Research on Methods and Applications Related to Question-and-Answer Dialogue Systems

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Abstract. In the face of more and more network data information, search engines have gradually become the main retrieval method to obtain relevant information knowledge. However, in today's increasingly explosive development of information on the Internet, by contrast, traditional search engines have problems such as semantic understanding and complicated answers. Therefore, question answering systems are more important. The automatic question answering system generally adopts natural language processing related technologies. When users ask questions, the system automatically judges and gives answers. It involves computer linguistics, machine learning, artificial intelligence and other popular technology research. According to different classification criteria, the automatic question answering system is roughly divided into open field automatic question answering system and stereotyped automatic question answering system.. This thesis investigates methods and applications related to question-and-answer dialogue systems. On the methodological side, we introduce commonly used datasets and the principles and techniques of text, speech and visual question and answer systems, and analyse in detail the excellent example ChatGPT. In terms of applications, we present the application of Q&A dialogue systems in search engines, smart campuses. There is some reference value.

Keywords: Question-and-answer Dialogue system; ChatGPT; Intelligent retrieval.

1. Introduction

With the continuous development and popularization of artificial intelligence technology, the question and answer dialog system, as a natural language-based human-computer interaction, has become an important means for people to obtain information and solve problems in daily life. From search engines to intelligent voice assistants, Q&A systems are increasingly used in a wide range of scenarios. Therefore, it is of great practical significance to study the methods and applications of question and answer dialog system. Firstly, question and answer dialogue systems can effectively improve the efficiency of information acquisition and processing [1]. In today's era of information explosion, people need to face a huge amount of information and complex knowledge system. Traditional information retrieval methods can no longer meet people's needs, so question-and-answer dialogue systems have emerged. Q & A dialogue system can help people to obtain information and solve problems quickly and accurately by means of natural language in the form of questions and answers, which greatly improves the efficiency of people's information acquisition and processing [2]. Secondly, question and answer dialogue systems are an important manifestation of natural language processing technology in practical applications. Natural language processing is one of the important branches of artificial intelligence technology, whose goal is to enable. Move the application and innovation of AI technology in other areas. Finally, question-and-answer dialogue systems have undergone decades of development, evolving from rule-based and pattern-matching systems t0 data-driven systems based on deep learning. As AI technology continues to development prospects and application prospects [3].

In summary, question-and-answer dialogue systems are a natural language based approach to human-computer interaction that is increasingly being used in a wide range of contexts, and it is of great practical importance an important technology.

2. Methods Related to the Question and AnswerSystem

2.1. Relevant Datasets

Question and answer systems require a large corpus for training, so the development and construction of relevant datasets has become an important factor in facilitating the development of the field [4]. There are three main stages in the development of relevant datasets for Q & A dialogue systems: simulated datasets, manually annotated datasets and large-scale datasets. The earliest QTS datasets were artificially constructed simulated datasets such as ELIZA, DOCTOR, etc. These datasets were constructed by researchers based on certain criteria. These datasets were constructed by researchers to simulate human-machine conversations based on certain patterns or rules. The advantage of such datasets is that they are simple to construct and easy to control, but the disadvantage is that they lack the linguistic features and diversity of real conversations. To counter this disadvantage, the emergence of artificially annotated datasets has made the study of question-and-answer dialogue systems more practical. Typical datasets at this stage include ATIS, TREC, SNIPS, etc. These datasets are real dialogue data, both speech and text, that have been manually annotated with more linguistic features and diversity. Researchers can use these datasets to train and evaluate models for question-and-answer dialogue systems. With the rise of deep learning techniques, a large amount of data is needed to support the training of models [5]. Many large-scale datasets of question-and-answer dialogue systems have emerged in recent years. Currently, several open datasets exist, such as SQuAD,TriviaQA andMS MARCO. Of these, SQuAD (The Stanford Qanswer Dataset) is one of the most popular datasets, containing over 100,000 questions with associated article passages and answers. The openness of this dataset has enabled many researchers to use the dataset for research related to natural language processing. The large size of these datasets, which cover question and answer conversations across a wide range of domains, allows them to be better adapted to the needs of real-world scenarios. At the same time, these datasets have contributed to the research and development of question-and-answer dialogue systems, driving continuous technological advances [6].

2.2. Text-based Quiz Systems

A text-based quiz system is a common form of quiz system. It is usually divided into two phases: question extraction and answer extraction. In the question extraction phase, the system converts the text question into a form that can be processed by the computer for the next step. In the answer extraction phase, the system uses various algorithms to find the most likely answer in a text passage. The architecture of text-based question and answer systems is divided into traditional rule-based question and answer systems and machine learning or deep learning-based question and answer systems [7]. Traditional rule-based Q&A systems rely on manually written rules and templates, which require significant human input and can only handle specific types of questions. In contrast, machine learning or deep learning based Q&A systems can automatically learn mapping relationships between questions and answers from large-scale data and are able to handle a much more complex and broad range of questions. Modelling of question and answer systems involves the representation of questions and answers and how to extract information and infer answers from text. Traditional bag-of-words, statistical and rule-based models consider only lexical information and lack consideration of contextual and semantic information, making it difficult to solve some complex problems. In recent years, deep learning- based models have become the dominant approach for text-based Q&A systems, such as convolutional neural networks, recurrent neural networks, attention mechanisms and pre-trained models.These modelscan automatically learn the semantic relationship between questions and answers from the data to achieve more accurate Q&A [8].

2.3. Audio Quiz System.

The architecture of a voice quiz system usually consists of several modules, including front-end processing, speech recognition, speech understanding, knowledge base and speech synthesis. The

front-end processing module is used to pre-process the speech input, the speech recognition module is used to convert the speech input into text, the speech understanding module is used to parse the user's intent and retrieve answers from the knowledge base, which stores knowledge and information relevant to the quiz, and the speech synthesis module is used to convert the system's answers into speech output. Speech recognition technology is one of the core technologies of a speech-based Q&A system. In a voice quiz system, the speech input is converted into text form and then fed into the speech understanding module. The accuracy and efficiency of speech recognition technology directly affects the performance of a voice quiz system. Currently, mainstream speech recognition technologies include deep learning-based end-to-end speech recognition, traditional GMM-HMM speech recognition and neural network- based speech enhancement and noise cancellation techniques. Natural language processing techniques also play an important role in speech- based question and answer systems. After converting speech input to text, natural language understanding is required, i.e. converting the natural language entered by the user into a count. Computer-understandable language. Natural language processing techniques include lexical analysis, syntactic analysis, semantic analysis, named, Financial services

2.4. Visual Question and Answer System

A visual question and answer system is a system that uses computer vision technology to perform question and answer sessions. The key to the system consists of two components: visual feature extraction and question and answer modelling. Firstly, the image processing module i responsible for converting the input image into a computer-processable form. The visual quiz system needs to extract relevant visual features from the image or video to help the system understand the question and answer. The most commonly used visual feature extraction method today is Convolutional Neural Networks (CNN). In a CNN, feature extraction is achieved by layer-by-layer convolution and pooling operations. There are also other feature extraction methods such as recurrent neural networks (RNN), image segmentation etc.; in visual question and answer systems it is very important to establish the connection between the question and the image. The most common approach is to represent questions and images as vectors, and then feed these vectors into a multi-layer neural network for training to achieve question and answer modelling. Specifically, question and answer modelling can be implemented using memory-based models, models based on image and text interaction, and models based on image and visual question and answer interaction. Having obtained these two crucial points, the knowledge base can help the system understand objects and scenes in the image and match them to the question, often referred to as feature fusion. Current roles for visual question and answer systems include: interactive search, assistance for language impairment or visual impairment, autonomous driving, medical diagnosis, etc.

2.5. ChatGPT

ChatGPT is a dialogue generation model based on the Transformer architecture, called "Generative Pre-train Transformer for Chatting", developed by OpenAI [9]. OpenAI. It is a heavily trained neural network model based on the GPT-2 model, which automatically generates fluent, logical and meaningful conversations. The pre-training phase of the model is conducted on large scale conversational text data to learn the patterns o conversational language. chatGPT uses a Transformer structure, which has excellent performance in processing long sequences of text data, making full use of contextual information to generate coherent and fluent conversational content [10]. ChatGPT has a wide range of applications and can be used in scenarios such as intelligent customer service, smart Q&A, chatbots, etc. It can also be used to generate natural language text such as articles, news and reviews. In practical applications, it can be fine-tuned to suit different needs for different tasks and domains. OpenAI also provides a number of APIs that enable developers to quickly build their own applications using ChatGPT, such as the OpenAI GPT API, OpenAI Codex, etc. In conclusion, ChatGPT is a very powerful natural language processing model with a wide range of applications.

3. Application Analysis

As a way of human-computer interaction, question and answer systems have a wide range of application prospects. This chapter will focus on the Towards.

3.1. Search Engines

Search engines are one of the most important information retrieval tools in today's Internet age and are used by almost everyone. With the explosive growth in the amount of information available, the importance of search engines is becoming more and more prominent. However, the traditional search engine based on keyword retrieval has many problems, such as low accuracy of information retrieval and single presentation of results. With the development of artificial intelligence technology, question and answer system has been introduced into the field of search engine to provide users with more intelligent and personalized information retrieval services. Baidu, for example, launched "Baidu Knows", a search engine based on a question-and-answer system. Users can get the information they need by asking questions or by browsing questions asked by other users. The system uses intelligent matching technology to match the questions put forward by users with the existing question library, and then returns the best answer. It is a search engine based on a question and answer system. Users can ask questions or browse questions asked by other users to get the information they need. The system uses intelligent matching technology to match questions asked by users with an existing question database and then returns the best answers. Baidu has also introduced smart devices such as smart speakers, which allow users to use the Q&A system by asking A higher level of technology.
In the future, with the continuous development of technologies such as natural language processing, machine learning and artificial intelligence, the application of question and answer systems in search Technology is combined to provide users with a more convenient and natural search experience.

3.2. Smart Campus

Smart campus refers to the use of advanced information technology, the construction of information and intelligent campus environment, to achieve the modernization of education and teaching, high efficiency. In the smart campus, the question and answer system is widely used in students' study, life and consulting services.

Answering students' questions: students may encounter various problems in the learning process, such as unclear understanding of homework content and exam content, and can get timely answers and guidance through the question and answer system

Academic management: There are many issues that need to be dealt with in academic management, such as course selection, course withdrawal and changing majors, etc. T h r o u g hthe Q&A system, these issues can be dealt with quickly and efficiently.

Admissions Advisory: The Q&A system can provide admissions advisory services on the campus website to help potential students answer questions about admissions policies and admissions criteria.

Course Arrangement Enquiry: Students can use the Q&A system to enquire about the time, location and teachers of the course, so that they can arrange their study plans.

Inquiries about campus announcements: The Q&A system can provide the latest developments in the university.

Tsinghua University, for example, has launched "Tsinghua Xiaowei", a smart campus solution based on a question and answer system. The system uses natural language understanding technology to intelligently answer questions from students, such as course enquiries, location queries and campus services. Tsinghua Xiaowei also supports voice recognition technology, which allows users to use the Q&A system by asking questions by voice.

3.3. Reading Search

With the advent of the digital age, people's reading habits are also changing, and traditional paper books have been gradually replaced by electronic books. However, due to the rapid growth of the

number of digitized books, it is becoming more and more difficult for readers to find the information they need among the huge number of books. At this time, the question and answer system, as a tool to obtain information quickly and efficiently, becomes a powerful tool to solve this problem. In the aspect of reading retrieval, the question and answer system can be interactive through natural language. For book search, the Q&A system can quickly provide readers with the information they need through natural language interaction. For example, using metadata provided by libraries and publishers, Q&A systems can quickly locate relevant books based on a reader's query and return a The company provides more precise answers to the questions asked by those who are interested.Currently, many organisations and companies have started to develop reading search tools based on Q&A systems, such as Alibaba's "Reader", Douban Books' "Douban Read" and Turing Robot's "Turing Read". These tools Quality. Overall, question and answer systems have a promising future in reading retrieval. As the technology continues to develop and improve, question and answer systems will play an increasingly important role in the reading process of readers.

4. Conclusion

In this study, we systematically introduce the relevant methods and applications of question and answer dialog system, and carry out in-depth analysis and research on it. Our research shows that question-and-answer dialog system has become an important research field of human-computer interaction, and it has a wide range of application prospects in practical applications. Through the detailed introduction and comparison of the relevant methods of question and answer dialogue system, we find that the current research mainly focuses on text, speech and visual aspects, which have their own advantages and disadvantages in different scenarios. At the same time, we find that advances in corpora and algorithms are driving the development of the question-and-answer dialogue system. In addition, we have analysed and summarised the applications of the Q&A dialogue system for search engines, smart campus and book search. These Use the experience. Despite the theoretical and practical achievements of question-and-answer dialogue systems, they still face a number of challenges and problems. inference, etc., which need to be studied and explored in greater depth. Looking ahead, we believe that Q & A dialogue systems will be more widely used as they continue to develop and improve. At the same time, we also Development in the field.

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