

# DigiValuate: Answer Sheet Evaluation System using Natural Language Processing

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**Abstract** - Student assessment is a critical point of the teaching and learning process that enables teachers to rate the productiveness of teaching with student performance. As of now, the objective-type questions alone can be practiced and assessed through online examinations. But most educators and researchers presume that a deep understanding of the lessons' concepts cannot be done by simple MCQ testing. Faculties find it challenging to gauge descriptive answers sent online by students and need to check each word and sentence of the answer sheet very carefully. Also, teachers must manually upload the mark sheet of the students. Our idea is to propose a system for online paper evaluation using natural language processing for handwritten answer sheets and automatic mark sheet publishing. Here the scanned answer sheet (by students) is converted and compared with the answer key (by teachers) using string-based similarity and meaning among sentences whether or not they have different words. Faculties need not waste time by evaluating the papers and also students get the marks in support of their content.

**Key Words:** Descriptive type answers, Handwritten answers, Natural Language Processing, Objective type questions, Online paper evaluation, String-based similarity Student assessment.

## 1. INTRODUCTION

The broadening of technology lessens the trouble of manpower in many of the areas. There are various assessment strategies used to evaluate a student's performance. The most widely used technique is descriptive question answering [1]. Descriptive-type answering is a method where a student expresses his/her point of view in a long textual way. The boon of technology and rapid advancements in the education industry has provided a good learning environment. It offers qualification and credits at the desktop through online courses and evaluation [2]. The automatic descriptive answer evaluation system will be very effective for various universities and educational institutions to assess a student's performance. This system aims for less time consumption for evaluation, less manpower association, preventing human evaluator's psychological changes, and easy to keep a record. The automatic answer sheet evaluation based on Natural Language Processing (NLP) will help us to overcome the difficulties faced in the

manual evaluation. To make it easier, automatic marks scoring is also included.

Natural language processing (NLP) is a branch of Artificial Intelligence (AI) that is responsible for interaction between computers and humans in such a way that computers have the ability to understand text and words in the same way as humans can. Natural language processing is that the drive behind machine intelligence in many modern real-world applications. Python programming language provides a wide range of tools and libraries. Natural Language Toolkit (NLTK) is one of the platforms for open-source collection of libraries for classification, tokenization, stemming, lemmatization, parsing, etc., programs and resources such as WordNet for building NLP programs.

## 2. OBJECTIVE

The main objective of the descriptive answer sheet evaluation system is to reduce manual work and time. It is difficult and time-consuming for faculties to go through each sentence of answer sheets of all students which are sent online. It prohibits human evaluator's psychological changes or we can say assures that their mood swings or change in perspective do not affect the evaluation process. Automatic evaluation system based on the similarity between answer sheet (by students) and answer key (by teachers). It greatly reduces the administrative burden of organizing and running exams when it moves online. With the increase in the pandemic, academic institutions shift all educational activities to the e-learning format. The automatic descriptive answer evaluation system will be very cooperative for various universities and educational institutions to assess a student's performance very effectively [1]. As a result, by using this system, online answer sheet evaluation is useful to simplify the answer sheet checking process for both online and offline assessments. This avoids delay in entire result processing and there is no physical contact with others. It is more environmentally friendly – with less paper, printing and transport used overall and so it is very cost-effective. Online proctoring gives candidates the power to take a seat on a secure and invigilated exam from the comfort of their home, which is a smaller amount stressful and saves time and money going to a test center. Automatic grading or marking system makes manual work more at ease.

### 3. EXISTING SOLUTION

There are some existing system for evaluating the answer sheet:

#### 3.1 Evaluation of Answer Sheet Manually

For evaluating student performance, answer script evaluation plays an important part. Typically, an answer script evaluation is done manually by the teachers that sometimes can be biased. There are various factors like mood swing of the evaluator, the inter-relation between the student and evaluator that affects the evaluation process. In addition to this, evaluation of answer sheets are very tiring and time-consuming task. Teachers need to travel different location for paper valuation and also institutes have to spent a lots of time on this.

#### 3.2 Eklavvy: Onscreen Evaluation System

Eklavvy is a platform for evaluating physical scripts of the answer sheets in digital format [3]. Exam master creation is first step in Eklavvy to initialize online evaluation activity. Question paper and answer key is also uploaded and it can be viewed here which is useful during evaluation process. Each student is entered into the system by providing details like name, email, contact, class, division etc. Handwritten answer scripts are scanned and uploaded to software system based on cloud by the students. Evaluator data should be provided onto the system. Each evaluator enter in Eklavvy using the login credentials and view answer sheets which are uploaded. Answer sheets are evaluated online using onscreen marking system and faculties can login and see all pages of the answer sheet. The answer sheets are evaluated using digital evaluation tools like digital annotations, assigning marks, total calculation, moderation is simplified and can be completed in quick time. Eklavvy has provided unique reporting and analytics to track progress of each evaluator, moderator for answer sheet evaluation process. Administrator can monitor dashboard to analyze total number of answer scripts evaluated, total pending evaluations and also monitor examiner wise answer sheet evaluation. Detailed reports can be downloaded in format like excel, pdf etc from the system.

### 4. PROPOSED METHOD

The field of study that focuses on the interaction between human language and computers is called Natural Language Processing(NLP) an aid for computers to understand the human's natural language. Natural Language Toolkit (NLTK) is the Python package you can use for NLP to handle language. NLTK includes resources such as WordNet along with text preprocessing libraries such as sentence parsing, word segmentation, stemming and lemmatization (methods of trimming words down to their roots), and tokenization (for breaking phrases, sentences, paragraphs and passages

into tokens that help the computer better understand the text). It also includes libraries for implementing capabilities such as semantic reasoning, the ability to reach logical conclusions based on facts extracted from text. OCR (Optical Character Recognition or Optical Character Reader) is used to convert scanned images of handwritten answer scripts to editable text format. Here we use OCR to convert answer scripts into an editable format for tokenization. Further, we use Gensim, Corpus, Wordnet for similarity check. Gensim is an open-source NLP library used for unsupervised topic modeling which handles large text collections. WordNet is a large lexical database corpus in NLTK, useful for text analysis which maintains cognitive synonyms called synsets of words correlated by nouns, verbs, adjectives, and more.

DigiValuate is a system for online paper evaluation using Natural Language processing for handwritten answer sheets and automatic mark sheet publishing. Fig. 1 shows a flow of the process in. Students can provide answers as direct input or upload a scanned image or pdf of a handwritten answer script. If it is a scanned image or pdf, it is converted to words on a document and compared with the answer key using string-based similarity and meaning among sentences even if they have different words. The answer key provided by the faculty contains keywords of required answers (excluding determiners/demonstratives) or normal answer key which is tokenized into keywords. Based on similarity checks, marks are provided and results can be viewed by all users. As a result, faculties need not waste time by evaluating the papers and students get their marks based on their content, with no partiality in evaluating the papers.

### 5. SYSTEM MODULES

#### 5.1 Registration and Login

Firstly, the admin registers all students and faculties into the DigiValuate. After registration by admin, they log into the system through their respective credentials and land on their separate dashboard.

#### 5.1 Upload

Upload module is used for uploading question papers and answer keys by faculties and for uploading answer sheets by students.

#### 5.1 OCR

Optical Character Recognition is a technique for conversion of scanned document or a photo of a document which is typed, handwritten, or printed text into machine encoded text. OCR systems are made up of both hardware and software that is used to converted scanned image into machine readable text.

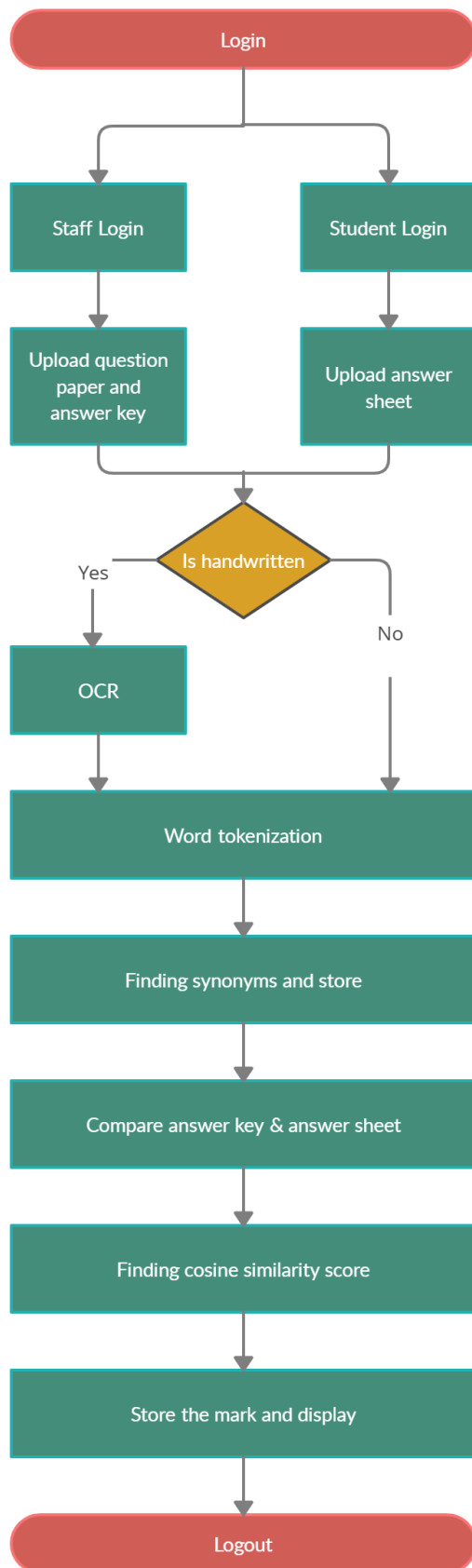


Fig -1: Flow Diagram of DigiValuate

Here we are using a mobile camera as the hardware which is used to scan the answer sheets written by the students. Google Vision API is used as the software of OCR systems. The Vision API can detect and extract text from images. There are two annotation features that support optical character recognition (OCR) - TEXT\_DETECTION and DOCUMENT\_TEXT\_DETECTION. TEXT\_DETECTION detects and extracts text from any image. For example, a photograph might contain a street sign or traffic sign. DOCUMENT\_TEXT\_DETECTION extracts text from an image (or file); the response is optimized for dense text and documents. The Vision API can perform feature detection on a local image file by sending the contents of the image file as a base64 encoded string in the body of your request. The text is then decoded from the base64 encoded string.

#### 4.1 Tokenization

Tokenization typically plays an important role in cutting a string into identifiable units that constitute a piece of language data [4], [5] called tokens. Here tokens are words from the answer sheet and answer key provided by the student and faculty respectively. The stopping words (like such, this, that, is, are, and so on) are removed from both the answer key and answer sheet. Here we use tokenize function and Corpus from NLTK for tokenization and to remove stop words. The tokenized words from each answer sheet are compared with words of the answer key in the further module below.

#### 4.1 Similarity Check and Scoring

Most of the previous auto-assessment system incorporates the word-matching techniques [6]. In [7], they explore many approaches that are used to measure similarity between sentences. Finding similarity between words is the core of similarity check. For similarity check, we use Gensim, WordNet, and Corpus from NLTK. Here the tokenized words from answer key or we can say keywords are compared with words tokenized from answer sheet and similar words are found. After checking the similarity, the marks are going to be assigned consistent with the number of matching words found. For determining the score obtained we use the cosine formula in which the distance term used refers to similarity measure. If this distance is small, there will be a high degree of similarity, but when the space is large, there will be a small degree of similarity. After this process, the obtained marks are stored in a table corresponding to every student. The mark is visible for all the users - Admin, Faculties, and Students - in the system.

#### 5. CONCLUSIONS

The present system is not capable of evaluating online sent answer scripts and maximum work goes manual. To avoid the burden of organizing exams and make it more eco-

friendly- less paper, printing, transportation, and also avoiding physical contact with others. This online answer sheet evaluation is useful to facilitate the answer sheet checking process for both online and offline assessments and also avoids delay in the entire result processing. An automatic marking system helps evaluators to save more time. Students can have stress-free, secure examinations, saving more time as well as money for traveling to test centers. This proposed system uses a natural language processing-based method for automatic answer script evaluation and marks scoring by making use of NLTK and OCR tools. The converted answer sheet is compared with the answer key by the faculty using similarity check by Gensim and WordNet and the score is determined using cosine formula which refers to the similarity measure. The limitation of this system is the evaluation of mathematical concepts and equations, and diagrams which may get solved in future works.

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