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Answer Script Evaluation using Machine Learning

Dr. K. Suresh[1], Nunna Jenny Sai Prasanna[2], Gorle Lakshmi Venkata Sravani[3], Puram Anjali[4]
[1]Assistant Professor,[2, 3, 4]UG Student, Dept of Computer Science Engineering, Anil Neerukonda Institute of Technology and Sciences, Affiliated to Andhra University, Accredited by NBA and NAAC,India

Abstract: ***The current way of checking answer scripts is hectic for the college. They need to manually check the answers and allocate the marks to the students. Our proposed system uses Machine Learning and Natural Language Processing techniques to beat this.***
Machine learning algorithms use computational methods to find out directly from data without hopping on predetermined rules. NLP algorithms identify specific entities within the text, explore for key elements during a document, run a contextual search for synonyms and detect misspelled words or similar entries, and more. Our algorithm performs similarity checking and also the number of words associated with the question exactly matched between two documents. It also checks whether the grammar is correctly used or not within the student's answer.
Our proposed system performs text extraction and evaluation of marks by applying Machine Learning and Natural Language Processing techniques.
Keywords: Cosine Similarity, Fuzzywuzzy, Grammar Checking, Machine learning, Naive Bayes Classifier, Natural language Processing.

I. INTRODUCTION

Presently Situation across the world has driven education into digital mode. Many manual tasks from the education system already have their alternatives such as blackboards replaced with digital boards, question papers with digital examinations, etc.
In these newly adopted examinations, the manual correction process would be a tedious task to perform by teachers. This can be replaced with digital correctors in which we can use Machine Learning and NLP techniques to evaluate through computers saves a lot of time and effort for the faculty. The two main modules for this digital correction system are:

A. Text Extraction
B. Evaluation of marks.

This system will take a scanned copy of the answer, then it will extract the text from the answer. Performs similarity checking to categorize the keywords, checking whether the grammar is proper or improper, and categorizes the things related to the question. These three categorized values will be given as input to the classifier. After performing all these steps it will finalize the marks to student answers.

II. WORKING

The process for the answer script evaluation comprises of following steps:

1) Uploading scanned copies of student and faculty answers.
2) Extracting text from both scanned copies.
3) Checking similarity between those two documents.
4) Checking grammar.
5) Checking to question related things.
6) Evaluating marks.

The fig-1 represents the architecture of the proposed system and the process of evaluation.

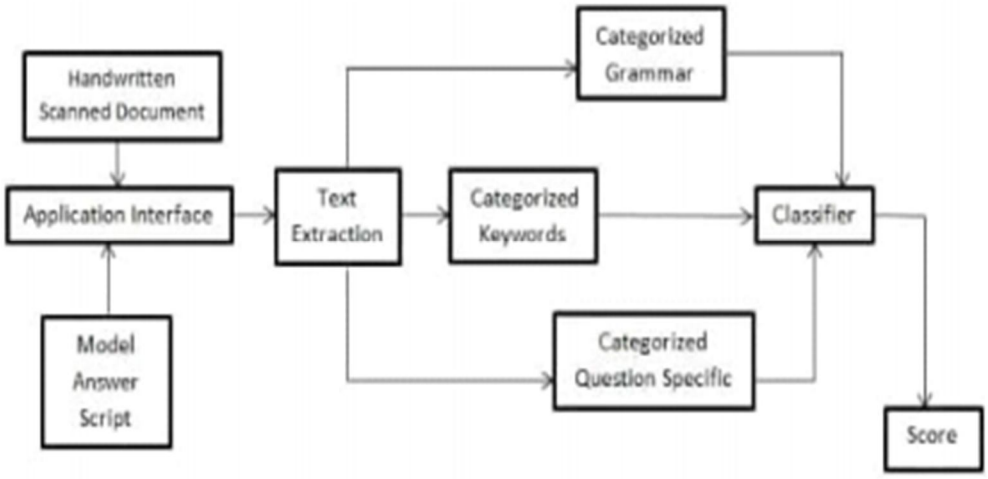

Fig.1: Architecture of the proposed method

a) *Uploading Scanned Copy of Answer*: Both Student and respective faculty should submit their scanned copies of handwritten answers in image format.
b) *Text Extraction*: The text present in the scanned copies of both faculty and student are extracted and organized properly.
c) *Checking similarity*: Cosine similarity is used to find out the similarity between documents no matter their size. It measures the cosine of the angle between two non-zero vectors projected in a very multi-dimensional space. Greater the angle means lesser the similarity and lesser the angle means greater the similarity. If two vectors have the same orientation the similarity is going to be '1', otherwise, it'll be '0'. If two vectors are opposed, then they're oriented exactly another way i.e, similarity measurement is -1. it's the representation of similarities in orientation.

It can be derived using the Euclidean dot product formula which is written as:

$$A.B=\|A\| \|B\|\cos\theta$$

Here, A, B are the two vectors, the cosine similarity is defined as:

$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2}\sqrt{\sum_{i=1}^{n} B_i^2}},$$

By applying the cosine similarity on those two documents will get the angle that represents how much they are. Based on that angle will assign the category for keywords in the range of 1 to 6.

d) *Checking Grammar*: An API named Textgears is used to integrate the latest technologies for text analysis virtually to a product irrespective of its scope. It checks all the grammatical errors such as spell-checking vocabulary, parts of speech, etc. It also determines the readability, performs auto-correction, text analysis, language detection, and extracting keywords. This API is available for regular HTTP and HTTPS requests. The output will be in JSON format. Based on the number of errors, categorize the grammar as proper(1) or improper(0).
e) *Checking Question-related Things:* String matching will be done by using the FuzzyWuzzy library in python. Levenheisten Distance may be a metric won't calculate the difference between given sequences. the opposite modules like regex, difflib are used to match strings. But, FuzzyWuzzy is exclusive in its way. The methods during this library return erase of 100 of what proportion the strings matched rather than true, false, or string. This library can help map databases that lack a standard key, like joining two tables by name, and these appear differently in both tables. supported the token set ratio will categorize the question-related things within the range 1 to 6.

f) Evaluating Marks: Naive Bayes classifier is one of the classification algorithms based on Bayes' Theorem which works on conditional probability. In this algorithm, every pair of features being classified is independent of each other. Naive Bayes classifiers are highly scalable, requiring several parameters linear in the number of variables in a learning problem. In the computer science literature, naive Bayes models are also called simple Bayes and independence Bayes.

Bayes theorem provides a way of calculating posterior probability P(D|X) from P(D), P(X), and P(X|D). Look at the equation below:

$$P(D|x) = \frac{P(x|D)P(D)}{P(x)}$$

$P(D|X)=P(X_1|D) \times P(X_2|D) \times \ldots\ldots \times P(X_n|D) \times P(D)$

Above,

P(D|X) is the posterior probability of class (c, target) given predictor (x, attributes).

P(D) is the prior probability of class.

P(X|D) is the likelihood which is the probability of the predictor given the class.

P(X) is the prior probability of the predictor.

Categorized values of keywords, grammar, and question-related things are given as input to the classifier it will give biased values in the range 1 to 9 as output. Based on that biased value, calculate the

marks of the given answer.

Calculated marks= (biased value* total marks evaluated for the question)/9

III. RESULTS

A. *Sample Input*

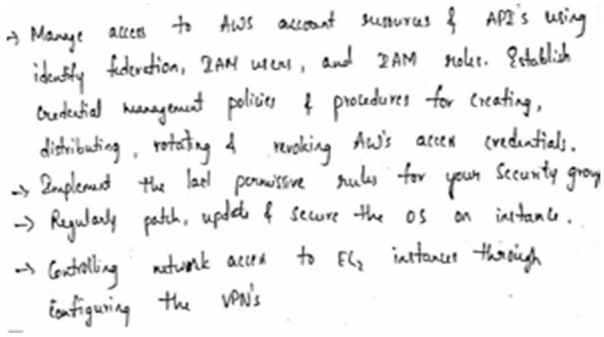

Fig 2:Student copy

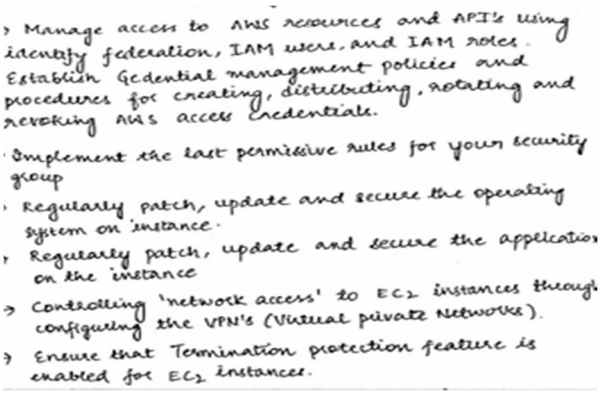

Fig 3 : Faculty Copy

B. Sample Output

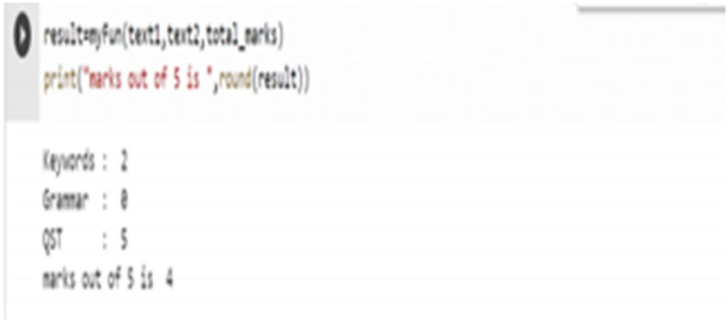

Fig 4 Output

IV. ACCURACY

Accuracy is the performance measure and it's simply a ratio of correctly predicted observation to the general observations.
Accuracy = TP+TN/TP+FP+FN+TN
Accuracy is utilized to check what proportion efficient the model is. Based on that, decide the model which is suitable for the particular system. Confusion matrix is utilized to imply the quantity of true positives,true negatives,false positives and false negatives.

Confusion matrix for our model is:

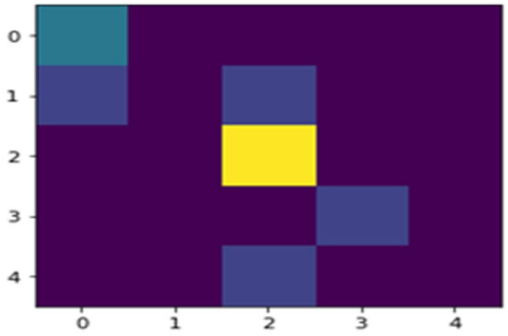

Fig 5 : Confusion Matrix

V. CONCLUSION

This paper reports to evaluate the text which is in English and calculate the marks. Our proposed system involves many tasks to generate marks. The crucial task is text extraction from the scanned copies. In the near future, this can be extended to evaluate the text in other languages, images, and mathematical formulas.

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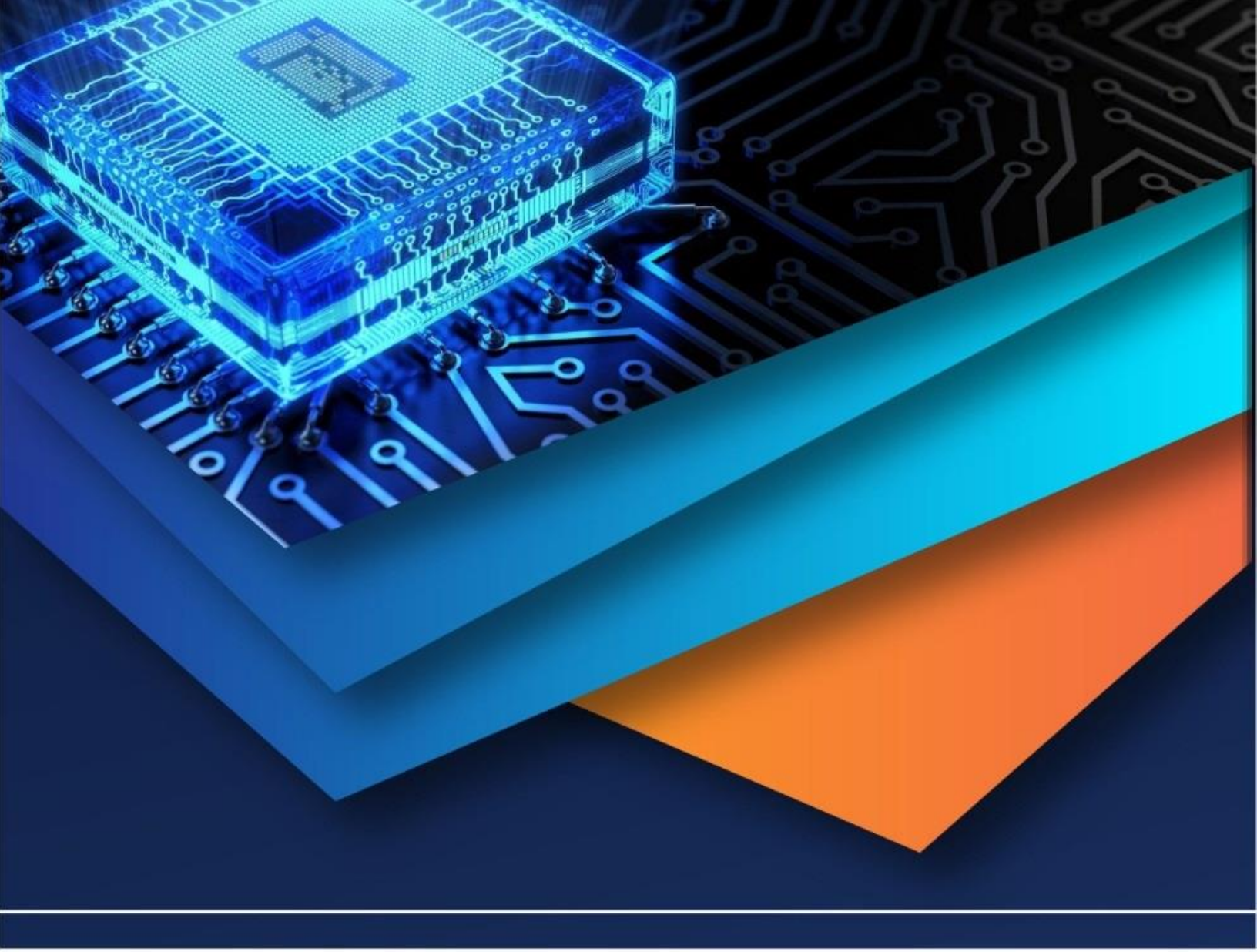

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