1. Related Work

Knowledge graph is a technical method that uses graph models to describe the relationship between knowledge and modeling the world [1]. The early idea of the knowledge graph comes from Semantic Web [2,3]. Its original idea is to transform the World Wide Web based on text links into a semantic web based on entity links. In November 2012, Google took the lead in proposing the concept of Knowledge Graph (KG), indicating that it would add the function of Knowledge Graph to its search results. Its original intention is to improve the capabilities of search engines and enhance the search quality and search experience of users. According to statistics in January 2015, the KG built by Google has 500 million entities and about 3.5 billion entity relationship information, which has been widely used to improve the search quality of search engines. Although the concept of Knowledge Graph is relatively new, it is not a completely new research field. As early as 2006, Berners Lee proposed the idea of ​​linked data, calling for the promotion and improvement of related technical standards such as URI (Uniform resource identifier), RDF (Resource discription framework), OWL (Web ontology language), prepare for the arrival of the semantic network. Subsequently, the knowledge graph is gradually used in semantic search [4,5], intelligent question and answer [6-8], auxiliary language understanding [9,10], auxiliary big data analysis [11-13], and enhance the interpretability of machine learning [14], combined with graph convolution to assist image classification [15, 16] and other fields play an increasingly important role.

Knowledge-based Question Answering (KBQA) is the core function of the intelligent question answering system and a natural way of human-computer interaction. Knowledge Q&A relies on a large knowledge base (knowledge graph, structured database, etc.), which converts users' natural language questions into structured query sentences (such as SPARQL, SQL, etc.), and directly derives the answers required by users from the knowledge base.

In recent years, with the strong demand of users for intelligent applications, many companies and institutions such as Google, Baidu, Wiki, etc. have adopted automatic or semi-automatic methods to design a series of complete knowledge graphs for the high-quality data obtained. For example, DBpedia [17], Freebase [18], YAGO [19], etc., this type of graph is composed of a large number of entities, relationships and attributes. At the same time, the development of machine learning and deep learning has laid a research foundation for intelligent question answering. For example, Baseball [20], Lunar [21] realized intelligent question answering with limited domains, Paralex [22], SEMPRE [23], ParaSEMPRE [24], STAGG [25] tried more challenging open domain intelligent question answering research.

In 2014, Ye et al. [26] pointed out that the key to solving single-knowledge point question and answer is to decompose the original task into two subtasks-topic word recognition and relationship detection. In 2015, Ye et al. [27] emphasized that it is more difficult to find the relationship that matches the meaning of the question directly from a large knowledge base. In the thesis, Entity Linking is first used to locate topic words, and then from the subset of relations related to topic words to find the relationship that matches the meaning of the question, the question is parsed into a structured query. In 2016, Ye et al. [28] inherited the open source WebQuestions data set of the Stanford Natural Language Processing Group, and based on this, annotated the semantic analysis results of the question (SPARQL query), and contributed to the WebQuestionsSP data set. In 2019，Yang et al. [29] demonstrate an end-to-end question answering system that integrates BERT with the open-source Anserini information retrieval toolkit. In 2020，Ma et al. [30] proposes an answer quality prediction model based on the question-answer joint learning (ACLSTM) which can effectively improve the prediction effect of answer quality.

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