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A Novel Approach – Automatic paper evaluation system

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Abstract - Machine Learning technique is used to find out the object recognition and character recognition using convolution neural network. In this paper, we present a real-time character recognition technique for smart paper correction. In this technique, Images captured by scanner device and converted into portable document format. In recent years, smart paper correction in machine learning technique is more important than other issues. We propose a system in which optical character recognition (OCR) tool converts handwritten answer sheet image into the text document and it's directly stored to the database database. We improve the security in the database and find out the errors in words, compare sentence meanings and to evaluate marks using NLP techniques.

Key Words: ***Machine Learning, NLP, OCR.***

1.INTRODUCTION

The method of extracting text from images is also called Optical Character Recognition (OCR) it referred to as text recognition, is a software technology that transforms characters such as numbers, letters, and punctuations from printed or written documents into an electronic form recognized and read by computers and other software programs. Some OCR programs can do this, as a document is scanned or photographed with a digital camera and even can apply this process to documents that have been previously scanned or photographed without OCR. OCR allows users to search within PDF documents, edit text, and re-format documents. In OCR processing, the scanned image or bitmap is analysed for light and dark areas in order to identify each alphabetic letter and numeric digit. When a character is recognized, it is then converted into an ASCII code. Special circuit boards and computer chips are designed expressly for OCR and used to speed up the recognition process. OCR (optical character recognition) is the process of recognition of printed or written text characters by a computer or mobile devices. This also involves in scanning of the handwritten texts character-by-character and analyses the scanned images, and then translates the character image into character codes, such as ASCII, that are commonly used in data processing.

A paper correction is an answer checker application that checks and evaluates marks for the written answers similar to a human being. This software application is built to check subjective answers in an examination and allocate marks to the user after verifying the answers. The system requires you to store the answer key into the system this facility is provided to the admin. The staff may insert questions and respective subjective answers in the system. These answers are stored as notepad files. When staff has to evaluate the answer sheet, he is provided with questions and area to upload answers. Once the user uploads answers sheet into the system then the system compares this answer sheet to the possible ways of answers written in database and allocates marks accordingly. Both the answer and key need not be exactly the same. The system consists of in built natural language program (nlp) that verifies answers and allocate marks accordingly as good as a human being.

1.1 OPTICAL CHARACTER RECOGNITION

Optical character recognition (OCR) technology in a Computer Vision detects the text content of an image and also extracts the identified text into a machine-readable character streams. You can use the obtained result for search and numerous other purposes like medical records, security, and banking applications. It automatically detects the language of the text. OCR also saves time and provides convenience for users by allowing them to take photos of text images instead of transcribing the text. OCR can read and recognize 25 languages. Those languages are: Arabic, Czech, Chinese Traditional, Chinese Simplified, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese,

Romanian, Russian, Serbian, Slovak, Spanish, Swedish, and Turkish. If you do a large amount of scanning, that can provide the ability to search within PDFs to find the exact one you require that can save quite a bit of time and makes OCR functionality in your scanner program a most important thing. Here are some other things which OCR helps with:

1.1.1 Automated data processing

Automated data processing is defined as the creation and implementation of technology that automatically processes data. This technology also includes computers and other communications electronics that gathers, stores, manipulates, prepares and distributes data. The automated data processing is used to more quickly and efficiently process a large amount of information that requires minimal human interaction and share it with a selective audience. Examples of automated data processing applications in the modern world include emergency broadcast signals, campus security updates and emergency weather advisories.

1.1.2 Index Documents

Index Documents are Text documents you might have indexed the whole documents for full text search where you can find a particular phrase contained in the documents. All document management systems has some level of system indexing. Default system indexing might be the date or document type or some other identifier that describes the whole document. In our example we have been using an invoice, we might search for an invoice number or we might have given the document that is a document type of "invoice". So, we can also search on all invoices.

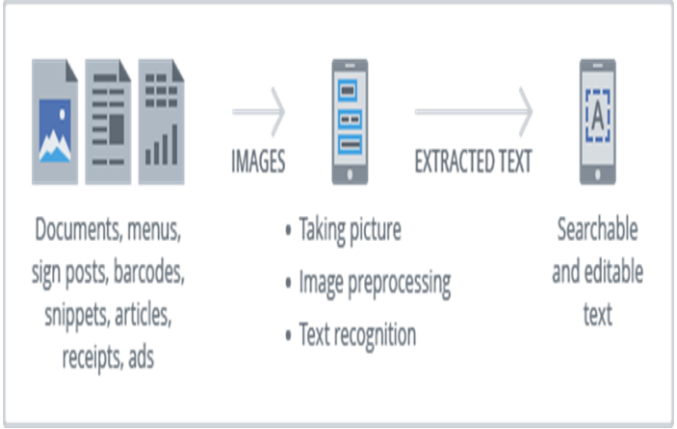


Fig 1.1 Optical character recognition

1.2 SPELL CHECKER

There are some cases where mistakes are skipped in order to limit the display of warnings or when the suggested corrections are not perfectly adapted to the context. Therefore, we advise not to rely exclusively on the results delivered by our tool and to review the text yourself after the correction. To improve your English spelling of words or sentences, you can also consult the online grammar module and conjugator. Each of the words is compared to the words in a given dictionary. A misspelled word can be identified easily as long as the dictionary is large enough to contain the words. This is the most simplest method and most of the spell checkers work like this. Spell checking and grammatical improvements of words can be achieved using three different main approaches. Our online converter uses all forms of them. Our servers are also quite powerful with lots of RAM that is required to store the large text corpus. They are also constantly updated and improvements are applied with time. There is no need to install the software on every devices you own to proofread your text. Just you can open your browser on any device and you are set. The spell checker works perfectly.

2. RELATED WORKS

Shu Tian, Xu-Cheng Yin et al [2017] [1] "A Unified framework for Tracking based text detection and recognition from web videos"Video text extraction plays an important role for multimedia understanding and retrieval. Most previous research efforts are conducted within individual frames. A few of recent methods, which pay attention to text tracking using multiple frames, however, do not effectively mine the relations among text detection, tracking and recognition. In this paper, we propose a generic Bayesian-based framework of Tracking based Text Detection And Recognition (T^2DAR) from web videos for embedded captions, which is composed of three major components, i.e., text tracking, tracking based text detection, and tracking based text recognition. In this unified framework, text tracking is first conducted by tracking-by-detection. Tracking trajectories are then revised and refined with detection or recognition results. Text detection or recognition is finally improved with multi-frame integration. Moreover, a challenging video text (embedded caption text) database (USTB-VidTEXT) is constructed and publicly available. A variety of experiments on this dataset verify that our proposed approach largely improves the

performance of text detection and recognition from web videos.There are also some failed cases of this proposed approach probably because of text tracking. In text tracking, different text regions are assigned to one ID when the captions have similar locations, similar scales and same backgrounds across consecutive frames with a fairly high probability. In the future, robust features for region match ing in text tracking should be further investigated to deal with such related issues.

Baoguang Shi et al[2017] [2] "An end-to-end trainable neural network for image-based sequence recognition and its application to scene text recognition" Image-based sequence recognition has been a long-standing research topic in computer vision. In this paper, we investigate the problem of scene text recognition, which is among the most important and challenging tasks in image- based sequence recognition. A novel neural network architecture, which integrates feature extraction, sequence modeling and transcription into a unified framework, is proposed. Compared with previous systems for scene text recognition, the proposed architecture possesses four distinctive properties: (1) It is end-to-end trainable, in contrast to most of the existing algorithms whose components are separately trained and tuned. (2) It naturally handles sequences in arbitrary lengths, involving no character segmentation or horizontal scale normalization. (3) It is not confined to any predefined lexicon and achieves remarkable performances in both lexicon-free and lexicon-based scene text recognition tasks. (4) It generates an effective yet much smaller model, which is more practical for real- world application scenarios. The experiments on standard benchmarks, including the IIIT-5K, Street View Text and ICDAR datasets, demonstrate the superiority of the proposed algorithm over the prior arts. Moreover, the proposed algorithm performs well in the task of image-based music score recognition, which evidently verifies the generality of it. The results have shown the generality of CRNN, in that it can be readily applied to other image-based sequence recognition problems, requiring minimal domain knowledge. Compared with Capella Scan and PhotoScore, this CRNN-based system is still preliminary and misses many functionalities.

Fábio Bif Goularte et al [2018] [3] "A text summarization method based on fuzzy rules and applicable to automated assessment" The proposed approach for text summarization with a relatively small number of fuzzy rules benefits the development and use of future expert systems able to automatically assess writing.

The proposed summarization method has been trained and tested in experiments using a dataset of Brazilian Portuguese texts provided by students in response to tasks assigned to them in a Virtual Learning Environment (VLE). The results of this proposed method provides better f-measure (with 95% CI) than aforementioned methods. Firstly, description and quantification of measures founded on fuzzy logics for text summarization; and a model for reducing the number of measures necessary for summarizing the texts.

Secondly, a method that uses those text pre-processing techniques to improve performance of text comparison, assessment, and classification. Finally, test of the proposal in the context of Computer-Assisted Assessment (CAA) in an VLE.The issue of this system is that it requires more comprehensive and systematic study to evaluate the answer sheets.

Rasmita Rautray et al [2017] [4] "An evolutionary framework for multi document summarization using cuckoo search approach" In this system, a novel Cuckoo search based multi-document summarizer (MDSCSA) is proposed to address the problem of multi-document summarization. The proposed system is also compared with other two nature inspired based summarization techniques namely Particle Swarm Optimization based summarization (PSOS) and Cat Swarm Optimization based summarization (CSOS). In comparison with the benchmark dataset Document Understanding Conference (DUC) datasets, the performance of all algorithms are compared in terms of ROUGE score, inter-sentence similarity and readability metric to validate non-redundant, cohesive and easy readability of the summary respectively.

As Cuckoo search algorithm is an evolutionary approach, thus the limitation of this approach is its controlling parameters. Therefore more systematic approach of parameter setting will need to be explored.

Yanwei Wang et al[2014] [5] "Topic language model adaption for recognition of homologous offline handwritten chinese text image" The content of a full text page usually focuses on specific topic, a topic language model adaption method is pro-posed to improve the recognition performance of homologous of-fline handwritten Chinese text image. Firstly, the

text images are recognized with a character based *bi*-gram language model. After that, the topic of the text image is matched . And then, the text image is recognized again with the best matched topic language model. To obtain a tradeoff between the recognition performance and computational complexity, a restricted topic language model adaption method is presented. The methods have been evaluated on about100 offline Chinese text images. Compared to the general language model, the topic language model adaption has been reduced the relative error rate by 11.94%. The restricted topic language model has reduced the running time by 19.22% at the cost of losing 0.35% of the accuracy. A TLM adaption method is introduced for improvising the recognition performance of homologous offline and written Chinese text image. The experimental results shows that TLM adaption significantly benefits the recognition. In the worst case, TLM would act the same as the GLM if the Th is carefully set up. The issue in this system is that TLM adaption method is over twice the running time of GLM. It cost 10.46 seconds for TLM to recognize one page averagely. As shown, rTLM (Th=005) saves 19.22% of the running time at the cost of losing 0.35% of the accuracy compared to TLM.

Xiaohang Re et al[2017] [6] "A convolutional neural network based Chinese text detection algorithm via text structure modeling" Here, a novel method for Chinese characters based on specific design convolutional neural network (CNN). The CNN model contains a text structure component detector layer, a spatial pyramid layer and a multi input layer, deep belief network (DBN). The CNN is pretrained via a convolutional sparse auto-encoded (CSAE) in an unsupervised way, which is specifically designed for extracting complex features from Chinese characters. Specifically, the text structure component detector which enhances the accuracy of feature descriptors by extracting multiple text structure components in various ways. The spatial pyramid layer is then introduced to enhance the scale invariablity of the CNN model for detecting texts in multiple scales. Finally, the multi input layer DBN is used as the fully connected layers in the CNN model to ensure that features from multiple scales are comparable. The proposed algorithm shows a significant 10% performance improvement over the baseline CNN algorithms. In addition, the proposed algorithm with only general components is compared to existing general text detection algorithms on the ICDAR 2011 and 2013 datasets, showing comparable detection performance to the existing algorithms.

A.Gupta et al[2016] [7] "Synthetic data for text localisation in natural images" Here, a fast and more scalable engine to generate synthetic images of text in clutter. This system overlays synthetic text to existing background images in a natural way, accounting for local 3D scene geometry. then, the synthetic images are used to train a Fully-Convolutional Regression Network (FCRN) which efficiently performs text detection and bounding-box regression at multiple scales in an image and at all locations. We discuss the relation of FCRN to the recently-introduced YOLO detector, and also other end-to-end object detection systems based on deep learning. The resulting detection network significantly out performs current methods for text detection in natural images, achieving an F-measure of 84.2% on the standard ICDAR 2013 benchmark. Furthermore, on a GPU it can process 15 images per second. The issue in this system is that CNN trained only on those images that can be generated synthetically, exceeds the state-of-the-art performance for both detection and end-to-end text spotting on real images.

H.Chu et al[2016] [8],a novel method for scene text detection, Canny Text Detector, which takes the advantage of similarity between text and image edge for effective text localization with improved recall rate. As the structural information of an object are constructed by the closely related edge pixels , this method shows that cohesive characters compose a meaningful sentence/word sharing similar properties namely location, stroke, color, size, and width regardless of language. However, those similarities have not been fully utilized by the scene text detection, but mostly rely on the characters that are classified with high confidence and provides low recall rate. By exploiting those similarities, this approach can quickly and robustly localize a variety of texts. Inspired by the original Canny edge detector, the proposed algorithm makes use of hysteresis tracking and double threshold to detect texts of low confidence. Experiment results on public datasets demonstrate that this algorithm outperforms the state-of-art scene text detection methods in terms of detection rate. The issue in this system is that speed and accurate localization of the Canny text detector lowers the barrier to develop a realtime end-to-end text reading system.

3. SYSTEM ARCHITECTURE

In our proposed system, the optical character recognition (OCR) tool converts handwritten answer sheet image into the editable text then evaluation takes place and evaluated marks are directly stored to the database. Firstly, the reference summaries are fed to the database with access to authorized person(admin and staffs). Secondly, the answer scripts are captured and text extraction takes place and the texts present in image are converted into editable text using Optical charater recognition tool (Google vision). Thirdly, the similarities between the extracted text and the answers fed into the database are compared and its similarity measures are obtained using NLP toolkit (NLTK). Finally, based on the similarity measures the marks are allocated using logics and the obtained marks are updated in the database. And the semantic context algorithm is used to read and find out characters. Semantic context of the text data they analyse, thereby considering both divergence from the statistical pattern seen in particular datasets and divergence seen from more general semantic expectations in every word from the text is looked up in the spell checker lexicon. When a word is not available in the dictionary, then it is detected as an error. In order to correct the error, a spell checker using NLP technique is used. All information about questions, marks, student login details and staff login details are stored in the database and they are protected with login of administrator to avoid unauthorized access.

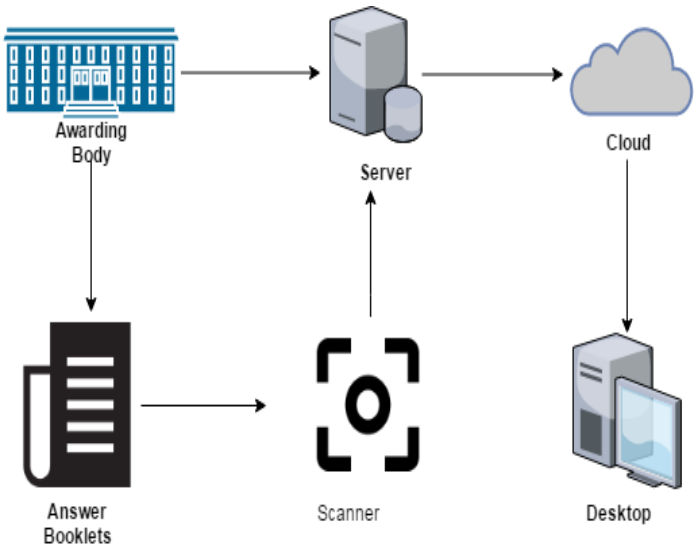


Fig. 3.1 System Architecture

4. SYSTEM IMPLEMENTATION

In this system, Natural Language Processing based evaluation of scanned answer sheets and automated assessment are performed. Various techniques used are ontology, Semantic similarity matching and Statistical methods. An automatic short answer assessment system based on NLP is attempted in this paper. Various experiments performed on a dataset, reveals that the semantic ENLP method outperforms methods based on simple lexical matching; resulting is upto 85 percent with respect to the traditional vector-based similarity metric.

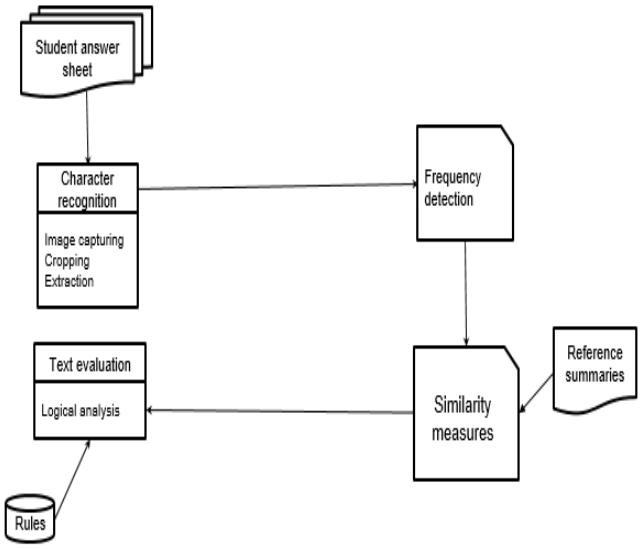


Fig 4.1 Flow Diagram

4.1. TEXT RECOGNITION

The first module of our system is about text recognition. The answer sheets are scanned using ocr and converted into a word document to compare it with the key answers that has already been loaded in the database. To store datas we use MySql database. The working of this module is as follows, firstly the user is allowed to capture the image of the answer sheet and can upload it in the ocr app which is then converted into a word document. Once it is converted

it can be copied for further comparison process.

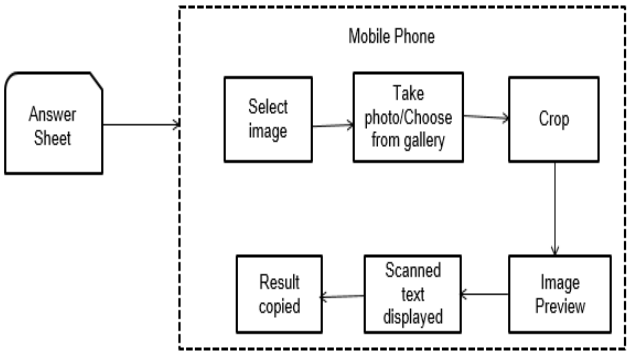


Fig 4.2 Text Recognition

4.2 TEXT COMPARISON

The staff may insert questions and respective subjective answers in the system. These answers are stored as notepad files. When staff has to evaluate the answer sheet, he is provided with questions and area to upload answers. Once the user uploads answers sheet into the system then the system compares this answer sheet to the possible ways of answers written in database and allocates marks accordingly. Both the answer and key need not be exactly the same. Once the answers are compared the system provides a threshold value according to the similarity level.

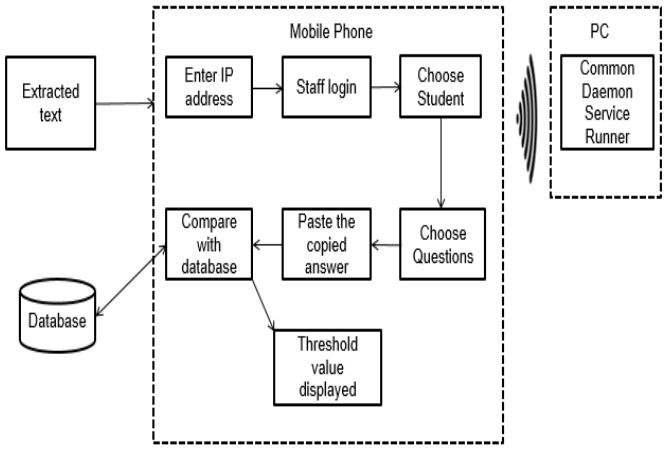


Fig 4.3 Text Comparision

4.3 MARK EVALUATION AND UPDATION

Based on the threshold value obtained marks are allocated which are displayed for immediate view to the staff in the application and it is also stored in the database and can be viewed by the students. To view the marks, students and the staffs are given separate login id using which the can login and view their obtained marks.

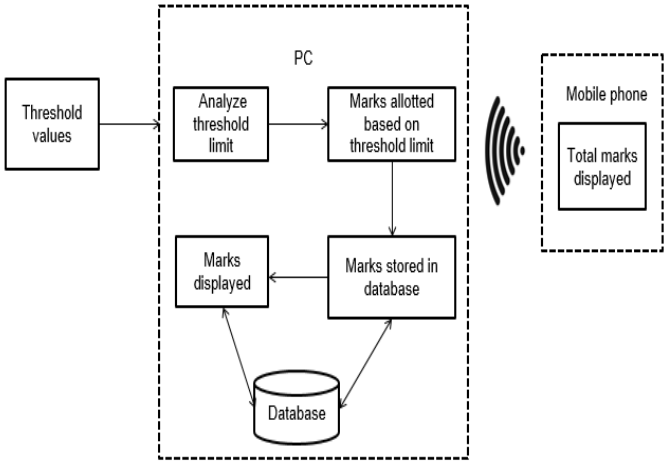


Fig 4.3 Mark Evaluation and Updation

5. RESULTS AND DISCUSSION

STUDENTS	QUESTIONS	PROFESSOR EVALUATION	SYSTEM EVALUATION
STUDENT 1	Q1	8	8
	Q2	0	0
	Q3	3	2
	Q4	6	4
	Q5	9	10
	Q6	0	0
	Q7	4	6
	Q8	5	6
	Q9	0	0
	Q10	8	10
STUDENT 2	Q1	4	6
	Q2	2	4
	Q3	8	10
	Q4	10	10
	Q5	10	10
	Q6	8	8
	Q7	6	6
	Q8	4	4
	Q9	10	10
	Q10	10	10

. . . . .		. . . . .	. . . . .
STUDENT 10	Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10	2 5 9 8 10 7 4 0 10 0	2 4 8 8 10 8 6 0 10 0

TABLE 5.1 COMPARING EVALUATION

Thus, our proposed system provides a better performance in evaluating the answer scripts. Here, the text are recognized and extracted in better speed when compared to existing system. Similarly, the comparison of similarities between answers extracted and reference summaries fed into the database is more accurate with the performance of 85% of correctness. But the only issue with the system is that it requires high speed data transfer to the server from the mobile device that requires high speed network connectivity.

5.1 MODULE 1: TEXT EXTRACTION

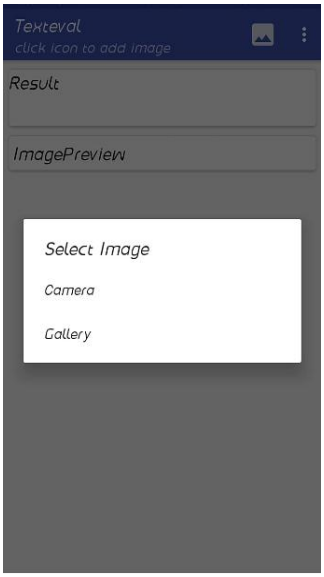


Fig 5.1 Image selection

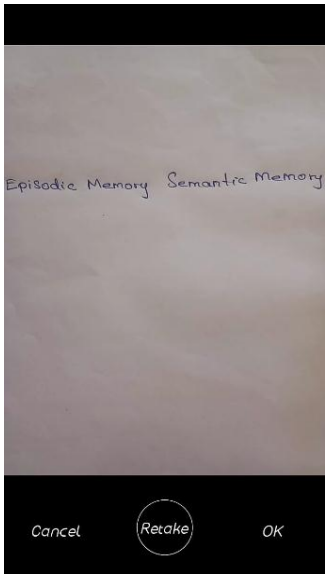


Fig 5.2 Image capturing

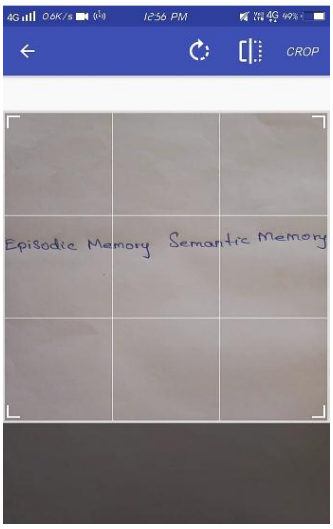


Fig 5.3 Image cropping

Fig 5.4 Text Extraction

5.2 MODULE 2: TEXT COMPARISON

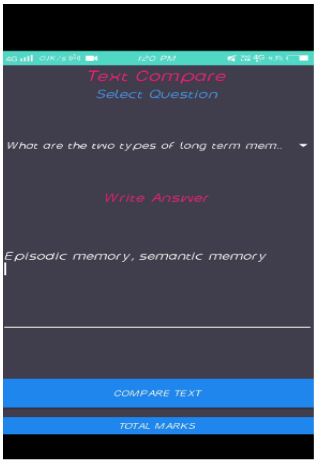


Fig 5.5 Selecting question & pasting answers & comparing

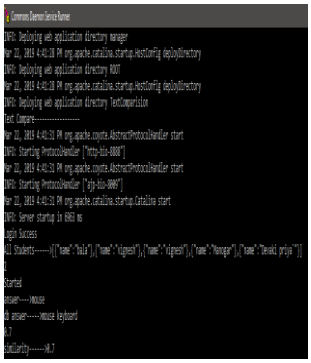
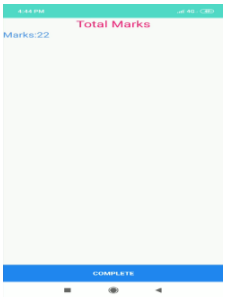


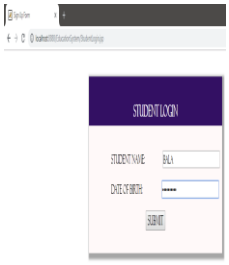
Fig 5.6 Detecting Similarity measures

5.3 MODULE 3: MARK EVALUATION AND UPDATION



5.7 Evaluating Marks

5.8 Uploading marks



5.9 Student login

5.10 Displaying marks in student portal

6. CONCLUSION

The techniques discussed and implemented in this project should have a high agreement (up to 85 percent) with Human Performance. The project works with the same factors which an actual human being considers while evaluation such as length of the answer, presence of keywords, and context of keywords. Use of Natural Language Processing along with logical techniques, checks for not only keywords but also the question specific things. Students will have certain degree of freedom while writing the answer as the system checks for the presence of keywords, synonyms, right word context and coverage of all concepts. It is concluded that using Machine Learning techniques will give satisfactory results due to holistic evaluation. The accuracy of the evaluation can be increased by feeding it a huge and accurate training dataset. As the technicality of the subject matter changes different classifiers can be employed. Further improvement by taking feedback from all the stakeholders such as students and teachers can improve the system meticulously. This process is implemented only for evaluating subjective answer scripts that does not contain any diagrams or equations. In future, this work can be extended to detect diagrams and to evaluate answer scripts that contains diagrams or equations.

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