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Semantic Features for Automated Answer Scoring

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ABSTRACT

This study reviews the features used in the previous Automated Answer Scoring system, and attempts to develop a new semantic features for Automated Scoring System. Automated essay scoring is a measurement technology in which computers evaluate typed text. Measuring semantic similarity of sentences is closely related to semantic similarity between words. It makes a relationship between a word and the sentence through their meanings. Determining the similarity between sentences is one of the crucial tasks in natural language processing (NLP).

Keywords: Automated Essay Scoring(AES), Natural Language Processing(NLP).

I. INTRODUCTION

Automated Scoring receives an answer text as an input and outputs a score based upon various features of the text. The scoring is performed by extracting the grammatical relations as well as semantic relations from the student answer and reference answer.

II. NEED OF AUTOMATED SCORING

The system will assist teachers' classroom assessment and help to overcome time, cost, reliability, and generalizability issues in writing(typed) assessment. Responding manually to student papers is a burden for teachers. Particularly if they have number of students and if they assign frequent writing assessment, providing individual feedback the student essays might be time consuming. Automated system can be very useful because they can provide the student with a score as well as feedback within seconds. Gradually, the need of Automated answer scoring system is felt in the educational sector.

III. AES AND NLP

NLP have major tasks such as discourse analysis, morphological segmentation, parsing, word sense disambiguation and information extraction etc. Automated Scoring can choose some tasks from NLP for scoring process. Automated Scoring systems are a combination of various techniques such as – NLP (Natural Language Processing) along with, Statistics, Artificial Intelligence (Machine Learning), Linguistics and Web Technologies, etc. Today, Automated Scoring is still a difficult, intricate and interesting issue for researchers in artificial intelligence and natural language processing though many English Automated Scoring systems have been proposed and developed but with little success.

Current automatic essay-scoring techniques are inappropriate for scoring the content of an essay because they either rely on grammatical measures of quality or machine learning techniques, neither of which identifies statements of meaning (propositions) in the text.

The system to be developed is planned to follow two step process. The first step involves analysing the input answer so as to identify possible errors wiz spelling errors and syntactic errors. The second step compares the input answer with given answer essay to detect semantics and differences as errors. There after the output generated by the system is compared with the result given by human rater and in this way the performance of the system is evaluated. To estimate the accurate score generated from syntactic similarity to semantic similarity.

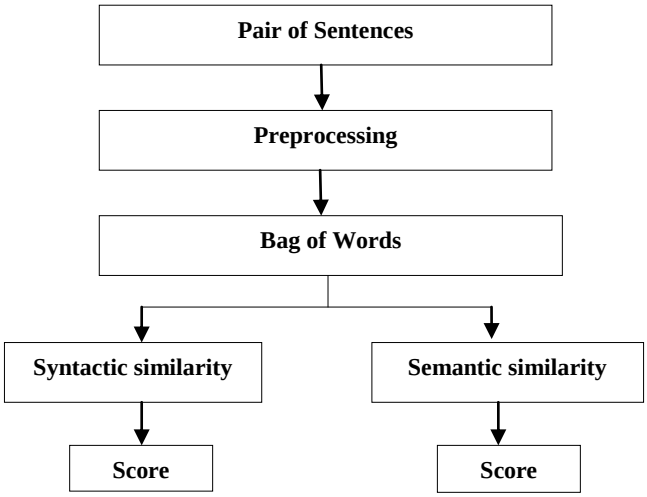

Fig 1: Features based Scoring

II. RELATED WORK

Latent Semantic Indexing Approach

Latent semantic analysis (LSA) is a technique in natural language processing that main focus is on the content related features rather than surface features. Latent semantic indexing is the application of a particular mathematical technique, called Singular Value Decomposition or SVD, to a word-by-document matrix. LSA assumes that words that are close in meaning will occur in similar pieces of text. Especially semantic structures can be considered problematic for machines. Latent Semantic Analysis (LSA) is an attempt to solve problem in the domain of information retrieval and can be seen as general attempt for representing semantic structure.

Xinming Hu, Huosong Xia(2010), discussed Automated Assessment System for Subjective Questions Based on LSI. In this paper they explore an approach to automated assessment system for subjective question based on latent semantic indexing. Specifically, LSI is a statistical method that analyzes and represents important associative patterns among terms. In our automated assessment system, LSI is used for reducing influence of synonymy and polysemy on the impartiality of the assessment result. While the experiment shows that the theoretical architecture and are generally applicable for the automated assessment for short essay questions.

Govinnage R. Perera, Deenuka N. Perera, A. R. Weerasinghe(2015), "A Dynamic Semantic Space Modelling Approach for Short Essay Grading". On most of other LSA based systems, it is required to feed the system with the pre-marked training essays. Those training data set is considered as the semantic space and each student answer essay is considered as a similarity query in order to calculate the score. In this proposed method, Student answers collectively themselves considered as a semantic space and similarity was calculated against the deviation from the model answer. Thus, it is considered as a dynamic semantic space. This dynamic semantic space was computed using Vector Space Models (i.e. LSA) and it was dynamically built upon each essay question set utilizing student answers. The future direction of this research is to extend this research for handling different languages other than English and to evaluate the system with a large data set.

Pantulkar Sravanthi, B Srinivasu(2017), explains "SEMANTIC SIMILARITY BETWEEN SENTENCES". In this, they evaluated and tested three different semantic similarity approaches like cosine similarity, path based approach, and feature based approach. They propose an unsupervised approach to automatically calculate sentence levels similarities based on word level similarities, without using any external knowledge.

III. SEMANTIC FEATURES

Semantic features are indispensable while scoring because they holds whole content(meaning) of student's answer. The system returns zero as final score if it does not find any semantic features even if syntactic features are available. No doubt, there are many existing predefined semantic features or rules. But this makes scoring a complex task, and at the same time proper integration and correlation among these features are not fully possible and thereby giving inaccurate results. The following semantic rules have been incorporate with automated scoring system:

Word POS

Word bigram and trigram

POS bigram and trigram

Word Vector similarity

Semantic Vector similarity

Text coherence

The following example sentence contains five syntactic constituents labeled with their corresponding semantic role. This type of semantic rules evaluates meaning of the text which are associated with our approach(Xinming et al,2010).

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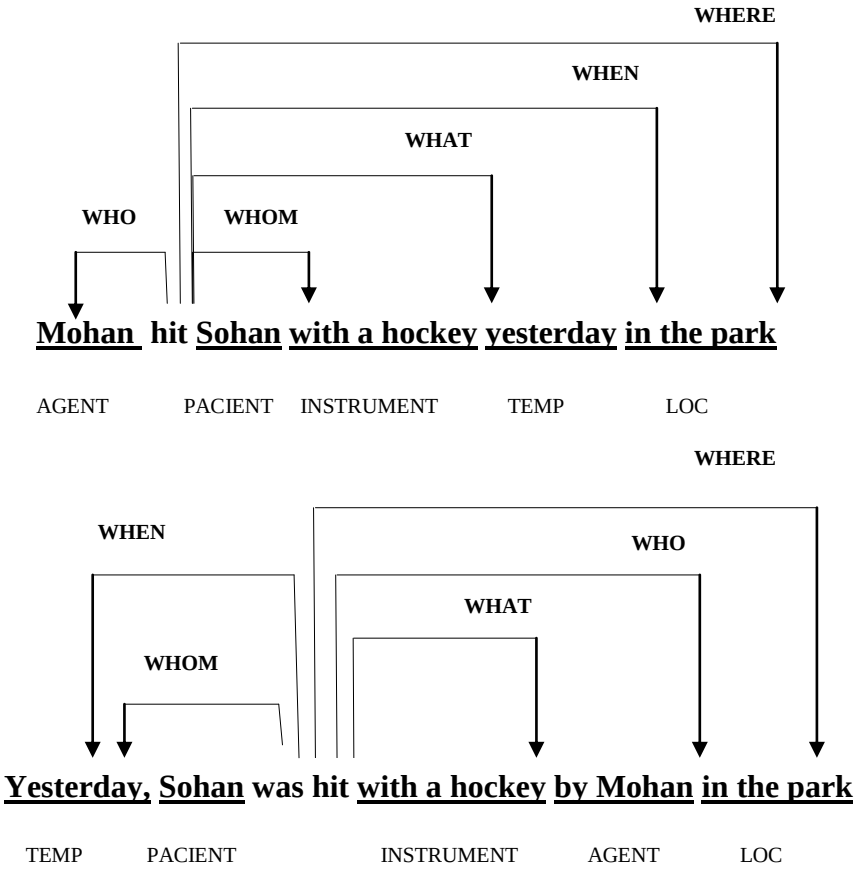

Fig 2: Application of Semantic rules

The semantic features points will calculate To compute the similarity we follow feature based approach which generates the similarity score in depth of word meaning level and definition level and then comparing the generated results with the previous existing measures for better results.

the final score of student answer. The surface or syntactic features are analyzing the input answer in order to detect possible errors, such as spelling errors and syntactic errors. The semantic features are comparing the student input answer with given reference answers to identify the semantics, and differences as errors. So, the semantic features are essential while scoring because it holds whole content(meaning) of student answer.

III. CONCLUSION

Automated system can be very useful because they can provide the student with a score as well as feedback within seconds. The Automated Scoring system is more objective and consistent than human raters. Automated Scoring will perform fair scoring, can be repeated again and again with consistency. The semantic features are essential while scoring because it holds whole content(meaning) of student answer. The research in this direction will open new dimensions for researchers as it is an interdisciplinary work. If such a system be developed for any Indian language, it will open the doors for other similar Indian languages.

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