International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

Question Answering System using Artificial Neural Network

Saifali Prasla[1], Sairaj Tawde[2], Vatsal Shah[3], Jyoti Chavhan[4]

[1,2,3]B.E. student, Dept. of Information and Technology, Atharva College of Engineering, Maharashtra, India
[4]Assistant Professor, Dept. of Information and Technology, Atharva College of Engineering, Maharashtra, India

---

Abstract - *In today's modern world, the Question Answering system is being used everywhere and it is a vital part of everyone's lives as it allows people to search their queries and gain knowledge. However, the major issue with all the existing systems is that they all fail to answer complex questions which require interpretation of the data and question asked by the user. They are all limited to answering only simple and objective questions. The proposed system aims to get overcome this problem by creating a deep artificial neural network with associative memory from various documents like pdf, txt, etc. provided by the user. It processes the question asked by the user and comprehends the question, and understand its contextual meaning. After that, it then proceeds to find the answer from the deep neural network created from the documents.*

***Key Words*: Question Answering system, Artificial neural network, Natural Language Processing, Intelligent data retrieval system.**

1. INTRODUCTION

NLP is used to understand the knowledge provided to the system and to process that knowledge. A Question Answering System is used for fast extraction by exempting the user to read all the unnecessary information which might not lead to the answer. There are multiple NLP models used in the Question Answering System. These models are usually symbol matching which makes use of linguistic annotations, structured world knowledge, and semantic parsing. The neural network's information processing mechanism is similar to the human brain. Due to this, it is used in various artificial intelligence models like pattern recognition, associative memory, etc. and they yield very high performance. Unlike any ML models, it doesn't require training sets to develop models. The proposed system, that creates a deep neural network from the documents provided by the user and storing them for future use. It will try to imitate the human information recalling feature by processing the document first - understanding it and then try to find the answer to the questions asked. The system will process, comprehend and try to understand what is the answer to the question asked and then try to find the answer from the deep neural network created from the documents previously provided.

2. RELATED WORKS

A Question Answering System is a system that reduces the human effort of searching for an answer by extracting it from its database or from the internet. Lu Liu and Jing Luo [1] had proposed a question answering system based on deep learning. Here the system used the CNN model and Word2Vec model to find the correct answer to the question asked. The reason for using these models is that the system was made to work in the Chinese language and in Chinese, there are no spaces between 2 words so eventually, the entire sentence is one single word and also the Chinese language has a lot of ambiguity in it. Sudha Morwal, Nusrat Jahan and Deepti Chopra [2] had proposed Name Entity Recognition using Hidden Markov Model (HMM). The HMM model was used to develop a language-independent NER. Yashvardhan Sharma and Sahil Gupta [3] had proposed a deep learning approach for question answering system, where the system used a basic AIML chat-bot to answer factual questions and then LSTM models and different memory networks to get accuracy as high as 98 percent.

3. PROPOSED SYSTEM AND IMPLEMENTATION

3.1 Proposed System

The proposed QAS system comprises two phases namely the learning phase and the extraction phase. The first phase takes a document as an input, processes it and generates or updates the system's neural network. After the document has been processed, the user can view the document and ask questions. In the second phase, the user can ask questions directly to the system. In this phase, the system takes a question as an input. The system then produces an answer to this question, if it has the answer, and displays the answer.

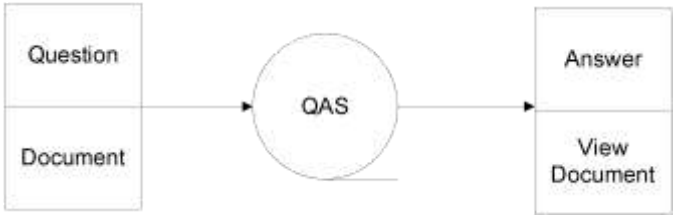

Figure -1: Overview of the system.

The block diagram in Figure 2 shows in schematic form the general arrangement of the parts or components of the proposed system.

Figure -2: Architecture

3.2 Implementation

3.2.1 Learning Phase

A. Sentence Analysis

This step involves Natural language processing in which knowledge units are derived from the sentence and words(neurons) from knowledge units.

B. Network Creation

After sentence analysis, an artificial neural network is created from the extracted words. If the words exist in the same knowledge unit then a connection is generated between them.

C. Assigning Deep Case

The deep case is assigned to the neurons in an artificial neural network to improve its inference capabilities. The deep cases that we are going to consider are shown below.

Deep Case	Information
Agent	One who performs the action or main actor.
Action	The action(event) being performed.
Location	A location where the action occurred.
Time	Time of the event.
Instrument	The object with which action is performed.
Patient	Action being performed on.
State	Current condition/state of agent or patient.

Table 1: Deep Case

3.2.2. Extraction phase

A. Question Analysis

In question analysis what answer is to be extracted can be estimated from the type of question asked. For example, if the question includes "where" then the answer will include a location. Words from the question are also extracted to search the neuron and the connection between them.

B. Search in Neural Networks

The neurons(words) extracted from the question analysis are searched in ANN to find a connection between them. This connection leads to the knowledge layer.

C. Backtrack to Knowledge Layer

This step involves generating a knowledge unit that possibly can be the answer to the question asked by the user.

3.2.3 Result

An experiment was carried out wherein a QAS document was fetched to the system and the results are illustrated below.

Step 1: In this step, an input (text data) was provided to the system from the user. Let's say the document contains the following details.

"Shivaji Maharaj was born on 19 February 1630 at Shivneri fort".

Step 2: In this step, the input sentences were divided into words and each word was assigned with a unique ID. The division of each input data and ID assignment is shown in Table 2.

ID	Words
ID1	Shivaji Maharaj
ID2	Born
ID3	19 February 1630
ID4	Shivneri Fort

Table 2: Assignment of id's to each word

Step 3: After assigning Unique ID's, knowledge units were extracted from the input data. Table 3 shows the extracted knowledge units and ID's assigned to each unit.

Knowledge ID	Knowledge
K1	Shivaji Maharaj was born on 19 February 1630
K2	Shivaji Maharaj was born in Shivneri fort

Table 3: Assigning knowledge ID's to each word

Step 4: Word type was assigned to each word after extracting the knowledge unit. The assignment of each word is shown in Table 4.

ID	Words	Word type
ID1	Shivaji Maharaj	Who
ID2	Born	What
ID3	19 February 1630	When
ID4	Shivneri Fort	Where

Table 4: Assigning word type to each word

Step 5: Now deep cases are assigned to each word. Table 5 shows the various deep cases assigned to each word.

ID	Words	Deep cases
ID1	Shivaji Maharaj	Agent
ID2	Born	Action
ID3	19 February 1630	Date
ID4	Shivneri Fort	Place

Table 5: Assignment of deep cases to each word

Step 6: In this step, the relationship between words and knowledge units was determined.

First Word	Second Word	Knowledge ID
ID1	ID2	K1
ID2	ID3	K1
ID1	ID3	K1
ID1	ID4	K2
ID1	ID2	K2
ID2	ID4	K2

Table 6: Relationship between knowledge units and words

Step 7: Finally a network was generated based on the sentence. The network generated is shown in figure 3.

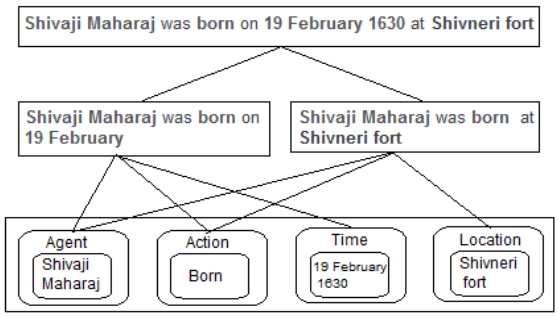

Figure 3: Network Diagram

Step 8: Now the neural network is generated. The system has some knowledge and can answer the questions based on this knowledge only. So, when a question is asked to the system our system will analyze each word from the question.

"Where was Shivaji Maharaj born?"

Table 7 below contains the words in the question.

Words
Shivaji Maharaj
Born
Where

Table 7: Different words of the question

Step 9: Now the words are searched from the network and knowledge units that relate these words are extracted. All the knowledge units that are related to the words in the question are shown in Table 8.

First Word	Second Word	Knowledge ID
ID1	ID2	K1
ID2	ID3	K1
ID1	ID3	K1
ID1	*ID4*	K2
ID1	ID2	K2
ID2	*ID4*	K2

Table 8: Searching the required knowledge unit

In the above sentence, K1 and K2 both relate the word "Shivaji Maharaj" and "born".

K1 answers "when" whereas K2 answers "where". We evaluate this from the word type table that was created in the learning phase. The user has asked "where" so the output knowledge unit will be K2.

Step 10: Finally, when the system will have the required knowledge it will display the selected knowledge unit. i.e. "Shivaji Maharaj was born at Shivneri fort."

4. CONCLUSION

The proposed system is able to answer the complex questions asked by the user based on the provided documents. The system can answer the questions elaboratively unlike the previous systems which answered only simple questions or answered in a yes or no format. The proposed system can be further enhanced to process other types of files. It can also be enhanced to extract information from tables or even images.

ACKNOWLEDGMENT

We would like to thank our project guide Prof. Jyoti Chavhan for her immense cooperation and guidance. We have no words to communicate our appreciation for a person who wholeheartedly supported the project and generously gave her valuable time while making this project. All the inputs provided by her were extremely useful and helped us build this project. She has always been a source of motivation for us.

REFERENCES

[1] Lu Liu and Jing Luo, "A Question Answering System Based on Deep Learning", in Springer International Publishing, 2018.

[2] Sudha Morwal, Nusrat Jahan and Deepti Chopra, "Name Entity Recognition using Hidden Markov Model (HMM)", in International Journal on Natural Language Computing (IJNLC), December 2012.

[3] Yashvardhan Sharma and Sahil Gupta, "Deep Learning Approach for Question Answering System", in International Conference on Computational Intelligence and Data Science (ICCIDS 2018) Procedia Computer Science 132(Elsevier), April 2018.

[4] Tsukasa Sagara and Masafumi Hagiwara, "Natural language neural network and its application to question-answering system", in IEEE, 2012.

[5] Shivani Singh, Nishtha Das, Rachel Michael, and Dr. Poonam Tanwar, "The Question Answering System using NLP and AL", in International Journal of Scientific and Engineering Research, December 2016.

[6] Karl Moritz Hermann, Tomáš Kočisky, Edward Grefenstette, Lasse Espeholt, Will Kay, Mustafa Suleyman, Phil Blunsom, "Teaching Machine to Read and Comprehend, in arXiv.org, June 2015.

[7] Abhishek Kumar, Kunal Thakur, Pranav Nachnekar and Nayan Vaity, "Question-Answer Text Mining using Machine Learning", in IRJET, March 2019.

[8] Mohit Iyyer, Jordan Boyd-Graber, Leonardo Claudino, Richard Socher, and Hal Daumé III, "A Neural Network for Factoid Question Answering over Paragraphs", in aclweb.org, 2014.

[9] Fatima Ashraf, Tansel Ozyer and Reda Alhajj, "Employing Clustering Techniques for Automatic Information Extraction from HTML Documents", in IEEE, September 2008.

[10] C. L. Philip Chen, "Deep Learning for Pattern Learning and Recognition", in IEEE, 2015.

[11] Maryam Habibi and Andrei Popescu-Belis, "Keyword Extraction and Clustering for Document Recommendation in Conversations", in IEEE, 2015.