**Question Answering based System**

* Question answering (QA) is a field of natural language processing (NLP) and Artificial intelligence that aims to develop systems that can understand and answer questions posed in natural language.
* The point of a QA system is to understand the question and give an answer that is correct and helpful.
* QA systems can be based on various techniques, including information retrieval, knowledge-based, generative, and rule-based approaches. Each method has its strengths and weaknesses, and the choice of method depends on the project’s specific needs.
* QA systems can be used in many places, like customer service, search engines, healthcare, education, finance, e-commerce, voice assistants, chatbots, and virtual assistants.

**Question Answering System work**

A natural language question-answering (QA) system is a computer program that automatically answers questions using NLP. The basic process of a natural language QA system includes the following steps:

1. **Text pre-processing**: The question is [pre-processed](https://spotintelligence.com/2022/12/21/nltk-preprocessing-pipeline/) to remove irrelevant information and standardize the text’s format. This step includes [tokenisation](https://spotintelligence.com/2022/12/07/nlp-tokenization/), [lemmatisation](https://spotintelligence.com/2022/12/09/lemmatization/), and [stop-word removal](https://spotintelligence.com/2022/12/10/stop-words/), among others.
2. **Question understanding**: The pre-processed question is analysed to extract the relevant entities and concepts and to identify the type of question being asked. This step can be done using natural language processing (NLP) techniques such as [named entity recognition](https://spotintelligence.com/2022/12/06/ner/), [dependency parsing](https://spotintelligence.com/2023/10/22/dependency-parsing/), and [part-of-speech tagging](https://spotintelligence.com/2023/01/24/pos-tagging-in-nlp-python/).
3. **Information retrieval**: The question is used to search a database or corpus of text to retrieve the most relevant information. This can be done using information retrieval techniques such as keyword search or semantic search.
4. **Answer generation:** The retrieved information is analysed to extract the specific answer to the question. This can be done using various techniques, such as machine learning algorithms, rule-based systems, or a combination.
5. **Ranking**: The extracted answers are ranked based on relevance and confidence score.

The specific methods used in each step and the system’s architecture will depend on the QA system’s design and the type of questions it intends to answer.

For example, some systems are based on a knowledge base, others on information retrieval, and others on [generative models](https://spotintelligence.com/2023/10/24/generative-models/). Hybrid systems can also be designed to combine several approaches to improve overall performance.

It’s also worth noting that the quality of the input data, pre-processing, tokenization, and the model’s architecture are essential to achieve an excellent question-answering system.

**Types of Question Answering Based System**

Question answering (QA) implementation in natural language processing (NLP) involves using various NLP techniques to answer questions in natural language automatically. There are several different approaches to QA implementation in NLP.

Information retrieval-based QA

Information retrieval-based question answering (QA) is a method of automatically answering questions by searching for relevant documents or passages that contain the answer. This approach uses information retrieval techniques, such as keyword or semantic search, to identify the documents or passages most likely to hold the answer to a given question.

Information retrieval-based QA systems are generally easy to implement and can be used to answer a wide range of questions. However, their performance can be limited by the quality and relevance of the indexed text and the effectiveness of the retrieval and extraction methods used.

It’s also important to note that IR-based QA systems are often used with other types of QA, like knowledge-based or generative QA, to improve the system’s overall performance.

2. Knowledge-based QA

Knowledge-based question answering (QA) automatically answers questions using a knowledge base, such as a database or ontology, to retrieve the relevant information. This strategy’s foundation is that searching for a structured knowledge base for a question can yield the answer.

Knowledge-based QA systems are generally more accurate and reliable than other QA approaches based on structured and well-curated knowledge. But their performance can be limited by how well the knowledge base is covered and how well the methods used to make queries and get information from their work.

It’s also important to note that knowledge-based QA systems are often used with other QA methods, like information retrieval-based or generative QA, to improve the overall performance of the QA system.

3. Generative QA

Generative question answering (QA) automatically answers questions using a generative model, such as a neural network, to generate a natural language answer to a given question.

This method is based on the idea that a machine can be taught to understand and create text in natural language to provide a correct answer in terms of grammar and meaning.

Generative QA systems are powerful as they can answer a wide range of questions and generate more human-like answers.

However, their performance can be limited by the training data’s quality and diversity and the model’s complexity.

It’s also worth noting that Generative QA systems are often used with other QA approaches, such as information retrieval-based or knowledge-based QA, to improve the overall performance of the QA system.

These combinations are known as Hybrid QA systems.

4. Hybrid QA

Hybrid question answering (QA) automatically answers questions by combining multiple QA approaches, such as information retrieval-based, knowledge-based, and generative QA. This approach is based on the idea that different QA approaches have their strengths and weaknesses, and by combining them, the overall performance of the QA system can be improved.

Hybrid QA systems are considered more robust and accurate than a single QA approach, as they can leverage the strengths of multiple QA methods. Hybrid QA systems can also be more flexible, as they can adapt to different types of questions and different levels of complexity. But designing and putting together a hybrid QA system can be more complex and take more resources than a single QA method.

5. Rule-based QA

Rule-based question answering (QA) automatically answers questions using a predefined set of rules based on keywords or patterns in the question. This approach is based on the idea that many questions can be answered by matching the question to a set of predefined rules or templates.

**Applications of question and answering systems**

Question-answering (QA) systems have various applications in various industries and domains. Some of the most common applications of QA systems include:

Customer service: QA systems can be used to answer customers’ questions quickly and correctly, reducing the need for human customer service reps.

Search engines: QA systems can make search results more accurate and valuable by answering specific questions instead of just giving a list of relevant documents.

Healthcare: QA systems can give patients accurate and reliable information about their health conditions and treatment options.

Education: QA systems can be used in education to give students immediate feedback and explanations for their answers, which helps them learn better.

Finance: QA systems can tell financial advisors about the latest market trends and investment strategies.

In e-commerce, QA systems can be used to recommend products to customers and answer their questions about the features and availability of those products.

Voice assistants: QA systems can be connected to voice assistants so that users can conversationally get answers to their questions.

Chatbots: QA systems can be linked to chatbots so that users can naturally get answers to their questions.

Virtual assistants: QA systems can be connected to virtual assistants so that users can conversationally get answers to their questions.

Business intelligence: QA systems can extract relevant information from large datasets and provide decision-making insights.