence technology can accelerate the progress of scientific research and promote the dissemination and sharing of knowledge. Chapter 9 studies the application of AI in identifying health information needs, especially helping and supporting caregivers. Health information needs are one of the important application areas of AI technology. By analyzing users' health information needs, personalized health services can be provided to improve users' health outcomes. In this chapter, we will explore the application of AI in identifying health information needs and analyze its potential in improving the quality and efficiency of health services. Chapter 10 explores the application of AI in scientific research and analyzes its potential in promoting scientific discovery and knowledge dissemination. Scientific research is one of the important application areas of AI technology. Through AI technology, the process of scientific research can be accelerated and new research directions and methods can be discovered. In this chapter, we will explore the application of AI in scientific research and analyze its potential in promoting scientific discovery and knowledge dissemination.

Chapter 11 analyzes the challenges faced by generative AI in current applications and proposes suggestions for improvement. By exploring the problems and solutions of generative AI technology in practical applications, we hope to provide readers with deep insights and practical suggestions. For example, in the field of automated writing and content generation, the application of generative AI technology has made significant progress, but how to ensure the quality and credibility of generated content is an urgent problem to be solved. In this chapter, we will analyze the challenges faced by generative AI in current applications and propose suggestions for improvement to promote the development and application of generative AI technology.

Finally, Chapter 12 summarizes the views of the whole book, reviews the main contents of each chapter, and proposes suggestions for future research and practice. Through a comprehensive exploration of the complex field of human–AI interaction and collaboration, we hope to provide academia and industry with new perspectives and methods to promote the development and applications of AI technology.

Through the above chapter structure, this book systematically explores the multi-dimensional dynamics of human–AI interaction and collaboration,

revealing the application potential and challenges of AI in different fields. We hope that, through the research of this book, we can provide readers with a comprehensive and in-depth understanding and valuable reference and promote the widespread application and development of AI technology in society.

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