

# A Survey on Automated Answer Paper Evaluation and Text Extraction Techniques

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**Abstract:** Examination is a most important factor in determining the performance of a student, so the answers scripts are evaluated to measure the performance accurately to estimate the understanding level of a student. But there are so many errors occurring in the evaluation of the answer scripts. There are so many automatic answer scripts evaluation systems which use techniques like Optical Character Recognition, Basic Elements, etc. and technologies like Image Processing, Neural Networks, etc. in which each has certain defects. Some system does not support meaning wise analysis, some do not allow semantic analysis, some of them are more time consuming. In this paper we can overview the factor that makes the system ineffective to use.

**Index Terms - Examination, Answer scripts evaluation, Image processing.**

## I. INTRODUCTION

In the current education system, there comes a lot of dispute in analyzing the performance of a student and to evaluate the knowledge gained by a student. Despite the fact that the innovation in this refreshing world is changing everyday but we have only one method to analyze the skill set gained by a student that is by conducting an exam either practical or theoretical. So the exam paper should be evaluated more accurately. At present the answer scripts evaluation looks biased that is the scorer who provides score does not allocate it only based on the key points it is mostly depended on the mentality of the scorer. There might be a colossal deviation between the scores assessed by various raters. Performing this manual grading of answer scripts leads to huge consumption of man power. To overcome this technique which is used all over the world, most of the MNC's conduct online exams that is mainly focused on multiple choice questions which are easy to be evaluated automatically, the results are delivered quickly and reduces human intervention. There are systems which have been developed specifically for evaluating short answers, descriptive answers and for online exams.

Computer Vision [CV] is an integral part of artificial intelligence. CV is used to configure a system to understand and use the details present in an image. It makes the system to view process and analyze image in the same way as how human views the scene. As said earlier CV is an integral part of AI because it includes certain AI concepts like Neural Network to decipher the contents in an image.

Image Processing [IP] is a sub domain of machine learning which involves method that allows a system to enhance an image and to extract gain able details from an image. Image processing is sub divided into two types, analogue image processing and digital image processing. Analogue image processing involves in processing the hard copies like printout, newspaper, etc. Digital image processing involves in the processing of digital images. It is divided into three steps preprocess, upgrade, show and data extraction.

Feature extraction method which is common to CV and IP used to extract the features and details present in an image.

In this paper, we have discussed about various automated evaluation schemes along with their merits and demerits. We have also given about various text recognition system involved in this evaluation schemes.

## II. RELATED WORKS

### 2.1 Short Answer Evaluation

Sijimol P J, Surekha Mariam Varghese are the authors who framed that this system uses the following technologies and techniques. This system is divided into three phases, scanning phase, preprocessing phase and comparison and evaluating phase. In the preprocess phase of this system it includes methods like grammar check, synonym check, tokenization, stemming. For the purpose of stemming they use the porter stemmer algorithm. WordNet is used for synonym check. Optical Character Recognition tools are used to extract the handwritten text from images. Instead of giving keyword and marks separately here NLP is used which gets the reference corrected paper and an answer key which in turn learns and assigns certain marks to certain keywords. Cosine sentence matching method is used to allocate marks for the matching keywords.

### 2.2 Basic Elements

Junichi Fukumoto, Eduard Hovy are the authors who framed this system, here they have used the technique named Basic Elements (BE) for automatic essay grading. This BE is divided into three categories, BE breakers, BE matchers, and BE scorers. BE breakers –breaks a given group of paragraph into individual BE units .BE matchers – It is used to identify the matching BE

units .BE scorers – Assigns scores to each BE units. There are many parsers available that can be used for breaking the descriptive answer. BE-S uses charniak parser (constituency tree) and CYL cutting rules, BE-F uses dependency tree and JF cutting rules, Microsoft Parser uses Heidorn and cutting rules. Here BE-F is used. They have only used lexical identity that is it identifies the exact word matching with the reference BE's. And in the scoring phase they have allocated 1 mark for each matching BE's.

### 2.3 Evaluation of answers in online examination

V.Nandhini, P.Uma Maheshwari is the authors who framed this system. This system uses syntactical relation based feature extraction to extract the contents in a summary. Cognitive based approach is used for identifying correctness by using matching phrases. This system is divided into 3 phases, preprocessing and feature extraction, identifying similarity, score computation. In preprocessing and feature extraction phase the question classification, answer classification are done using Naïve Bayes classification and head word, bigram count are identified using LESK algorithm. In Identifying similarity phase this system looks for exact match, cosine similarity and jacquard similarity used to identify the similarity between sentences. In score computation phase the overall score of cosine similarity and jacquard similarity is used to provide score. Key feature 1- questions are classified into factual type, inductive type, and analytical type that indicates the answer type. Key feature 2- for head word extraction syntactic passers is used and bigram count is taken. Key feature 3 – Naïve Bayes classification is used to give the probability of possible answers with the help of LESK algorithm.

### 2.4 Evaluation of descriptive answers in natural language processing

Shweta M.Patil, Sonal Patil are the authors who developed this system. This system uses Computer Assisted Assessment (CAA). This system focuses to determine the semantic meaning of student answer. This system is divided into five modules student module, keywords and weightage module, process module, match identification and scoring module, results module. In Student module the student will type the corresponding answer for the question. In keywords and weightage module the correct answer to respective question is entered, as well as the keywords with their respective weights is also entered. In processing module both the correct answer and student typed answer is processed by dividing the entire text into tokens with the help of Natural Language Processing (NLP). In match identification and scoring module the exact match of student answer with correct answer is checked, if not found then it checks with the synonyms of the given keyword and assigns score according to the weightage given. Here SR DB and CA DB are used to store the keywords, weightage and to provide score.

### 2.5 Pattern matching

Pranali Nikam, Mayuri Shinde are the authors who developed this system. This system converts a summary into graphical form then it makes an assessment over matching sentences using pattern matching. This system is divided into 5 phases feature extraction, stemming, converting into graphical form, identifying similarity, score allocation. In feature extraction phase the texts are extracted from both the feeded teacher's answer and student typed answer. In stemming phase the text are subdivided into groupings and represented in the form of constituency tree. In converting into graphical form phase the constituency tree is converted and represented in the graphical form. In identifying similarity phase the similarity and correctness is verified using pattern matching and the left out unmatched words is checked with their synonyms with the given keywords and replaced accordingly. For matching the similarity this system uses partial string match, full string match and WordNet. In score allocation phase the score are assigned based on matched patterns

### 2.6 Subjective answer evaluation

Piyush Patil, Sachin Patil are some of the authors who developed this system. This system is divided into 4 phases scanning, preprocessing, training, evaluating similarity, results. In scanning phase the student written answer sheet is scanned. In preprocessing phase the features in the scanned answer scripts is extracted and reference model is given to the system. In training phase the system is trained with model answers so that the system is capable to evaluate different answers. In evaluating similarity phase the keywords, important sentences, grammar and synonyms are checked for keyword and key sentence checking cosine similarity is used, for checking Question Specific Things (QST) fuzzy wuzzy library of fuzzy logic is used. In result phase the result is displayed in an android application.

## III. TEXT EXTRACTION TECHNIQUES

Text extraction from image is a technique that is the growing demand in many organizations including many universities .In this modern era some organization have succeeded in extracting text from a document but now they focus mainly on extracting text from handwritten document photocopies. Many organizations use application that has text extraction techniques as an integral part with other intelligent features that enable you to extract data out of images. This makes the data in the photocopies available in text format to be used in some other form. This process is also known as data capture automation processing.

### 3.1 Optical Character Recognition

Optical Character Recognition (OCR) is the most widely used text extraction technique worldwide. The OCR tools have libraries that are capable of recognizing about 200 languages. FineReader XIX is used for recognizing old documents, books and newspapers that were published in between 1600 and 1937 in English, French, German, Italian and Spanish in old fonts and Gothic fonts. It also recognizes the documents printed by dot-matrix printers or typed on typewriters. But this OCR recognizes only computer printed text from image.

### 3.2 Intelligent Character Recognition

Intelligent Character Recognition (ICR) is slightly like OCR and it can also be said that ICR is an extension of OCR. As the name implies it invokes some intelligent characteristics that helps it to understand the handwritten texts. ICR(Intelligent Character Recognition) technology is applicable for more than 120 languages. It can understand 22 regional styles of hand printing. Recognizing handwritten text from images which is in multiple languages is done through multilingual ICR. ICR have an inbuilt dictionary, grammar comprehension to decide an unsure part of the text recognition process for this purpose intelligence is used.

### 3.3 Neural Networks

Mostly the neural networks either the fully convolution neural networks or convolution neural network is used as a text classifier widely. It is used along with the combination of OCR in text recognition systems. It uses Region of Interest (ROI) which allows selecting the desired portion of image. After this ROI detection neural networks are used to label those ROIs. It uses multilayer perceptron as a classifier. It should be trained to recognize whether it is text or not. It is trained with both positive and negative samples. The geometrical and morphological features are extracted from each ROI and next, used for classification by a multilayer perceptron.

TABLE I – RESEARCH WORKS

Researches	Description	Techniques	Drawbacks
Short answer evaluation	OCR (Optical Character Recognition) tools are used for text extraction, Natural Language processing used for giving weightage to keywords, cosine sentence similarity is used to evaluate score.	OCR tools, NLP, cosine sentence similarity.	No semantic or meaning wise analysis. Allocates marks for same type of answer more than once. It needs a reference model for training.
Basic Elements	The BE is divided into three categories, BE breakers –breaks entire essay into small units, BE matchers – identifies matching BE's , BE scorers – evaluates score based on similarity.	BE-F parser uses dependency tree and JF cutting rules.	It matches only the lexical identity. First the model should be trained. No semantic or synonym identity analysis.
Evaluation of answers in online examination	The question classification and answer classification are done using Naïve Bayes classification and head word, bigram count are identified using LESK algorithm. Cosine similarity and Jacquard similarity are used to identify the similarity between sentences.	Naïve Bayes classification, cosine similarity, jacquard similarity, LESK algorithm.	Can only be used in online exams. Difficult to recognize natural language answers and extracting precise meaning.

Researches	Description	Techniques	Drawbacks
Optical Character Recognition	Recognizes the typed text in an image and extracts it.	FineReader XIX.	Recognizes only computer typed text.
Neural Networks	It is used in combination with OCR to classify the text extracted from an image.	Convolutional neural network (CNN) , Fully convolutional neural network (FNN), Multilayer perceptron.	It is difficult to recognize large characters.
Intelligent Character Recognition	It recognizes the handwritten text in an image and extracts it.	Has inbuilt dictionary, grammar comprehension.	Accuracy level varies.

TABLE II – TEXT RECOGNITION TECHNIQUES

#### IV. DISCUSSION

From the study in different automatic evaluation systems and text recognition techniques above made we found that, the OCR and Neural Networks have the ability to recognize only the computer typed documents it is not able to recognize handwritten documents.

Only ICR can recognize handwritten text and extract it from image. But it has a difficulty in maintaining the accuracy level. It should be trained with more than billions of data to achieve highest accuracy in converting the handwritten text into digital text form.

Most of the computerized answer evaluation system evaluates and assigns mark only if the reference key and student typed answer matches exactly. It does not perform semantic analysis of each word.

#### V. CONCLUSION

The lot of hustle that were created due to manual evaluation of paper can be eradicated with the use of automatic evaluation of answer paper and man power required for correction can be reduced and comes with minimal cost. In this literature, we have given a comprehensive view of various text recognition techniques and its drawbacks. We have also briefed some of the automatic grading systems that lags in performance due to small defects either in the algorithm used or the technology chosen.

The above discussed techniques and methods have its own constraints that can be rectified. We can use these existing algorithms as reference model to train the system to rectify those disadvantages addressed above.

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