An Interactive System for E-Learning

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ABSTRACT

This is the era of progressive technology where the main players comprise of mobile and mobile devices. Mobile application pool has grown tremendously because of high availability and the portable nature of mobile phones and public API's. M-learning or mobile learning is defined as "learning across multiple contexts, through social and content interactions, using persona electronic devices". This learning allows seeking information with our personal smart-phones and with ease. Combining E-learning concept, with a motive of providing mobility for learning and seeking the usefulness of OCR, an interactive E-learning system has been developed. The proposed system includes image processing, client (mobile) – sever (computer) communication for interaction and exchange of data. The client side will first send the image consisting of the source code to the server (any personal computer) and the server side will make use of OCR technique to convert the text (in the image) into editable text form, compile it, generate and send the output/result of the source code in the form of a text file, back to the client side(mobile).

General Terms

Pattern Recognition, Image processing

Keywords

E-learning, m-learning, Image Processing, Client-Server Communication, OCR.

1. INTRODUCTION

Technology has the power to transform education and the focus of the proposed system is to empower the concept of interactive teaching and learning process which will enable the students to learn more efficiently, whether with the help of their teachers, or on their own. The concept of e-learning is a fast-growing concept in the new age technology, and hence may not be prevalent in every school or college. The institutions which can afford the necessary

material required for e-learning are only inculcating this process into their teaching process. But to make this concept a widespread idea, this project is a small step for the students in the field of computer science and technology, that they will now be able to process codes and understand the working of various techniques like OCR, client-server communication, much easily and efficiently. 2. BACKGROUND

E- learning mainly focusing on the subjective information providing to the end user and moving one step ahead mlearning extend towards the practical exposure for the same. Hence to achieve this goal various fundamental concepts are needed to understand such as image processing, CS communication, OCR, Batch script etc.

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2.1 Image Processing

Image processing is a technique of processing images using computations and mathematical operations by using any configuration of signal processing. Here, the input is an image, videos, a series of photographs or video frame and the output of image computing may be either a set of characteristics related to an image or it can be an image. Most of the similar and dissimilar patterns are recognised with the help of image and pattern recognition techniques. A pattern recognition start from an initial set of builds acquired values (features) and fixed and measured data intended to be instructive and non-redundant, determining the consequent generalization and learning steps, and in some cases leading to better human interpretations.

2.2 Client-Server Communication

The client-server structure (figure 1) comprises of an architecture that distributes tasks between the service requesters called clients, and providers of a service called servers. More frequently clients and servers establish communication over a computer network on separate hardware, but it is a possibility that both client and server may reside in the same system. A server host shares resources with its clients and can run one or more server programs. A client requests a server's content or service function, but does not share any of its resources. Clients therefore initiate communication sessions with servers which await incoming requests.



Fig 1: CS communication

2.3 Tesseract

OCR is the process of converting as shown in figure 2 image information as input into editable text format. The Tesseract OCR engine was amongst the top 3engines according to UNLV accuracy Test. However, there was very little activity in Tesseract between 1995 and 2006, until it was opensourced by HP and UNLV in 2005, it was again re-released to the open-source community in August of 2006 by Google. A complete overview of Tesseract OCR engine can be found [5] and there are multiple efforts underway to integrate the recognition support of different scripts.



Fig 2: Flow diagram of OCR

2.4 Batch Script

A batch file is a type of script file in DOS and Microsoft Windows. It contains a series of commands to be executed by the command line-interpreter, which is stored in a plain text file. Any command can be obtained in a batch file which the interpreter accepts and uses constructs that enables the ability of looping and conditional branching, all within the batch file. The term "batch" means 'non-interactive execution', is from batch processing, though a batch file may not process a batch of multiple data.

2.5 Android Device

An Android device is a device that runs on the Android operating system. Android is an arrangement of software intended mostly for mobile devices that features an operating system and core applications. An Android device may be a Smartphone, tablet PC, e-book reader or any type of mobile device that requires an OS. Open Handset Alliance developed Android, which is led by Google. Acer, HTC, Samsung, LG, Sony Ericson and Motorola, etc. are some of the well-known Android devices.

The remaining portion of the paper is organized as follows: In Section II, work related to this project and inferences taken from various papers, and other research work has been discussed. This section gives a brief introduction about various notable works of other authors. Section III, discussed the problem statement, and gives an insight as to what dilemma is faced by the students while operating or processing on lengthy codes or inputs. Similarly, the objectives of the proposed system are identified. Section IV, discussed the proposed system. Section V, shows the input data samples taken for experimentation and its output. Finally conclude with some notable futuristic development.

3. RELATED WORK

OCR can be defined as a process where the computer understands automatically, the image of handwritten or printed script and transfers into characterselection of a relevant feature extraction method. This is probably the most crucial factor in obtaining high text recognition with is much better precision in character recognition and text recognition systems. The various work has been done by the researchers in the field of Character recognition, and these techniques proves to be useful for the various applications. The sufficient studies and papers are available that describe the techniques for converting textual content from a paper document into machine readable form.

A brief view [1] is presented in the subject of Optical Character Recognition. The concept of 'coded object' was proposed for such a new generation product by Kitchin and Dooge [2]. It is proposed as a novel interaction method using OCR for coded objects, which is aimed at clarifying. The operations on the mechanism of code objects and making the recording, sharing, and distribution of the configurations universal. In this prototype, utilization of open-source OCR engine "Tesseract" is done, adding a pre-processing of projective transforms to cope with free angle capture by the camera.

In paper [3], a literature script on English OCR techniques is presented. Generally, English-OCR system is compulsorily preferred to convert numerous books of English into editable computer text files. Recently, latest research in this area has been able to find some new methodologies and techniques to overcome the complexity of English writing style. Still these algorithms have not been tested for more complex characters of English Alphabet.

The android based application is developed [4] having integrated facility of OCR for phones' built-in speech out technology. This app, useful for the travellers who visit a foreign country to understand messages portrayed in different language. Similarly, the Visually impaired users are also able to access important message from a printed text.

OCR's accuracy depends upon character pre-processing and segmentation algorithms. Sometimes it is difficult to retrieve text from the image because of distinct size, style, orientation, complex background of image etc. Paper [5] starts with an introduction of the OCR method, history of the tool Tesseract, architecture and experimental result of Optical Character Recognition performed by Tesseract on various images.

Paper [6] presents a new adaptive binarization technique for degraded hand-held camera-captured document images. The use of ridges detection for rough estimation of foreground regions in a document image has been done. This approach is better initiative for the binarization in OCR process

Paper [8] presents an easy and coherent approach for the implementation of Optical Character Recognition and translation of scanned images of printed text into machineencoded text. It makes use of four different image analysis phases followed by image detection. It also elaborates scanning a whole document and recognizing individual characters from image irrespective of their position, size and various font styles

4. PROBLEM STATEMENT

Consider a scenario, in-order to obtain the output of the source code, in textbooks or in journals, it is necessary to type the whole source code on the machine and wait for the output. This manual process consumes a lot of time and might also generate typing errors. For such scenarios, a system can be proposed, which can avoid typing of whole source code and also provide mobility of output code by a simple click on an image. Such system can be helpful for comparison of results during experimentation and can be a boost in e-learning. Following objectives are identified with respect to e-learning.

- a. Develop an interactive system for e-learning, that can provide output of a batch script by a click on the image of its source code.
- b. To use non-conventional ways to get the output of the source program.
- c. To save time which is wasted in typing lengthy source codes.
- d. To avoid typing errors.
- e. To introduce mobility in attaining output code.
- f. To edit the text extracted by the OCR engine (if needed).

5. PROPOSED SYSTEM

The general approach for obtaining the text of the batch script in an image involves browse image, upload image, Segmentation and binarization, correct perspective distortion, and recognize text, uploading to the server, then compilation and acknowledge result on client side.



Fig 3: Proposed System

The whole proposed system as shown in figure 3 consists of two subsystems i.e. an android application and server platform. The android application will browse the image which will be already be stored in the android device's gallery, display the image for user confirmation and upload it. The other subsystem is the server which does the binarization of image, segmentation, text recognition and saving the file as batch script or batch program.

The initial process in this system starts from connecting the android device with the android studio emulator so that the software can read the external device and run the app on the device rather than launching its own emulator. The project stored in the software "Intellij Idea" is also given the command 'run' from the Tomcat server. The same options of browsing the picture and uploading it are shown in the android application on the android device, after running the app session through Android studio. The command of automatically opening the webpage along with the graphical user interface is given in Android studio, with the computers or server IP address. The picture is uploaded through browsing the image from gallery and uploading it through the android device. When the 'upload' button is pressed, the terminal in "Intellij Idea" shows an acknowledgement known as "Request Received", and then shows the desired output and at the same time the output is sent back to the phone. This means that the program and the characters in it are read correctly by Tesseract, and since batch script needs no extra compiler, the output is correctly obtained. Binarization is converting an image from color or grayscale to black- and white image, color images can be processed and checked for text extraction and getting the output of batch script on client side. This process will need the initial stage of binarization. Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests. Other types of communication ways between a phone and a pc are using a data cable, which should be connected to the phone as well as the pc, or using Bluetooth which comes under wireless communication systems.

This system mainly uses Android studio, for the development of the client side, and Intellij Idea for the development and operation on server side. Intellij Idea is a java integrated development environment for computer software, commonly known as IDE. Apache Tomcat, or Tomcat server, which is an open source Java Servlet Container, developed by the Apache Software Foundation (ASF) is used for CS communication. Apache Tomcat server can be found as an option in Intellij Idea for operations in Java environment. Tomcat implements several Java EE specifications including Java server pages, and provides a 'pure Java' HTTP web server environment in which Java code can run. This Tomcat server serves the purpose of an interface which provides the facility of optical character recognition, compilation and sending the output back to the client in text format.

6. RESULTS AND DISCUSSION

For the experimentation on the given system some image samples are captured which is taking as a input for the system.

6.1 Data Samples

The following images have been taken as sample input images and for evaluating the results obtained and check if any error is encountered. @echo OFF @set a=8 @set b=4 @set /a c=%a%+%b% @echo %c%

(a)

@echo off SET /A a = 5 SET /A b = 10 SET /A c = %a% + %b% echo %c% SET /A d = %a% - %b% echo %d% SET /A e = %a% * %b% echo %e% SET /A f = %b% / %a% echo %f% echo %c% %d% %e% %f%

@echo off
SET a = Hello
SET b =
if [%a%] == [] echo "String A is empty"
if [%b%] == [] echo "String B is empty "
(c)

```
@echo off
set list = 1 2 3 4
(for %%a in (%list%) do (
echo %%a
))
```

Fig 4: Input data samples as image

6.2 Output on client-side:

Following are the results obtained on the client-side i.e. mobile, after the operations are done on the image by the server side.



Figure 5: a) Image uploaded b) Output on client side c) Incorrect output if error persists

Figure 5(a), shows the display of the image uploaded and the other option for the output. On clicking the output button, the

correct output is shown below the input image on the same screen, as shown in figure 5(b). Whereas if there is some mistake in recognizing some characters in the image sample, a result is shown as depicted in figure 5(c). When images a), b) and c) are considered, it can conclude that the tesseract gets fairly good accuracy (see Table 1). When the text is in printed form, the background of the text is white and the font colour is black. This scenario is appropriate for this system to obtain the output of the batch script. The outputs and the remarks of the images taken as sample are given in the tabular form (Table 1). However, for data sample (d), it fails to read the alphabet 'l', which gives the garbage output as 'echo is off'. This can happen due to number of reasons, for example, there are more special characters in given image, there may be less space between two words or characters, etc. These and numerous others can be a reason that the characters are not read properly, hence system will acknowledged the correct output.

 Table1: Summary of Results

Data Samples (Figure 4)	Output	Error	Remark
(a)	12	No	Shows output of the addition operation.
(b)	15 5 50 2	No	Shows output of operations.
(c)	String B is empty	No	Shows the variable whose string is empty.
(d)	Echo is off	Yes	Does not recognize the alphabet 'l'

7. CONCLUSION & FUTURE SCOPE

The focus of proposed scheme is to minimize the processing time of any source code in batch programming and to make the output available on client-side with the facility of mobility and efficiency. A faster processing system with client-server network is a good option and helpful in the teaching-learning method. The proposed technique is evaluated for the application of gaining output from an input in the form of an image, with the input code in printed format. This system directs towards saving specific time for typing the code, the compilation time and searching for any mistakes in the code. Thus, this system serves as an innovative idea in the field of computer science as well as an example of teaching-learning process. Future scope includes the further changes that can be done to make the system more efficient as well as increasing the overall scope of the system.

- a. Can increase the length of the source program, i.e more number of lines or lengthy source code can be used.
- b. The extraction and recognition process doesn't match for some characters such as letter L so, in future a method needs to be thought upon where confusion of letter L and digit 1.
- c. From the initial stages of the system, there is an issue of recognizing the hand-written text because the intensity with which the hand-written text is written does not match with that of the printed text. Hence improvements can be made in the system so that the handwritten text is also recognized efficiently.
- d. The source code conversion for more advanced languages like C, C++ can also be developed.

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