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Online Subjective Answer Text Matching Using Semantic Approach: An Overview

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ABSTRACT: Computer based evaluation of students' performance is playing a vital role in world wide for all kinds of examinations. This method is somewhat faster than our manual evaluating process. In this study a new method is proposed to evaluate the students' brief answers such as descriptive answers using Artificial Neural Networks (ANN) algorithm and Natural Language Processing (NLP) algorithms. In this system staff member creates answer sheet and keyword dataset for the examination process. These dataset are stored in data storage and student enters their answers in the examination page. This system automatically calculates result using two algorithms of NLP and ANN. Before this evaluation process the pre-processing technique is applied on the answers entered by the students. In this study, we used an Artificial Neural Networks algorithm for the normal answer comparison and stores marks for this in database and also evaluate the same answer using Natural language processing (NLP) algorithm to check grammar mistakes and stores the marks in database and finally compares both marks and provides final result. By these methods we can get an efficient result. The results given by the system is compared with the evaluation done by the faculty member.

KEYWORDS: Artificial neural networks (ANN), Clustering, Evaluating, Keywords, Natural language Processing (NLP), Text mining.

I. INTRODUCTION

Computer based evaluation of student answer is the common work which is used in many areas in assessment of students learning process. The great idea on using the computers in learning process has changed the field of learning system widely. The computer assisted assessment system was developed for to evaluate the one word answer such as of multiple choice questions. And can also evaluate the paragraph answer such as descriptive answer based on the keyword matching. The great drawback of this system is the student cannot know their mistakes and they won't try to improve them. Hence to make them to improve their English knowledge and grammar knowledge the proposed new method called evaluating the student descriptive answer using the Natural Language Processing algorithm and Artificial Neural Networks algorithm will be used. Many Researchers at this field only try to provide the marks and by this method the student will not know their mistakes and again at other exams they will make the same mistakes. It cannot able to improve the student knowledge on study. Hence this method of Evaluation of student answer using natural language processing and artificial neural networks is used.

Several methods have been suggested for descriptive answer assessment. The approaches are mainly based on text mining technique which involves keyword matching, sequence matching and quantitative analysis and semantic analysis. The purpose of Text Mining is to process unstructured (textual) information, extract meaningful numeric indices from the text, and, thus, make the information contained in the text accessible to the various data mining (statistical and machine learning) algorithms. Information can be extracted to derive summaries for the words contained in the documents or to compute summaries for the documents based on the words contained in them. Text mining is used to extract important information or data or pattern or knowledge from the exam owners and candidates answer which are in the unstructured form. The main purpose of text mining is to find valuable information from natural language text. After the text mining is applied the words like am, is, are, was, etc. are neglected by the system and we get keywords from the answer. After the finding out the keywords system shows total number of keywords to the exam owner. As per the number of keywords exam owner can decide marking scheme to that particular question.



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In the text mining for assessment of student answer, the teacher prepares questions and answers. Text mining process is done by natural language processing and word net tools. Artificial Intelligence and computational Linguistics concerned with the interaction between computer and human (natural) languages. It will groups the English words into some of the sets of synonyms called synsets provides short definitions and usage examples, and records a number of relations among these synonym sets. PoS tagger (Part of Speech tagger) is implemented to extract the important keywords in the answer given by staff before assessment is done. The extracted Keywords are categorized as mandatory keywords, subordinate keywords, and technical keywords. WordNet tool is used to give the related synonyms to literal word in the subordinate terms. Now Teachers can feed the servers with the eligible terms in the categories to be present for student evaluation. The main objectives of this study is to evaluate the student descriptive type answers using the NLP and ANN algorithm and to design a tool for evaluation of the student descriptive type answer using the NLP algorithm for Grammatical checking and produce marks and ANN algorithm for normal answer comparison and produce marks.

II. RELATED WORK

In this study to evaluate the student answer Natural Language Processing (NLP) algorithm and Artificial Neural Networks are used. The process starts by first staff creates answer sheet and keyword dataset for the examination process. These dataset stored in data storage and students enter their answer in the examination page. Once the student has submitted an answer text, the system will automatically calculate result using two algorithms of NLP and ANN. Before this evaluation process the pre-processing technique in undergone for the answer. Here we used Artificial Neural Networks algorithm for the normal answer comparison and stores mark for this in database and also evaluates the same answer using Natural language processing [NLP] algorithm to check grammar mistakes and stores the marks for this in database. Some basic linguistic analysis is performed in a natural language parser is respectively used to perform POS tagging of the student's answer text. After linguistic analysis, the student's answer text is processed by the artificial neural networks algorithm it will compares the student's answer text with the staff answer and with keywords.

The result of each process is calculated used by "marks calculator" to compute the total marks obtained by the student for his/her answer. and finally compares both marks and provides final result. By these methods we can get an efficient result.

Pre-processing

It is normalization of the text includes throwing unwanted words, stemming etc. All relational operators are separated by white space. The preprocessing is dependent upon the natural language processing algorithm's ability to recognize the sentence tags in desired format. Split compound sentences to simple sentences. The process of converting data to something a computer can understand is referred to as "preprocessing." One of the major forms of preprocessing is going to be filtering out useless data.

Part-of-Speech Tagging

It assigning a part-of-speech to each word in a sentence, useful in information retrieval, word sense disambiguation and it helps in parsing by assigning unique tags to each word thus reducing number of parses. We use POS tagger

Misspelling words:

Number of misspelled words are recorded from the short answers.



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Removing Stop Words

The process of converting data to something a computer can understand is referred to as "preprocessing." One of the major forms of preprocessing is going to be filtering out useless data. In natural language processing, useless words (data), are referred to as stop words.

Literature Survey

Dharma Reddy et. al. proposed in [1] PYTHON TOOL FOR EVALUATION OF SUBJECTIVE ANSWERS (APTESA). ApTeSa works either in a Semi-automated mode or in full automated mode. Semi-automated mode give the option to faculty to reassess an answer and update the results. This shown that the Semi-automated mode gives moderately enhanced results than the complete automated mode. ApTeSa evaluates the descriptive answers by equivalent keywords and phrases in the answer given by the candidate, with the keywords and phrases of the original answer. The keywords and phrases of the original answers are stored in the answer base of the system. Answer base contains the entities for keywords and phrases, along with the no. of marks to be given for each of their existences.

Thomas N. T. et. Al. [2] implemented e-learning system like Learning Management System (LMS) to assess candidates descriptive answers and provide immediate feedback to teachers. This is implemented by comparing candidates answers with teacher's ideal set of answers using latent semantic analysis. Then evaluating order of previous and upcoming words in the answer using positional indexing based on the keyword list added by the teacher. Then final score is generated

Meena K and Lawrance Raj evaluated candidates' answers online using Hyperspace Analog to Language (HAL) procedure and Self-Organizing Map (SOM) method [3]. The answer is given as input to HAL. HAL represents a procedure that processes a corpus of text and produce numeric vectors containing information about its meanings. The clustering method of Kohonen Self-Organizing Maps is applied to the vector. SOM is neural based technique. It takes the vectors as inputs and forms a document map in such a way that nearby neurons contain a similar document. The proposed method will be tested with short answers written by learners of our department. This method has a number of benefits like increased reliability of results, reduced time and effort, reduced burden on the faculty and efficient use of resources.

C rater [4] is a technique used for the content scoring. This content scoring is based on model building which makes various answer model for candidate's short answer. ETS (Education Testing Service)[4]is used for examining small answer of candidate having near about 100 words. It uses systematic method & rubrics element which specify accurate & significant terms which should be exist in candidate's answer. The problem of dissimilar answer contents of candidate is resolved using c-rater. C rates includes the steps like Model building, C Rater automatically processes, Maintaining algorithm gold map, Apply candidate answer.

Indus Marker [5] matching the structure of answer text in terms of predefined structure which is developed by structure editor which built for purpose. The teacher provides the essential structure of an answer in a simple purpose designed language. The language was originally named Question Answer Language (QAL) but later on it is renamed as a sublanguage of XML and called it Question Answer Markup Language (QAML)[5].

Raheel and Christopher [6] propose a system that provides a novel approach for automated marking of short answer questions. To compute the grade for the student's answer, authors introduce the architecture for the system that is composed of three phases to address the student's answer. Three phases are 1) spell checking and correction that is implemented by an Open Source spell checker like JOrtho.2) parsing the student's answer using the Stanford Parser. This statistical parser can be creating parses with high accuracy. The parser offers the following results which are the part of speech tagged text and design dependency grammatical relations among singular words. 3)The Third phase of the processing answer is a comparison between the tagged text with syntactical structures specified by authors in Question and Answer Language. This phase addressed by syntax analyzer. Also, architecture contains analyzer of



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grammatical relation that compares between the grammatical relations in student answer with the grammatical relations specified by the examiner. The last task in the comparison phase is passing the results summarized from the syntax analyzer and the grammatical relation analyzer to the marker that calculates the final grade of the answer.

The Automatic marking system for a student's answer examination of the short essay was introduced by Mohd et al. [7]. The system applied to sentences were written using the Malay language that requires technique to process it. The technique mentioned in [6] which is the syntactic annotation and the dependency group to represent the Grammatical Relations (GR) from Malay sentences. To process the sentences from the marking scheme and the students' answers, all entries to the Computational Linguistic System (CLS) for linguistic processing like tokenizing, recognizing, collocating and extracting the GRs. The system contains a database for a table of Malay words and their Part of Speech (POS) to assist the CLS. To compute the mark for the student's answer, compare the GR extracted from the students' answers with the GR for the marking scheme. In other words, comparison components of the sentences as follows: subject to the subject, verb to the verb, object to object and phrase. The authors did the test of the system to view how the system gives marks compared to the marks awarded by a human. They selected lecturers have experienced in marking the scheme from Malaysia to set the mark for each question. The test presents which the system can give similar marks as marks awarded by the lecturers.

A new automated assessment algorithm for assessing the Chinese subjective answers was proposed by Runhua et al. [8]. The algorithm called Automated Word and Sentence Scoring (AWSS) assesses the student answers for the level of word and sentence. From fundamental problems of the Chinese, Natural Language Processing is the word segmentation, but this problem solved by the Institute of Computing Technology, the Chinese Lexical Analysis System (ICTCLAS). It assesses the student's answer to the standard answer in two phases as follows: 1) compute similarities between two words depend on How-Net. In this phase, they check keywords weight and phenomena of the synonym. The authors' present results of How-Net is satisfied. To compute the similarity between student answer with the standard answer for the level of the sentence, the authors' divide sentence to a series of words. Then computing the best matching pair of every word in the sentence and computing the sentence similarity as functions mentioned in [8]. 2) compute the similarity of sentences depending on dependency structure among words of a sentence. This phase parses the sentence by the language technology platform (LTP) to find out the dependency structure of the sentence. The method of computing dependency structure is finding a valid pair which is a noun, verb or subjective linking to the head of the sentence. Then, computing the sentence similarity based on dependency structure as functions mentioned in [8].

Xia et al. [9] design automatic scoring algorithm for a subjective question. They use the idea of a one-way approach degree depending on the closeness theory of fuzzy mathematics. The authors are calculating the closeness of two fuzzy sets which are set "A" denoted by the standard answer string and set "B" denoted by the student answer string. A fuzzy set is an ordered collection from a single character that decomposed from a string. To compute a one-way approach degree between two fuzzy sets "A" and "B", "B" contain n characters and one-way approach degree denoted by $\delta(B, A) = m/n$ whereas m denotes by the effective sum number of the set B in each element in the set A. $\delta(B, A)$ introduce B close to A unidirectional closeness. The introductory algorithm provides the aim of the system.

Zhenming et al. [10] propose a novel web-based online objective examination system for computer science education. This system conducts the examination and auto-marking of objective questions and operating questions. The system transmits answers and questions into the bit stream after encoding to ensure security and intrusion. It is the password protected system and camera are used to monitor the activities of students. The auto-grading system can automatically grade the answers, that are collected from the examination system. The objective questions can be graded effectively via fuzzy matching. But operating questions is difficult to grade by simple Matching technologies. Thus, researchers propose a universalized grading system that is achieved on the foundation of a database for key knowledge. The system does the following: first, they elicit all likely knowledge points and store them in a triple form (key, value, location). Then they make the question file via labelling the question point directly on it. After that, the system will add the identical question key to the standard key library. The last process of the system is comparing the answer file with the standard key library.



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Literature Review

No.	Title Author and Year	Method Used	Gap Identified
1	Dharma Reddy et. Al. PYTHON TOOL FOR EVALUATION OF SUBJECTIVE ANSWERS (APTESA) Dharma Reddy et. Al. 2017	ApTeSa is a tool implemented for automated assessment of descriptive answers. ApTeSa uses a smart and efficient technique to analyze the answers.	Inbuilt functions has used for evaluation, it cant support for runtime user define parameter tuning.
2	Thomas N. T. et. Al. Automatic Answer Assessment in LMS using Latent Symantec Analysis 2015	LMS has implemented for generating the similarity score.	Pattern matching algorithm has used for generate similarity score, it generates false ratio sometime.
3	Meena K and Lawrance Raj Evaluation of the Descriptive type answers using Hyperspace Analog to Language and Self-organizing 2014	HAL algorithm has used for clustering.	System can't support multiple languages, and HAL applicable only for predefined answers.
4	C. Leacock and M. Chodorow C-Rater: Automated Scoring of Short-Answer Question 2003	c-rater map has used for content scoring and evaluation.	C-rater not support for different platforms, it works like homogeneous dataset.
5	Raheel Siddiqi et. Al. Improving Teaching and Learning through Automated Short-Answer Marking 2010	Question Answer Markup Language (QAML) has used for Question Answer Language	High time complexity.
6	R. Siddiqi and C. J. Harrison A systematic approach to the automated marking of short-answer questions 2008	NLP approach has used for feature extraction as well as selection and evaluation.	System work with semantic approach only not sentiment base approaches.
7	M. J. A. Aziz Automated Marking System for Short Answer examination (AMSSAE) 2009	NLP and Machine Learning has used	It works only short answers like 4-5 words answers with similarity techniques.
8	R. Li et. Al. A new algorithm to the automated assessment of the Chinese subjective answer 2013	Chinese linguistic compiler has used for evaluation	1: Provide support for only Chinese language. 2: It work only short text max 150 characters
9	X. Yaowen et. Al. The Design and Implementation of Subjective Questions Automatic Scoring Algorithm in Intelligent Tutoring System 2013	Semantic approach has used using supervised learning	Low accuracy and high time complexity for long answers.
10	Y. Zhenming et. Al. A novel web-based online examination system for computer science education 2013	Web base online assessment system used for subjective answer evaluation	Multiple classifiers has used should be generate collusion during the classification.



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III. DISCUSSION

The role of Artificial Neural Networks algorithm is normal answer comparison and stores marks for this in database. Here the answer will be evaluated only by normal comparison of text using the keywords. In this module compare student answer with correct answer. Each and every word of student answer is compared with correct answer. If student answer is match with correct answer increase scores are assigned using Artificial Neural Network (ANN) algorithm. After score assignment Final scores are divided by making summation of assigned scores of all words. Here we used two type of dataset for result analyzing process. One is correct answer dataset and another one dataset is keyword dataset for comparison method. These two dataset uploaded by staff. If answer is correct assume value 1 else value 0, Results was calculated based on comparisons in Two parts. In an existing system to evaluate the students performance NLP process is applied. In study we developed a tool to calculate the results using Natural Language Processing (NLP) and Artificial neural network (ANN) algorithms. The staff will create answer sheet for question sheet and keyword dataset set related to answer for the examination process. These dataset stored in data storage And student answer compare with correct answer using ANN algorithm, and student answer check out spelling mistake and grammatical mistake using NLP algorithm after complete text mining process automatically calculate result using NLP, ANN results.

IV. CONCLUSION

The techniques discussed and implemented in this project should have a high agreement with Human Performance. The project works with the same factors which an actual human being considers while evaluation such as length of the answer, presence of keywords, and context of key-words. Use of Natural Language Processing coupled with robust classification techniques, checks for not only keywords but also the question specific things. Students will have certain degree of freedom while writing the answer as the system checks for the presence of keywords, synonyms, right word context and coverage of all concepts. It is concluded that using ML techniques will give satisfactory results due to holistic evaluation. The accuracy of the evaluation can be increased by feeding it a huge and accurate training dataset. As the technicality of the subject matter changes different classifiers can be employed. Further improvement by taking feedback from all the stakeholders such as students and teachers can improve the system meticulously.

V. FUTURE WORK

To implement a work with deep learning as well as POS tagging was also performed while extraction of words for better accuracy using negation handling approach.

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