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Semantic Analysis and Evaluation of Subjective Passage

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Abstract:

Automation of descriptive answer evaluation process would be helpful for various universities and academic institute to efficiently handle the assessment of exam answer sheets of students. An automatic answer checker application that checks and remarks written answer similar to human being. The purpose of this system is to automate the old fashioned manual system and introduce automatic evaluation of marks in much faster and accurate way. The system requires you to store original answer (i.e. sample answer paper) for the system to perform semantic analysis. By representing the descriptive answer in the form of paragraph and comparing it with standard answer are the key steps in our approach. The similarity obtained from semantic analysis is then normalized to obtain the final resultant score of answer.

Keywords — **Computer Assisted Assessment , Natural Language Processing , Keyword Analysis, Semantic Matching.**

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I. INTRODUCTION

The idea of using computers to assist learning process has surprisingly changed the field of learning system. The study in the field of CAA started nearly in 70's. The CAA systems developed so far are capable of evaluating only essay and short text answers such as multiple choice questions, short answer, selection/association, hot spot and visual identification. [1] Most researchers in this field agree on the notion that some aspects of complex achievement are complicated to measure using objective type questions. [4] one has to find out the degree of learning of a student by conducting so me written test of specific pattern which may include descriptive/objective questions or through some practical examination and evaluating it to find the degree of learning. Evaluation of objective answer is comparatively easy and well supported in many systems but, in the case of descriptive answer, it is an open problem. Evaluation work is very cumbersome as far as descriptive answer is concerned. So, how to automate this task? Our objective is to design an algorithm for the automation of evaluation process of descriptive answer. [2] Motivation behind automation of descriptive answer evaluation includes fast processing, less manpower, independent of change in psychology of human evaluator, ease in record keeping and extraction.

II. RELATED WORK

[4] Many architectures and features have been proposed for descriptive answer evaluation. The approaches are mainly based on keyword match, sequence match and quantitative analysis , but semantic analysis of descriptive answer is still an open challenge.[3] Considering the structure of text analysis in natural language processing, most of the work has been done for morphological and

syntactic analysis but semantic, pragmatic and discourse are still being explored.

III. SYSTEM ARCHITECHTURE

The system architecture is divided into 2 different modules as shown in Fig 1. Purpose of student module is to collect and store the answers written by the students into the database for future evaluation process. Before admin module starts the evaluation of answers submitted by students the processing module processes the answers. [5] Every record that is fed into our system is expected to have the student answer, a model answer, the question, and the maximum marks

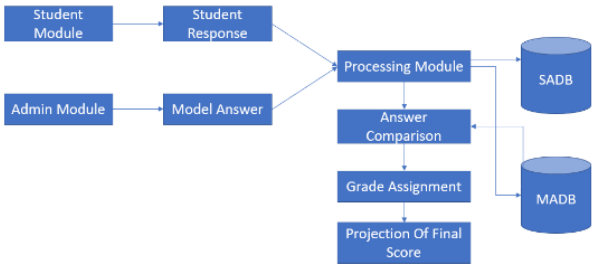

Fig. 1 System Architecture

The final grade assignment is done in the evaluation module by using different Algorithms like Cosine similarity, API based semantic similarity. The MADB(Model Answer Database) database is used for storing and retrieval of model answer paper were as, the SADB(Student Answer Database) database is used to store and retrieve student answer submitted to student module.

IV. METHODOLOGY

A. Mathematical Model

System Description:

Let S be the set for Semantic Analysis and Evaluation of Subjective Passage where,

S = (s , e , I , O , f ,d , n , su , fa)

Start:

s = Start state

End:

e = End state

Input:

I set of inputs I= {mo , sa , max_m , min_m}

mo = Model Answer

sa = Student Answer

max_m = Maximum Marks

min_m = Minimum Marks

Output:

O set of outputs O={nm , res }

nm=Normalized Marks

res= Result of student (pass , fail)

Function:

f = set of functions

f = {f1 , f2 , f3 , f4 , f5 , f6 }

f1() = Production_Rule_Generation()

f2() = Semantic_Analyzer()

f3() = Lexical_Analyzer()

f4() = Syntactic_Analyzer()

f5() = POS_Generation()

f6() = Pragmatic_Analysis()

Deterministic State:

d = Deterministic State

d = {Production rule created, normalized marks}

Non-Deterministic State:

n = Non-Deterministic State

n = {False production rules, incorrect normalization}

Success Condition:

su = Success

su = {Correct Evaluation , Correct rule generation , Normalized marks}

Failure Condition:

fa = Failure

fa = {Incorrect Evaluation , Incorrect rule generation , Incorrect Normalized marks }

B. Cosine Similarity

[5] The equation for this baseline is:

$$cosinesim(s1, s2) = dot(v1, v2)/(|v1| * |v2|)$$

where, v1 is the one-hot encoded vector form of s1 and v2 of s2, dot performs a dot product operation on the vectors passed, and |vi| is the length of vi.

C. API- ParallelDots

Semantic Text API finds similar documents corresponding to an input document . Sematic text API consists of five different phases as discussed below:

- Adding a corpus of documents for indexing
- Training a model to compute similarity
- Predicting similar documents for a new document
- Updating the similarity model with new documents
- See all information related to model like number of documents trained and untrained.

V. OPERATIONAL DETAILS

This section contains the operational details of every module which is an important part of the system and the module that represents the target feature specified in the System Requirements.

Module 1: Student Module

1.1 student Login/ Sign up

This module is specially design for student. Students have to first sign up to the system using this module. This sign up module will help user to generate new user name(PRN no.)and user will also create new password which gets submitted into the database by using the submit button given below but If user is already register then system will show an alert message that user is already registered. After this login module appears to users when portal direct entry is on.

1.2 Student Answer Input Module

The first thing student do with this module is that they provide there PRN NO. so that the of that specific student information gets retrieved. After that student is involve in typing the answers as per the questions given.

Module 2: Admin Module

2.1 Admin Login

This module is specially design for admin. Admin have to login to the system using this module. Admin is logged into the system where he can make multiple choices of functionality provided by the system. The admin login is pre-fetched in the system and no signup is given for Admin Panel. After this admin is given a choice of either uploading model answer sheet in MADB or retrieving student stored answer sheets and evaluating them.

2.2 Model Answer Uploading

This is a major function of system, where a model answer designed by the teacher can be directly fetched into MADB database, for future processing requirement. Only Admin has the authorization to verify and Upload Model Answer Sheets.

2.3 Student Answer Evaluation Model

In this module, the admin searches for students answer sheets w.r.t their PRN number and evaluate them on system, and generate results. This module also gives the liberty to select the methodology of evaluation to the admin.

VI. RESULTS AND DISCUSSIONS

In the given below graph we can see that how our system evaluate marks with respect to API, Cosine similarity and marks are assigned to student. After that marks get normalized and this normalized marks gets compared with manual checking i.e. teacher evaluation. So here we can see the fair evaluation by our system.

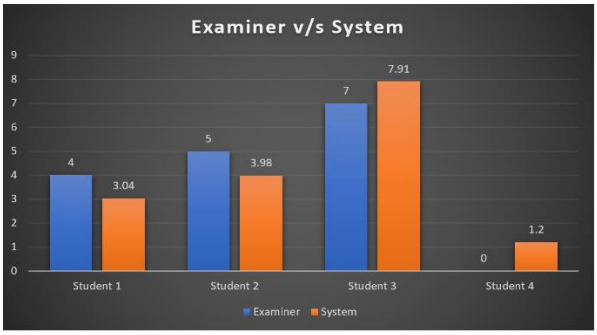

Fig. 2 Examiner v/s System

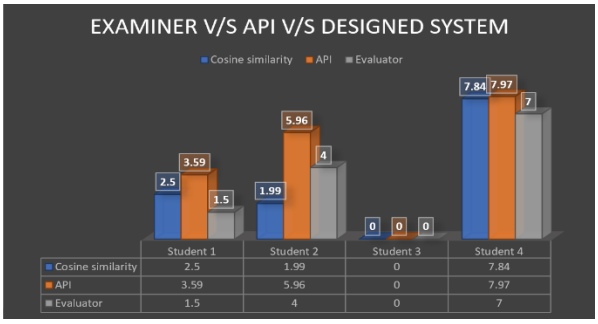

Fig. 3 Examiner v/s System

VII. CONCLUSIONS

The Automatic evaluation of descriptive answer would be beneficial for the universities, schools and colleges for academic so the system which are proposed are providing ease to faculties and the examination evaluation cell. Also it provides accuracy and biased result. Evaluation of marks is carried out with the help of various methods which gives efficient result. So accurate assessment of marks will be given to student.

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