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Implementation of Question and Answering Retrieval System in Natural Language Processing

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Abstract: Question and Answering System is one of the major researches are in Natural Language. Main challenges of Question and Answer system gives exact answer of question which give by user. Question and Answering system can be classified into three category are open domain, closed domain and restricted domain. Using advanced Natural Language Processing tool we will be developed a framework for question answering system. In this paper we work on restricted domain question answering system. Proposed system work on keyword and question matching and return precise answer of question.

Keywords: **Natural Language processing, information retrieval, semantic similarity, restricted domain, answer extraction, answer ranking**

I Introduction

Although the set of documents which are retrieved by the search engine contain a lot of information about the search topic but it may or may not contain exactly that information which the user is looking for [1].The basic idea behind the question answering system is that the users just have to enter the question and the system will retrieve the most appropriate and precise answer for that question and return it to the user. Hence in those cases where the user is looking for a short and precise answer, question answering System plays a great role rather than Search Engines, which usually provide a large set of links of those web pages which might contain the answer of that question. A typical Question Answering system can be divided into 3 modules namely: Question Processing module, Document Processing or Information Retrieval module and Answer Processing module. Each ***Processing and Information Retrieval*** module contains several sub modules and these modules use several Natural Language Processing Techniques in order to extract the proper answer. The usual Question Answering system is designed to answer simple wh-questions like "who", "what", "when", "where", etc. But the recent QA research focuses on extending the system to answer complex questions, summary questions, opinion questions etc. The paper proposes a Question Answering system that answers simple factoid, wh-questions by using a technique called Semantic Role Labeling.

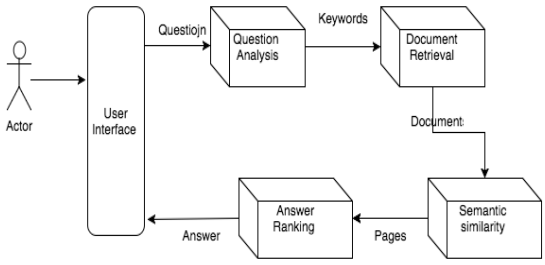

Figure 1. Block Diagram Question Answering System

The rest of the paper is organized as follows. The next section describes the general architecture of a Question Answering System. Section 3 discusses some of the related works in this area. The proposed system architecture is described in section 4. The paper concludes with the experimental setup and results.

II Architecture of a Question Answering

In this section we describe the architecture of our system. The overall architecture of the system can be subdivided into three main modules: (1) pre-processing, (2) question template matching, and (3) answering. Each module is described in detail in the following subsections.

Question Answering Systems can be classified on the basis of the domains over which it has been constructed.

- Open Domain Question Answering
- Close Domain Question Answering
- Restricted Domain Question Answering

Open domain question answering systems are domain independent. It relies on general ontology and world knowledge. Usually these systems have a large collection of data from where the required answer is to be found out. Since in case of Open Domain question answering information content is not of particular domain it can answer questions of various fields however here deep reasoning is not possible [3].

Close domain question answering systems deal with questions in a specific domain [3]. LUNAR and BASEBALL are the example of close domain QA systems .In this case the data set contains a very limited amount of focused and structured information . hence in case of close domain question answering systems deep reasoning is possible but the problem with these systems was that due to the very small size of data set they are not more than a 'Toy Systems"[4].

Research in restricted-domain question answering (RDQA) addresses problems related to the incorporation of domain- specific information into current state-of-the-art QA technology with the hope of achieving deep reasoning capabilities and reliable accuracy performance in real world applications. In fact, as a not too-long-term vision.

III Literature Survey

In most of the research papers [4, 5, 6] LUNAR [7] and BASEBALL [8] have been discussed as the earlier developed question answering systems. However there are various question answering systems which have been developed with different concepts since the idea of QA System has been coined

In a system developed Athira P. M, Et.al [10], presented an architecture of ontology-based domain-specific natural language question answering that applies semantics and domain knowledge to improve both query construction and answer extraction.

Another system developed by Pragisha K. Et.al [11], described about the. It receives Malayalam natural language questions from the user and extracts most appropriate response by analyzing a collection of Malayalam documents. The system handles four each question.

Research and reviews in question answering system developed by Sanjay K Dwivedi Et.al[12] propose taxonomy for characterizing Question Answer (QA) systems, survey of major QA systems described in literature and provide a qualitative analysis of them.

S. No	Type of Question and Answering System	Question and Answering System Methods
1	Multilingual Question/Answering	Tokenization and pos tagging., Word sense disambiguation, Answer type identification, Keywords expansion, Semantic Disambiguation
2	Analysis of the Asks Question-Answering System	Query Reformulation, NGram Mining, N-Gram Filtering, N-Gram Tiling.
3	Multilingnality, Spatial- temporal context awareness, Textual entailment	Answering architecture
4	A Question Answering System based on Information Retrieval and Validation	Expected Answer Type, Named Entities Presence,
5	A Hybrid Question Answering System based on Information Retrieval and Answer Validation	Module, Hypothesis Generation Module, Document Processing and Indexing
6	A specifiable domain multilingual Question	Answering architecture

In a System developed by Poonam Gupta Et.al [13] A Survey of Text Question Answering Techniques. Question answering is a difficult form of information retrieval characterized by information needs that are at least somewhat expressed as natural language Template Matching Automatic Answering System For natural languages questions proposed by Pachpind Priyanka Et.al [17], Frequently Asked QA System that replies with pre-stored answers to user questions asked in regular English, rather than keyword or sentence structure based retrieval mechanisms.

IV Proposed System

Since both the Open Domain QA System and Close Domain QA System have their own pros and cons a new concept of Question Answering has been coined by Molla& Vice do [4] called RESTRICTED DOMAIN QA SYSTEM, which is the midway of these two domains.

We are convinced that research in restricted domains will drive the convergence between structured knowledge-based and free text-based question answering.

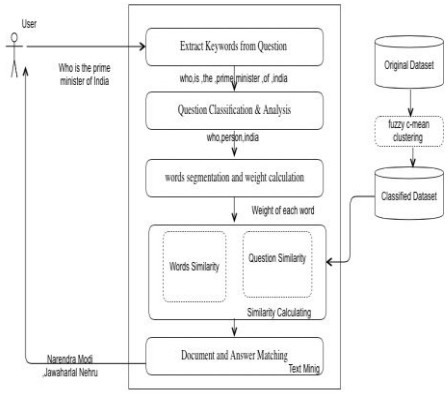

Figure 2. Proposed System

Our proposed system performs following operations:

- Question Processing: In this module the given Question is processed to get some important information from it. Steps through which question Processing Module passes and their descriptions are given below. Steps in Question Processing Module:
- Find the Type of given question using Wh word.
- Find out the expected type of answer.
- Get the Keywords from the Question.
- Find out the Focus of the question.

he first step in the QA System is the Question Processing or Question Classification module. Various information, which we will get through this module, are the Type of Question, Expected Answer Type, Focus or Head Word of the Question and the Question Keywords.

WH word	**Question Type**		
	Factoid Type	**Definition Type**	**Descriptive Type**
Question	Who When What Where Which	How What Why	What

•Document Processing: Once the question has been processed we will move towards the document processing module. In this module the documents which are relevant to the given question are retrieved and processed. Following steps used in document processing.

- Get the question in hand and search relevant documents using a reliable search engine.
- Take top relevant documents.
- Extract the content from these documents.
- Save these contents in to file

- Answer processing**:** This module presents algorithms for extracting the potential answer for all the three categories of questions that is Definition Type of Question, Descriptive Type of Question and Factoid Type of Question.
- Dataset Clustering: cluster dataset using fuzzy c-mean algorithm then process for question and answer processing.

V. Result Analysis

Question and Answering System is developed in this research with help Java (JDK1.8) and Net Beans IDE8.02 on window operating sytem7. All forms of Question Answering System design in Swing. Graph plotted for computation time, type of question and memory management using JFree Chart Library. In Result Analysis compare Proposed Question Answering system with existing Question Answering system in term of computation time and memory.

In Question Answering System took each type of questions for experiment like Factoid Question, Descriptive and Definition. Wikipedia used as dataset for search Question answers. Below figure 5.1 shows that home screen of project.

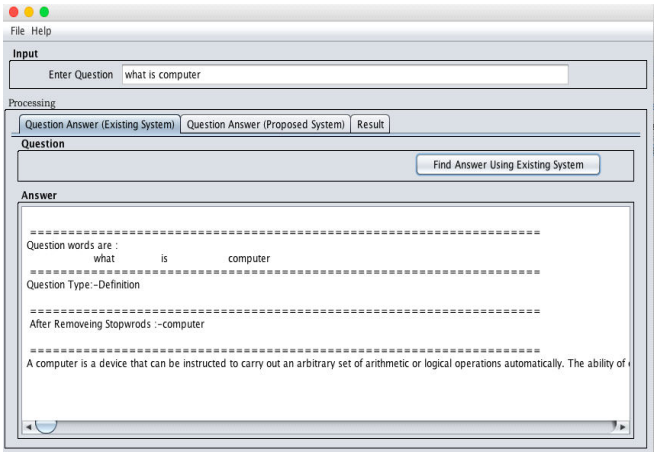

Figure 5.1 Home screen of project.

Evolution Parameters

In Question Answering system focus on following parameters

- Question type
- Computation Time
- Memory Management

Question Types

Find type of Question corresponding to Enter Question for Answer. Using type of question design template that helps to find more accurate answer for given entered Question.

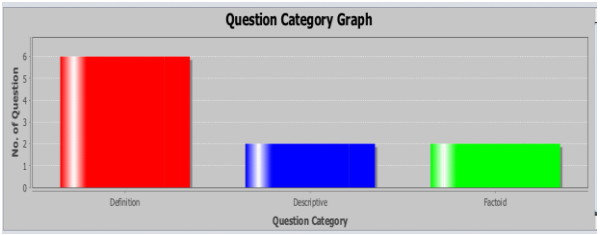

Figure 5.2 Question Types

Table 5.1 Number of Question in Types

S.No.	Question Type	No. Of Questions
1	Definition Type	6
2	Description Type	2
3	Factoid Type	2

Table 5.2 Question Type of each Question

S.No.	Question Number	Question Type
1	Question Number 1	Description
2	Question Number 2	Definition
3	Question Number 3	Definition
4	Question Number 4	Definition
5	Question Number 5	Description
6	Question Number 6	Definition
7	Question Number 7	Factoid
8	Question Number 8	Description
9	Question Number 9	Factoid
10	Question Number 10	Definition

Computation Time

We calculate computation time for Exiting Question Answering system and Proposed Question Answering system. And results shown with help of graph. From experiments found that Proposed Question Answering system less computation time compare to Existing Question Answering system.

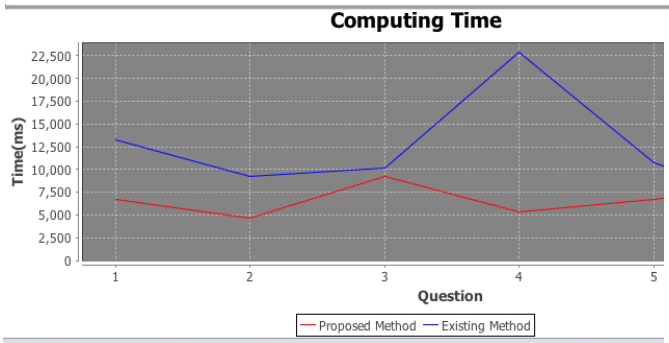

Figure 5.3 Computation time for Existing and Proposed System.

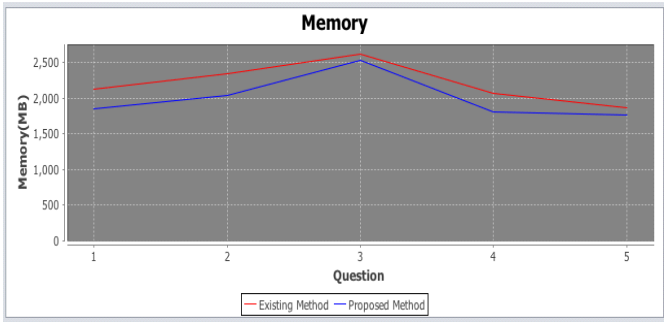

Figure 5.3 Computation Memories for Existing and Proposed System.

Table 5.3 Computation time for Existing and Proposed System.

S.No.	Question Number	Computation Time of Existing Question Answering System (MS)	Computation Time of Proposed Question Answering System (MS)
1	Question Number 1	13203	7215
2	Question Number 2	9853	4978
3	Question Number 3	10340	9734
4	Question Number 4	22565	5123
5	Question Number 5	11287	7460

Computation Memory

We calculate computation memory for Exiting Question Answering system and Proposed Question Answering system. And results shown with help of graph. From experiments found that Proposed Question Answering system less computation memory compare to Existing Question Answering system.

Output Screen

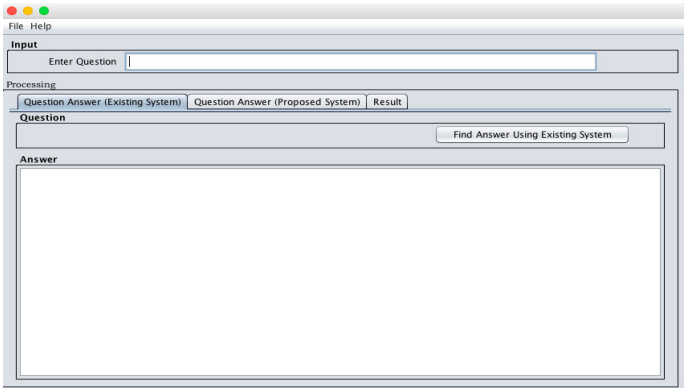

Figure 5.5 Initial screens for Existing and Proposed System.

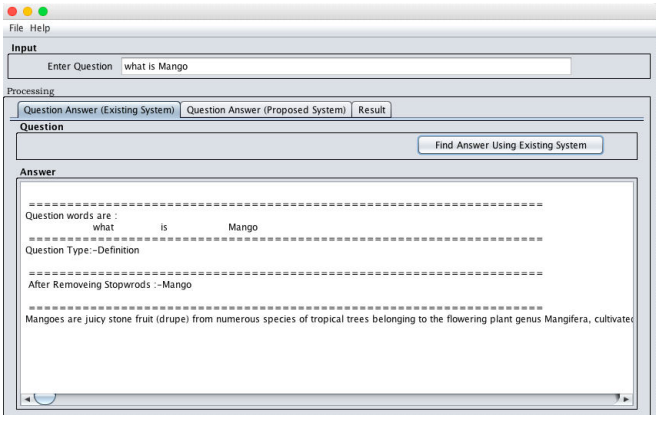

Figure 5.6 Existing Question Answering System

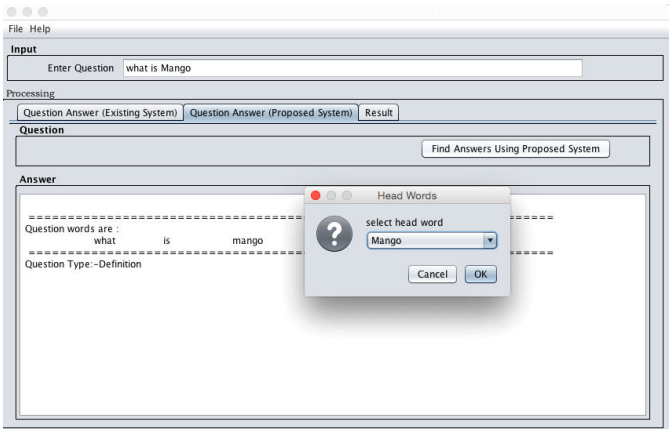

Figure 5.7 Proposed Question Answering System

Figure 5.8 Select Head Word of Question

Figure 5.6 Answer of Proposed Question Ans

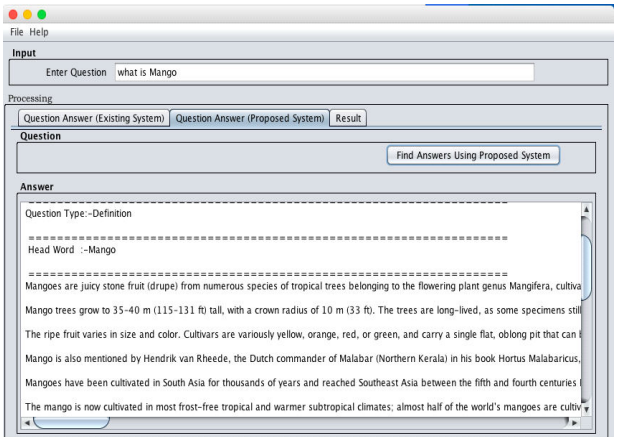

Table 5.4 Computation memory for Existing and Proposed System

S.No.	Question Number	Computation Memory of Existing Question Answering System (MB)	Computation Memory of Proposed Question Answering System (MB)
1	Question Number 1	2183	1940
2	Question Number 2	2434	2015
3	Question Number 3	2507	2473
4	Question Number 4	2164	1946
5	Question Number 5	1798	1816

VI Conclusion

In this paper we have proposed a framework for restricted domain question Answering System using advanced NLP tools and software. This framework can be used to develop a Question Answering System for extracting exact and precise answer from restricted domain textual data set. The proposed framework not only provides a simple and implementable framework for developing question Answering System but also provides a proper flow of data for answer extraction.

Since the proposed model works over keywords and headword and is independent of the question or sentence structure, it has reduced the overhead of question normalization. Moreover since the framework is given for restricted domain, it also handles the issue of word sense disambiguation. The major problem which exists with the proposed framework is that it's performance is dependent on the performance of the search engine and the used NLP tools.

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