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Assessment Of Descriptive Answers in Moodle-based E-learning using Winnowing Algorithm

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Abstract: Assessment in education allows for obtaining, organizing, and presenting information about how much and how well the student is learning. An automatic evaluation tool is proposed that allows the assessor to evaluate descriptive answer at any time and receive instant feedback of the students. Due to the lack of descriptive answer grading in Moodle-based E-learning system, there is a need to build a model and also add this feature as a plug-in for the E-learning system .Up until today, most assessors still choose to examine descriptive document manually for each student document. This method takes time where assessor needs to be focused and thorough while examining a number of descriptive documents. This reason often affects essay examinations to be less objective and not optimal. To improve objectivity, time efficiency and fair correction in descriptive answers assessment process, a system is needed that can automatically assess student documents, or in other words a descriptive answer evaluating system. An evaluation of descriptive answer system, works by analysing student answer document with model answer document. The higher the semantic similarity, the higher the score obtained.The purpose of this paper is to check the similarity between the teacher's answer and the student's answer using Winnowing algorithm. Winnowing algorithm is one of the document fingerprinting algorithms that can be used to detect document similarity by using hashing technique. The fingerprint document itself is a method used to detect document similarities with other documents. The Winnowing algorithm has fulfilled one of the requirements of the plagiarism algorithm, which is whitespace insensitivity, disposing of irrelevant characters such as punctuation. The similarity value is calculated using Jaccard Coefficient. Later this assessment is used for grading the student's performance.

Keywords: Moodle-based E-learning system, Winnowing Algorithm

I. INTRODUCTION

Evaluation and Grading perform a main task in the educational method. Analysis of pupil functionality is crucial as that would help the educators comprehend the degree of each student. It's important to review the amount of understanding that has been soaked up by the trainee. For this, one needs to find out the level of discovering of a student through performing some composed test of details pattern which may feature detailed or even unprejudiced inquiries or even with some functional examination and also analyzing it to locate the level of discovering. After the exam, the instructors spend the majority of their opportunity for analyzing the signs of the trainees and also the examination gets majority consumption of individual attempt, opportunity and also expense. An automatic assessment analysis system can lower the initiatives in the course of the assessment. Lots of architectures and attributes have been recommended for detailed response assessment. The strategies are mostly based upon keyword match, sequence match, but semantic analysis of detailed response is still an open problem.

Online resources that sustain managing of on the internet evaluations such as Moodle and also Zoho are based on strand matching method for short answers however lengthy solution examination is still handled personally by most units.

The assessment of detailed responses is still a concern. A major problem among the existing bodies is their effectiveness. The issue related to the assessment of individual solutions is that each trainee has his/her means of answering and it is complicated to find out the level of correctness. The majority of extensively used AES devices are Project Essay Grader (PEG), Smart Essay Surveyor (IEA), E-rater, IntelliMetric and also Bayesian Essay Test Scoring System (BETSY).

The necessity in the growth of Computer-based Examination Units (CAS) has increased significantly in the final handful of years, due to both the boost of the number of pupils joining educational institutions and to the options supplied by e-learning techniques to asynchronous and also common education and learning.

Automated essay certifying or even composing bodies are certainly not, even more, a misconception they are the truth. As of today, the individual created (certainly not palm composed) essays are dealt with certainly not merely through inspectors/ educators additionally through devices. The TOEFL exam is among the most effective instances of the treatment.

Moodle is free of cost available resource platform, Understanding Control System utilized by different educational institutions across the planet. Moodle represents Mobile Object-Oriented Dynamic Learning Environment. It possesses a lot of attributes like job collection, converses, questions, discussions, and so on. It makes use of PHP shows language and also data sources that operate on different internet servers. Moodle is a knowing platform made to supply teachers, managers and also learners along with a security system to create a learning setting.

In the proposed system the automatic certifying of detailed solutions is attained with the help of the Winnowing Algorithm. This algorithm is also used to detect the counterfeiting of records. It is just one of the file fingerprinting algorithm that may be used to discover file resemblance by using the hashing procedure. The hashing strategy made use of is this research study job is the SHA1. The similarity value is worked out making use of Jaccard Coefficient. Later this evaluation is used for classing trainee's efficiency.

II. LITERATURE SURVEY

Attali Y. and likewise Burstein. J (2019) [1], proposed an E-Rater for composing of arrangements. The Educational Assessment Company's Digital Make-up Rater (e-rater) utilizes syntactic assortment, discourse framework and likewise relevant information study. To assess syntactic array, e-rater looks at a lot of infinitives, juniors, provisions and likewise bears in mind the incidents of modal action-words to calculate percentages of these grammatic components every paragraph and per structure. E-rater utilizes 60 several features for building evaluation. The more recent variant of e-rater uses a preset set of about 10 elements in 7 groups where it obtains the utmost ranking. The function set utilized alongside e-rater V. 2 features procedures of sentence structure, utilization, experts, type, company, advancement, lexical trouble, as well as likewise prompt-specific lexicon use. Rankings relied on every one of the characteristics are blended in addition to a regression formula to maximize the foresight of personal credit rankings. E-Rater is made use of in rating essays in GRE and also TOEFL examinations. The specification of e-rater and also private rankings are looked at as classing essays. If there is an alternative of 0.5-1.5 in scores made using the person along with E-Rater afterwards the 2nd individual rating is similarly taken as well as additionally the standard of 3 scores is taken into consideration approving. E-Rater gives added actions concerning premiums of writing related to the topic as well as a resource just.

Problems:

It concentrates on attributes such as Phrase structure, lexicon, leading to mistakes, tired words and so forth. But not on the semantic importance of the paper. Likewise requires individual help in classing expositions.

E-Rater is far more complex and needs much more instruction than several other offered devices.

No on the internet show and also no downloadable trial style of E-Rater have been offered to the clinical place.

Amit Rokade, Bhushan Patil, Sana Rajani, Surabhi Revandkar, Rajashree Shedge (2018) [2], recommended a solution for accrediting of concept documents, which makes use of Natural Language Processing (NLP), Semantic Analysis as well as Ontology. This system takes the pupil option as input as well as contrasts it with the right reaction originating from the data banking company. The option is compared with the help of keyword words, basic synonyms as well a word substitute tool of the word. Unexposed Semantic Customer Review(LSA) technique is utilized for setting up the semantic relationship in between expressions along with significance monitoring for allowing scores based upon the know-how as well as trainee's guideline quality along with certainly not merely via keyword fits. Ontology is taken advantage of for applying keywords based on the facts offered in the data bank.

Potential task:

Utilizing this system as well as enhancing it furthermore, a system for correcting algebraic responses, procedures, flowcharts etc may be cultivated.

Drawback:

LSA over grades remedies that has a repetitive wide array of essential expressions.

Praful Mishra, Anmol Mishra, Aniket Bharati, Prof. Serta Ambadekar (2018) [3], proposed a construct including 3 blocks such as an analytical style Unexposed Semantic Evaluation(LSA), Bilingual Evaluation Understudy(BLEU), Word Representative Closeness(WMD) and also Fuzzy thinking, a design based upon the degree of fact to result in scores. LSA identifies the semantic connection between pair of concepts. The problem with LSA is actually that it over grades remedy that has a repetitive lot of key phrases and also it carries out dismiss terms investment. These drawbacks relapse taking advantage of BLEU. BLEU is taken advantage of to

evaluate the analysis distance in between a student analysis as well as a collection of model translations in addition to an algebraic dimension. WMD makes use of angle encoding of phrases to figure out the lowest enhancing range that phrases arising from a recommendation option need to travel to match key phrases stemming from a student option. Ballgame provided using LSA, BLEU along WMD are given as input to the blurred thinking to generate the outcome.

Downside:
WMD carries out not follow word order.
Sijimol P J, Surekha Mariam Varghese (2018) [4], popped the question a design to immediately review the short answers in the translated documents. Within this system, there are 3 components. The first component is the checking duration. Ocr Device (Optical Character Recognition) gadgets are made use of to remove the paragraphs in reactions as well as are changed to text files. Secondly is the preprocessing stage which requires phrase structure examination, tokenization, quit phrase elimination, essential synonym and likewise antonym inspect along with control. The third is the analysis and likewise rating phase. During instruction, a model is produced based upon racked up answers as well as much higher weightage offered action technique. These are exchanged slants based on TF-IDF as well as likewise the cosine correlation is computed in between words angle in ballgame response and likewise key phrase slant in the tip. The screening involves racking up unscored responses based upon the data in the skilled version. The unscored reactions are swapped the TF-IDF angles as well as also cosine resemblance is done based upon the skilful design.

Potential work:
The potential variation is actually that our firm can quickly reduce the evaluation opportunity using offering hashing systems into this system and also growing the system for diagram evaluations.
Mitchell, T. Russell, P.Broomhead, N. Aldridge (2017) [5] considered Automark strategy for certifying in-depth answers. Automark uses NLP techniques to perform an intelligent search of free-text reviews for electronic mark system solutions. The system takes advantage of a spot strategy that reveals satisfying as well as an improper explanation for each problem. The system embodies result strategy reactions as syntactic-semantic design themes. Each format indicates one particular form of appropriate or unacceptable solution. The template might be assumed to match a pupil activity if the response has among the revealed nouns as its very own client; is composed of several of the said action-words as well as prepositions. Development of the design in the digital indication set up is an offline method. In this particular system, to begin with, the input text message is pre-processed. Paragraph Analyser figures out the major grammatical factors of text message and also how they relate. Concept Matching factor hunt for suits in between the outcome program style layouts in addition to the grammatic constituents of the pupil text message. The outcome of the style match is refined by the responses component. Remarks are usually such as signs.
Gregory K.W.K. Chung, Harold F. O'Neil, (1997) [6] looked at PEG. Project Essay Top Quality(PEG) was developed through Ellis Webpage which makes use of "trains" and also "substitutes" for racking up of essays. Trains are the intrinsic variables featuring diction, resource, punctuation, sentence structure, a stretch of essay, regular paragraph stretch etc. Stand-ins are the activity of these innate variables. The system contains an instruction as well as a scoring stage. In the first stage, PEG is educated on an example of essays. In the second phase, substitutes are computed for every essay and additionally this info is joined the many regression formulae, with personal unpredictable as the replacement action and the reliant variable is the human-rated essay credit rating. The weights acquired within this period are utilized in the list below measure. For the remaining to be essays, variables are examined as well as take part in the foresight equation taking advantage of the beta body weights from the previous activity. Foreseen credit rating scores are afterwards connected with the essays scores handed over by individual scores. PEG has a restriction of dismissing the semantics of the essay along with concentrates extra externally structure.
Raheel Siddiqi, Christopher J. Harrison, along with Rosheena Siddiqi, [7] advised Indus Pen, an automatic short answer representing the system. This system is based upon "platform matching", which is matching a prespecified framework together with the trainee's action text message. The prespecified construct is cultivated using a purpose-built design editor. The manager indicates the call for the platform of an answer in a basic purpose-designed language, which is mobile phoned as QAL, yet eventually, it was actually redefined as a sublanguage of XML and also called it as Issue Response Profit Language. It is viable that a pupil might use fundamental synonyms of words to be taken advantage of. Therefore, WordNet 2.1 API is utilized within this system. WordNet 2.1 offers fundamental words of keywords to the Indus-Marker Algorithm. Indus Marker additionally offers quick responses to the students no matter their dimension.
Md. Monjurul Islam, A. S. M. Latiful Hoque, [8] cultivated an AEG system using Generalized Hidden Semantic Study, which produces n-gram with records resource instead of phrase by document source. The system performs a function in 2 steps: the era of the instruction essay collection and also the evaluation of newly delivered essays utilizing the direction collection. In the preliminary stage, the essays are classed by more than

one individual specialists. After pre-processing of classed essays, an n-gram by report resource is created. Every line of the source stands for an n-gram in addition to every cavalcade collaborates with a training document. Every mobile of the source holds the frequency market price of the n-gram representing its very own row-index in the instruction information that represents its row sign. Then the SVD of n-gram through paper resource is calculated. The measurements of SVD matrices are decreased. The training angle along with human grades of pre-graded essays create the direction collection. In the second activity, a query vector of new delivered essays is additionally made. The similarity between the training along with concern vectors is calculated by cosine correlation. GLSA does away with the drawback of LSA. Terms through report matrix development of LSA does dismiss term series in a record. As an example, in LSA words specifies "concurrent transactions" as well as also "deals synchronous" are considered as similar. GLSA eliminates this difficulty by checking out n-gram as the atomic gadget of the documents rather than a personal word. Thereby currently, "concurrent transactions" is undoubtedly not recognized like "transactions concurrent".

III. WINNOWING ALGORITHM

Winnowing Algorithm is likewise made use of to recognize counterfeiting of records. It is just one of the paper fingerprinting algorithm that may be utilized to identify document correlation by using the hashing procedure.
The hashing strategy used in this research study work is the SHA1 Hash. The resemblance worth is figured out using Jaccard Coefficient. Eventually, this evaluation is made use of for grading student's performance.
The Winnowing algorithm has satisfied the demands of the counterfeiting algorithm, which is whitespace ignorance, getting rid of unimportant characters including spelling.
The algorithm decides on fingerprints for every record and also reviews them.
The following two buildings ought to be satisfied offered a collection of files that are actually to be contrasted:

1. A match is detected only if the length of the match is at least as long as the guarantee threshold t.
2. Any matches shorter than the noise threshold k are not detected. The constants t and k are chosen by the user, where $k \leq t$.

Input : a sequence of hashes h1,.....,hn that represents a document, and two parameters k<= t.
Let the window size be w = t - k -1
Each position 1 <= i <= n-w + 1 defines a window of hashes hi,.....,hi+w-1
In each window select the minimum hash value. If there is more than one hash with the minimum value, select the rightmost occurrence
-The selected hashes are the fingerprints of the document

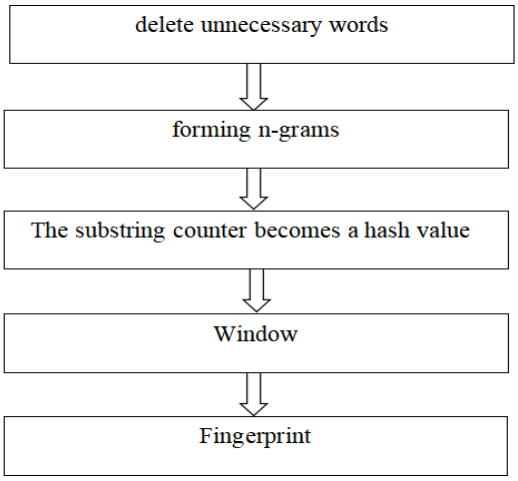

Fig.1: The Concept Of Winnowing Algorithm

The algorithm selects fingerprints for each document and compares them.
The following two properties should be satisfied given a set of documents that are to be compared:

1. A match is detected only if the length of the match is at least as long as the guarantee threshold t.
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-The selected hashes are the fingerprints of the document

IV. IMPLEMENTATION

This chapter describes the software and Modules implemented in this project.

Modules

1. Teacher – moodle interaction module
2. Student – moodle interaction module
3. Evaluation of grade module

1). Teacher – moodle interaction module :

(a). Creation of a quiz
(b). Adding questions in the quiz
(c). Teacher has to upload a model answer

2). Student – moodle interaction module :

(a). Students attempts the quiz and submit their answers

3). Evaluation of grades module :

(a). Importing of Student's and Teacher's answers from moodle
(b). Preprocessing
(c). Hashing
(d). Fingerprint generation
(e). Comparison of Fingerprints of both the documents
(f). Apply similarity metric on the fingerprints to calculate the similarity between the documents
(g). The score is used for grading the answers
(h). These grades are made available on the moodle and get updated in the Teacher's database

V. RESULTS AND ANALYSIS

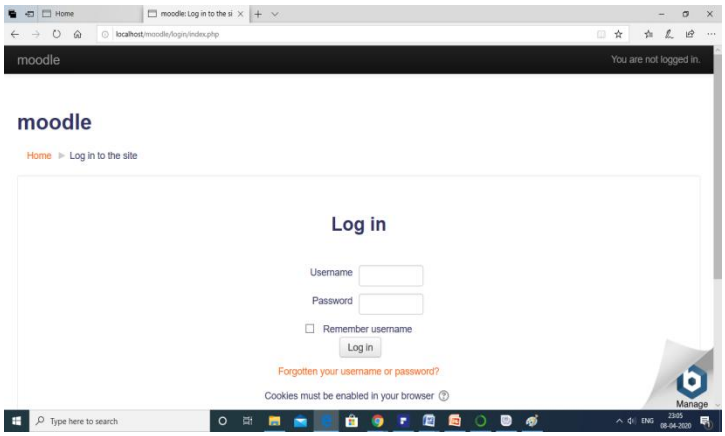


Fig.2: Installation of Moodle

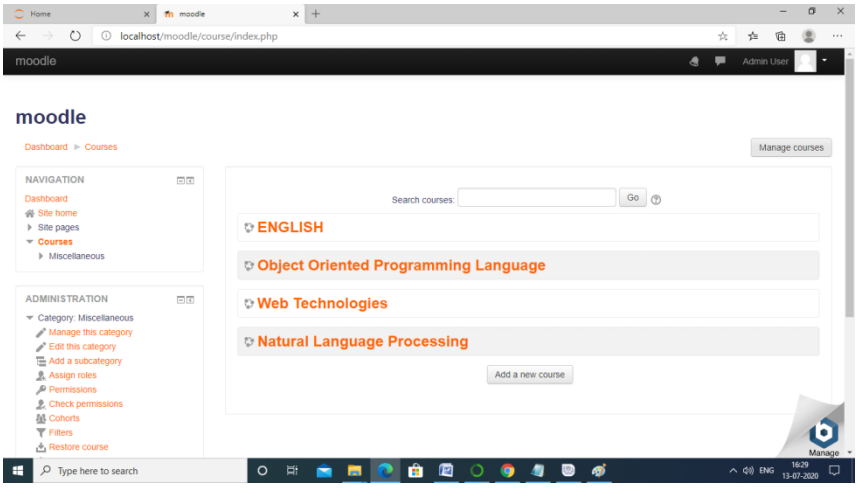


Fig.3: Creation of courses

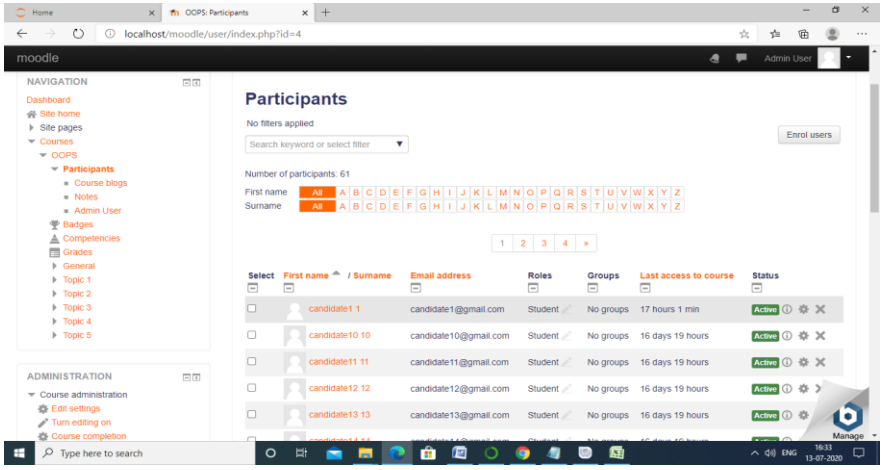


Fig.4: Enrollment of students into the course

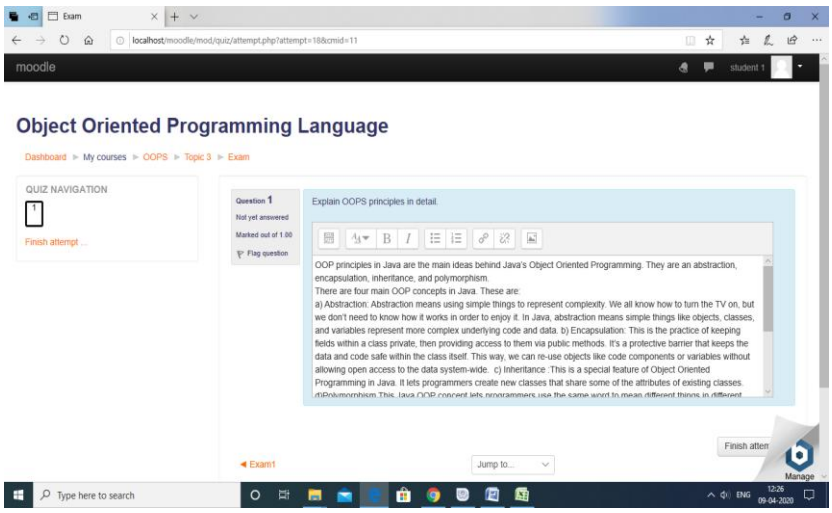
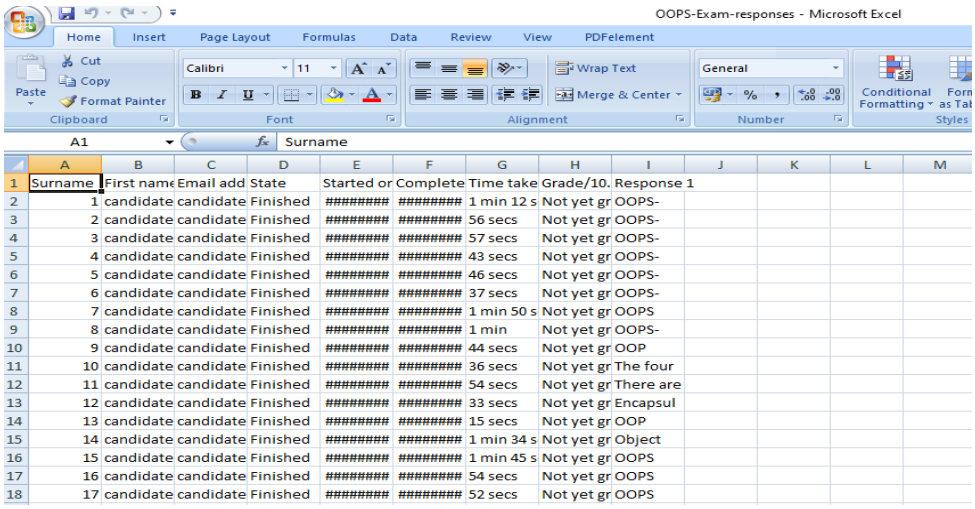


Fig.5: Creation of quiz in the Moodle



OOPS-Exam-responses - Microsoft Excel

	Surname	First name	Email add	State	Started on	Complete	Time take	Grade/10.	Response 1
2	1	candidate	candidate	Finished	########	########	1 min 12 s	Not yet gr	OOPS-
3	2	candidate	candidate	Finished	########	########	56 secs	Not yet gr	OOPS-
4	3	candidate	candidate	Finished	########	########	57 secs	Not yet gr	OOPS-
5	4	candidate	candidate	Finished	########	########	43 secs	Not yet gr	OOPS-
6	5	candidate	candidate	Finished	########	########	46 secs	Not yet gr	OOPS-
7	6	candidate	candidate	Finished	########	########	37 secs	Not yet gr	OOPS-
8	7	candidate	candidate	Finished	########	########	1 min 50 s	Not yet gr	OOPS
9	8	candidate	candidate	Finished	########	########	1 min	Not yet gr	OOPS-
10	9	candidate	candidate	Finished	########	########	44 secs	Not yet gr	OOP
11	10	candidate	candidate	Finished	########	########	36 secs	Not yet gr	The four
12	11	candidate	candidate	Finished	########	########	54 secs	Not yet gr	There are
13	12	candidate	candidate	Finished	########	########	33 secs	Not yet gr	Encapsul
14	13	candidate	candidate	Finished	########	########	15 secs	Not yet gr	OOP
15	14	candidate	candidate	Finished	########	########	1 min 34 s	Not yet gr	Object
16	15	candidate	candidate	Finished	########	########	1 min 45 s	Not yet gr	OOPS
17	16	candidate	candidate	Finished	########	########	54 secs	Not yet gr	OOPS
18	17	candidate	candidate	Finished	########	########	52 secs	Not yet gr	OOPS

Fig.6: Retrieval of student's answer from the Moodle

```
    answer_fingerprints = []
    ans = winnow(j)
    for j in range(len(ans)):
      answer_fingerprints.append(ans[j][1])
    ans = 0
    for i in range(len(answer_fingerprints)):
      if len(str(answer_fingerprints[i])) >= 3:
        ans = int(answer_fingerprints[i]/100)
        answer_fingerprints[i] = ans * 100
    intersection = 0
    for i in range(len(answer_fingerprints)):
      if(answer_fingerprints[i] in question_fingerprints):
        intersection += 1
    jaccardcoeff_score = (intersection) * 2/(len(question_fingerprints) + len(answer_fingerprints))
    essay_score = jaccardcoeff_score * 12
    #print("ID",l,int(essay_score))
    essay_score = int(essay_score)
    if(essay_score == (model_answer[l]) or essay_score+1 == (model_answer[l])):
      accuracy += 1
    l += 1
print((accuracy * 100)/1000)
```

```
74.0
```

Fig.7: Accuracy obtained

Analysis

Table 1: k-gram ,window size and accuracy

k-gram	Window size	Accuracy
1	2	3.9
1	4	4.1
1	8	3.8
1	12	3.7
2	2	8.5
2	4	13.8
2	8	18.8
2	12	21.9
3	2	35.2
3	4	67.8
3	8	68.4
3	12	66.0
4	2	61.6
4	4	69.3
4	8	68.6
4	12	55.8
5	2	56.5

5	4	71.3
5	8	69.4
5	12	71.8
6	2	41.3
6	4	66.9
6	8	74.0
6	12	71.5
7	2	45.5
7	4	66.7
7	8	72.5
7	12	70.2
8	2	39.2
8	4	62.9
8	8	69.4
8	12	64.4
9	2	54.0
9	4	67.9
9	8	72.1
9	12	70.5
10	2	40.8
10	4	68.7
k-gram	Window size	Accuracy
10	8	69.7
10	12	69.3
11	2	52.3
11	4	71.7
11	8	70.6
11	12	67.8
12	2	39.7
12	4	64.2
12	8	68.6
12	12	70.4
13	2	49.2
13	4	69.1
13	8	70.6
13	12	66.4
14	2	49.0
14	4	72.8
14	8	72.8
14	12	70.3
15	2	39.5
15	4	70.1
15	8	71.8
15	12	67.8
16	2	40.4
16	4	65.4
16	8	68.3
16	12	69.2

17	2	38.2
17	4	57.1
17	8	64.8
17	12	67.5
18	2	52.1
18	4	72.4
18	8	70.1
18	12	63.3
19	2	36.6
19	4	59.6
19	8	65.7
19	12	70.1
20	2	48.3
20	4	70.7
20	8	70.8
20	12	69.5
25	2	35.7
25	4	66.9
k-gram	Window size	Accuracy
25	8	70.8
25	12	69.9
30	2	45.6
30	4	70.3
30	8	69.2
30	12	67.7
35	2	40.8
35	4	71.4
35	8	69.5
35	12	71.5

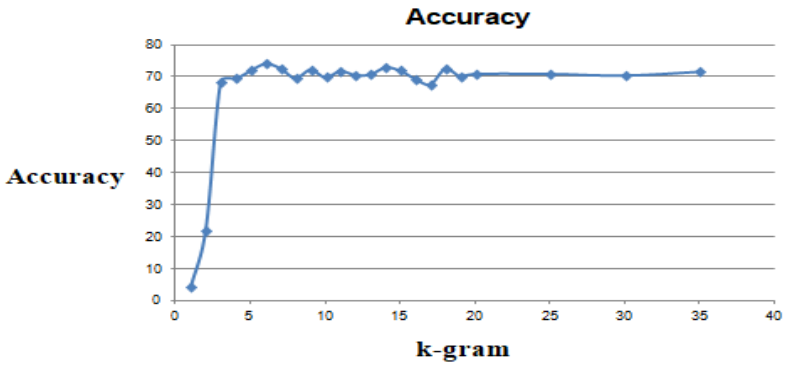


Fig.8: k-gram vs accuracy

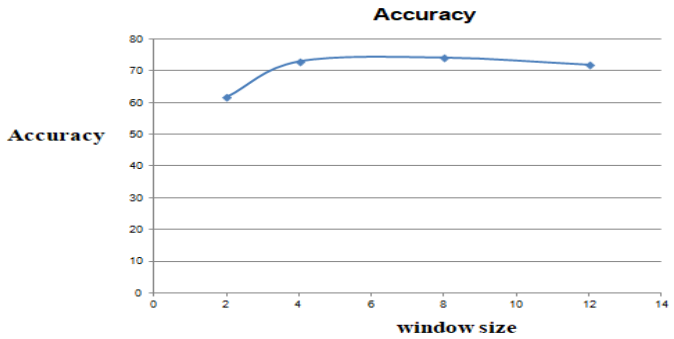


Fig.9: window size vs accuracy

Table 2: Accuracy values

Essay id	Accuracy
1	74.0
2	72.0
3	58.86
4	78.31
5	45.20

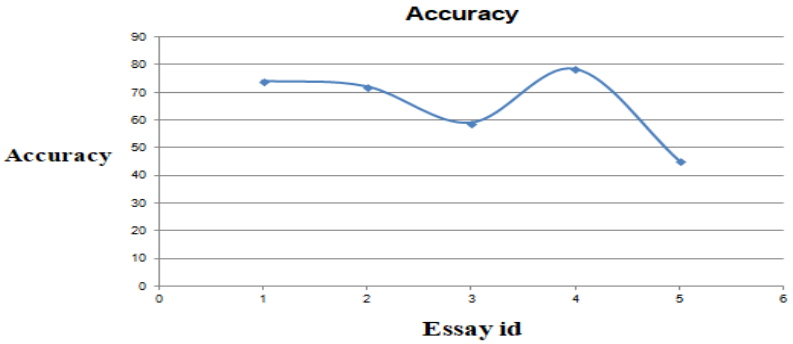


Fig.10: essays accuracy

Table 3: List of essays

Essay id	Essay Title	No of essays	Accuracy
1	Write a letter to your local newspaper in which you state your opinion on the effects computers have on people. Persuade the readers to agree with you.	1000	74.0
2	Write a persuasive essay to a newspaper reflecting your vies on censorship in libraries. Do you believe that certain materials, such as books, music, movies, magazines, etc., should be removed from the shelves if they are found offensive? Support your position with convincing arguments from your own experience, observations, and/or reading.	1800	72.0
3	Write a response that explains how the features of the setting affect the cyclist. In your response, include examples from the essay that support your conclusion.	1726	58.86
4	Read the last paragraph of the story. "When they come back, Saeng vowed silently to herself, in the spring, when the snows melt and the geese return and this hibiscus is budding, then I will take that test again." Write a response that explains why the author concludes the story with this paragraph. In your response, include details and examples from the story that support your ideas.	1771	78.31
5	Describe the mood created by the author in the memoir. Support your answer with relevant and specific information from the memoir.	1805	45.20

VI. CONCLUSION

We are using Winnowing Algorithm for grading of descriptive answers and we have done an analysis on how the accuracy of the system is varying depending upon the changes in value of k- grams and window size.

REFERENCES

1. Attali, Y. and Burstein. J, "Automated essay Scoring with e-rater V.2", The Journal of Technology, Learning and Assessment, 2019.
2. Amit Rokade, Bhushan Patil, Sana Rajani, Surabhi Revandkar, Rajashree Shedge, "Automated Grading System using Natural Language Processing", 2nd International Conference of Inventive Communication & Computational Technologies (ICICCT) 2018.
3. Praful Mishra, Anmol Mishra, Aniket Bharati, Prof. Serta Ambadekar, "Theoretical Answer Evaluation Using LSA, BLEU, WMD and Fuzzy Logic", International Journal of Advanced Research in Computer Science, Vol 9, March-April 2018.
4. Sijimol P J, Surekha Mariam Varghese, "Handwritten Short Answer Evaluation System (HSAES)", International Journal of Scientific Research in Science and Technology, 2018, Volume 4, Issue 2.
5. Mitchell, T. Russell, P.Broomhead, N. Aldridge "Towards Robust Computerised Marking of Free-text responses", Proceedings of the 6th computer assisted assessment conference, Loughborough, 2017.
6. Gregory K.W.K. Chung, Harold F.O'Neil, "Methodological Approaches to Online Scoring of Essays", The Regents of the University of California, December 1997.
7. Raheel Siddiqi, Christopher J. Harrison, and Rosheena Siddiqi, "Improving Teaching and Learning through Automated Short-Answer Marking", IEEE TRANSACTIONS ON LEARNING TECHNOLOGIES, VOL. 3, NO. 3, JULY-SEPTEMBER 2010.
8. Md. Monjurul Islam, A. S. M. Latiful Hoque, "Automated Essay Scoring Using Generalized Latent Semantic Analysis", JOURNAL OF COMPUTERS, VOL. 7, NO. 3, MARCH 2012.
9. Eric Ganiwijaya Hasan, Arya Wicaksana, Seng Hansun, "The Implementation of Winnowing Algorithm for Plagiarism Detection in Moodle-based E-learning", 2018.
10. Srujana Inturi,"A Survey on the Assessment of Models towards Automated Free-Text Marking Engine", JETIR May 2018, Volume 5, Issue 5, 2018