AUTOMATED ASSESSMENT OF SHORT ANSWER USING NLP

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Abstract

The authors of this paper propose a design of an intelligent approach for mapping short answer with the items/questions using Natural Language Processing (NLP). In the present era of technology there has been a significant impact of automated assessment, most of these uses MCQ. These assessment techniques use web-based teaching and learning systems. This technique, if implemented will facilitate the quick assessment of subjective type answers using technology enabled teaching and learning systems. In this research article authors have discussed a method for assessing answers based on NLP. Authors have divided the system into two modes, first mode is belonging to instructor and second one belongs to learner and each mode works separately.

In instructor mode, a set of items/questions are provided to the system using a file. In this mode, the instructor also provides the tentative correct answers to the system. In the learner mode, a learner opts for a set of questions based on a particular topic in a related domain. The system provides a set of items from the item bank. The learner provides the answer through the interface for the respective items in given instance of time. Once the learner finishes answering the question, the system evaluates using the proposed algorithm.

The proposed answers submitted by the learner are first pass through the process of tokenization. Next the tokens are passed through POS tagging Stop word removal and stemming process will be applied to the answer; these processes alleviate all prefix, suffix statements attached with answer. Subsequent to this the remaining part is mapped with answer stored in repository. This system provides the flexibility for a learner to write answer in different ways. It also provides flexibility to write answers in their own style provided answer must be grammatically correct in terms of the language.

The authors of this paper used different algorithms to improve this system technically, for POS tagging we have used “The penn treebank” algorithm and for stemming process “Porter stemming algorithm” have been used.

Keywords: e-Learning, Natural language processing, POS tagging, Stemming, Tokenization.

1 INTRODUCTION

In recent years, an enormous number of organisations uses a very common assessment and evaluation tool and there are various types of assessment in form of questions or items such as: True or False, Multiple Choice Questions (MCQ) with one correct answer, MCQ with multiple correct answers, Fill-in-the-blanks, Matching from list in two columns, etc. Our research is based on short answer for questions/items. Short answer questions are usually composed of a brief prompt that demands a written answer that varies in length from one or two words to a couple of sentences. They are most often used to test basic knowledge of key facts and terms. Short answer questions have multiple advantages. Today number of instructor reports that they are comparatively very easy to construct and can be constructed easily and speedy than multiple choice questions [1]. Short answer questions make complicated for learners to presume the answer in contrast to matching, true/false, and multiple choice questions. Short answer questions offer learners with more flexibility to provide details of their understanding. Short answer also express more creatively, compared to multiple choice questions. Therefore, we can say that scoring is relatively difficult and can be quite subjective. Short answer questions provide more structure than essay questions and thus are often easy and faster to mark and often test a broader range of the course content than full essay questions [1].

2 METHODOLOGY

Our system works on two modes, first mode is belongs to Instructor and second mode belongs to Learner mode.
Instructor Mode is a mode where all question and their corresponding short answer is stored in database. For example “What is the capital of India?” and its corresponding precise answer is “New Delhi”, which is stored in the database.

In Learner Mode a learner has privilege to answer question in one of all the possible way of English grammatically correct sentence(s). For example, if question is “What is the capital of India?”, learners can answer in any one of the forms such as “New Delhi is the capital of India”, “Capital of India is New Delhi”, “India’s capital is New Delhi”, “New Delhi” and etc.

2.1 Natural language processing (NLP)

NLP came into existence in the year 1950s as the interdisciplinary are of artificial intelligence and linguistics [2]. NLP was originally distinct from text information retrieval (IR), which employs highly scalable statistics-based techniques to index and search large volumes of text efficiently. NLP is the ability of a computer program to understand language spoken by human beings. It is concerned with the communications between computer and human beings based on natural languages. We have used The Penn Treebank Part-of-Speech (POS) Tagset for tagging [2].

2.1.1 The Penn Treebank Part-of-Speech Tagger

In the eight-years (1989 to 1996) of operations of Penn Treebank which produced approximately 7 millions of words as parts-of-speech tagged text, 2 million words of text parsed for predicate argument structure, 3 million words of skeletal parsed text, and 1.6 million word of transcribed spoken text annotated for speech disfluencies [2]. There are many lists of parts-of-speech, whereas most modern language processing on English uses mainly 45 tagPenn Treebank tagset [3]. All these tags has been used to array of corpora, including the Brown corpus, the Wall Street Journal corpus, and the Switchboard corpus.

2.2 Steps involved with processing of Answer

Tokenization is the process of breaking up the given text into atomic units called tokens. The tokens may be words or number or punctuation mark. Tokenization performs this task by locating word boundaries. Ending point of a word and beginning of the next word is called word boundaries. Tokenization is also known as word segmentation [4].

POS Tagging is the process of classifying words into their parts of speech and tagging them therefore is known as POS tagging or simply tagging. POSs are also recognized as word classes or lexical categories. POS tagging is mainly process of assigning a POS marker to each and every word in an input text. Tags are generally applied to punctuation, tokenization is usually performed before, or as part of the tagging process separating commas, quotation marks, etc., from words and disambiguating end-of-sentence punctuation (period, question mark, etc.) from part-of-word punctuation (such as in abbreviations like e.g. and etc.) [3]. The group of tags used for a particular task is known as a tag set [5]. We have implemented the solution using The Penn Treebank algorithm.

Stop Word Removal is used where some extremely common words which would appear to be of little value in helping select documents matching a user need are excluded from the vocabulary entirely. These words are called stop words. The general strategy for determining a list of stop-word is to sort the terms by collection frequency, and then to take the most frequent terms, often hand-filtered for their semantic content relative to the domain of the documents being indexed, as a stop list, the members of which are then discarded during indexing [6].

In stemming process, after removing common words, an indexing procedure tries to mix word variants into the same stem or root using a Porter stemming algorithm [7]. For example, the words "user", "using" or "used" may be reduced to the stem "use".

After Stemming we have mapped with the answer stored in database and on the basis of mapped percentage we have calculated the result with processed answer. Figure 1 shows flow chart of Steps involved in our assessment of answers. Algorithm for instructor and learner is in figure 2 and figure 3 respectively.
Figure 1 Flow Chart

Algorithm: Q and A storing
Input: Question and their short Answer
1. begin
2. create a table named QA having the field Quid, Questions, Answer and AnslD
3. Initialize the counter variable is 1
4. While the counter variable is less than the no of total Question and Answer
5. Insert the Question and Answer into the table
6. Increment the counter variable
7. Exit

Figure 2 Algorithm for Question and Answer storing in DB
Algorithm: Answer processing

Input: Answer

1. begin
2. initiate the counter variable as A.
3. while the counter variable is less than the number of total word in Answer.
4. for each word do
5. Create token and store in A.
6. use stanford tagger to tag POS.
7. for each word do
8. search the stop word list
9. if word is found then
10. remove the word from A
11. else
12. do nothing
13. end if
14. end for
15. steam all word in A after stopword removal
16. if word is mapped with DB>70 percent then
17. variable correct_answer=1
18. else
19. variable wrong_answer=1
20. end if
21. repeat from step 2 to step 20 for each answer
22. end

Figure. 3 Algorithm for Answer processing

3 RESULTS
In this proposed system we have implemented our system with 50 questions, all question started with WH like WHO, WHAT, WHEN, WHAT etc and tested with answer provided by the learner. The result shows that the assessment of learner using NLP is better.

4 CONCLUSION
In this paper, authors provided a framework for short type question answering system. We have implemented the system using NLP. During the experimental evaluation, authors found that the developed system is efficient and reliable in assessment for learner using proposed system. However, the system cannot handle complex and compound sentences using this algorithm.

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