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Dyslex_Re: The Real-Time Assistance for Dyslexic People

By Shahna E, Gill Varghese Sajan & Neethu Subash

Abstract- DYSLEX_RE is a real-time reading assistant app for dyslexic people. Dyslexia, also known as reading disorder and it is characterized by trouble with reading ability. Different people are affected to varying degrees. Problems may include difficulties in spelling words, reading at high speed, writing some words, sounding out words in the head, pronouncing words when reading aloud and understanding what one reads. Some cases run in families. OpenDyslexic is a free typeface/font designed to avoid some of the common reading errors caused by dyslexia. The font that includes regular, bold, italic, bold-italic, and monospaced font styles. This application is developed in English language using multisensory approach and it is an appropriate and suitable learning ecosystem for dyslexic children. Previous studies shows that many application that are developed in Malay and Spanish language. And this applications that only recognize some of the alphabetic. But in our application we work with all the alphabetic using OCR. The main objective of the proposed system that uses Google's mobile vision API & OCR and it provide real-time facility. The detected text is then displayed to the user in OpenDyslexic font. Mobile vision API is regarded as the best real time OCR API for mobile devices. It provides good detection accuracy and real time detection capability. Thou it does not feature real time detection, it has higher accuracy than mobile vision API.

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I. Introduction

Dyslexic reader is a real-time reading assistant app for dyslexic people. It is developed on the basis of Android and Core Java. It used to scan and convert text in to OpenDyslexic font. The app that include four buttons Real time button, Image to text button, PDF to text and Video to text button. The Mobile Vision API provides finding objects in photos and video. The framework that includes detectors, which locate and describe visual objects in images or video and an event driven API that tracks the position of those objects in video.

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Optical character recognition (OCR) is the electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and boards in a landscape photo) or from subtitle text superimposed on an image (for example from a television broadcast). It is a common method of digitizing printed texts so that they can be edited electrically, searched, stored more compactly, displayed on-line, and used in machine processes such as machine translation, text-to-speech, key data and text or data mining. OCR is a field of research in pattern recognition, artificial intelligence and computer vision, sometimes in neural network.

Children with Dyslexia are having language learning disorder and makes them difficult mastering the skill to read, spell and write. Although their cognitive capability is adequate, they faced difficulty in learning to read via conventional instruction approach. The treatment of the Dyslexia Disorder requires patients to be disciplined and have a lot of reading practice so that they can reach a level of fluency and accuracy similar to people not diagnosed with this disorder. For this people we provide an android application as assistance for them. The paper named dyslexic reader is a reading assistant app for dyslexic people. It is developed on the basis of Android and Core Java. It used to scan and convert text in to OpenDyslexic font. The treatment of the Dyslexia Disorder requires patients to be disciplined and have a lot of reading practice so that they can reach a level of fluency and accuracy similar to people not diagnosed with this disorder. Due to cost or availability of health professionals, patients are not able, in general, to follow the treatment accordingly keeping a constant attendance. Besides, nowadays there are not many available tools to support health professionals towards dyslexia diagnosis. Here we describe an application developed for mobile devices, through which dyslexic users can practice their reading skills, turning the treatment accessible as well as helping health professionals as an auxiliary tool to diagnose their patients. This tool can be applied to support dyslexia diagnosis and to help people already diagnosed with this disorder training reading. The main objective of the proposed system that uses Google's mobile vision API & OCR. The detected text is then displayed to the user in Open Dyslexic font. Mobile vision API is regarded as the best real time OCR API for mobile devices. It

provides good detection accuracy and real time detection capability. Thou it does not feature real time detection, it has higher accuracy than mobile vision API. The mobile vision API is used for real time OCR and extracting text from small text areas such as sign boards etc.

We extend image-to-text retrieval in to video-to-text retrieval. It can be performed by extracting the frames of videos, retrieving the text from the video and displayed it in the OpenDyslexic font. The performance can be improved by using threads in multitasking. The performance degradation is avoided by using multiple threads.

II. Overview of Existing Applications

According to the development of the iLearnRW system, we conducted a review of existing readers used on tablets and phones. The research provided both an important overview of currently available software and common features but also revealed which features were missing.

Many of the most commonly used readers have a very limited feature set and features that are present are frequently only partially implemented. For instance, many readers (including Google Play Books) contain text-to-speech but no easy way to navigate back and forward during playback. There were also frequent bugs in the implementation, such as navigation and highlighting going out of sync with the voice. Also, many readers do not allow full control of text display, such as the choice of font, font size or text/background color combination. Another finding was that the interface for accessing features and changing settings is also inconsistent across readers and often only presented in long text-based lists difficult to navigate for users with hard to comprehend categories. This makes a focus on usability essential. Settings should be presented in logical sections with graphical illustrations. However, all of these implementations simply roll a bar across text in a way that would be very confusing to a reader with cognitive control issues. The review also identified two very popular Open Source projects (FB Reader and Cool Reader) developing free reader apps for the Android platform. Both of these apps are the most feature-complete of the whole set. However, they both lack interface polish and focus on features over usability. At least two other readers focused on the special needs community (GoReader and IDEAL Group Reader) are based on code from these Open Source projects. However, even these suffer from quite basic usability and accessibility issues.

III. Proposed System

a) Dyslexia

Dyslexia is believed to be caused by both genetic and environmental factors.[4] Some cases run in families. It often occurs in people with attention deficit hyperactivity disorder (ADHD) and is associated with similar difficulties with numbers.[6] It may begin in adulthood as the result of a traumatic brain injury, stroke, or dementia or any other symptoms related to brain .[2] The underlying mechanisms of dyslexia are problems within the brain's language processing. Dyslexia is diagnosed through a series of tests of memory, spelling, vision, and reading skills and sometimes writing skills are included. Dyslexia is separate from reading difficulties caused by hearing or vision problems or by insufficient teaching.[4] Treatment involves adjusting teaching methods to meet the person's needs.[2] While not curing the underlying problem, it may decrease the degree of symptoms and also increase the ability to read. Treatments targeting vision are not effective. Dyslexia is the most common learning disability and occurs in all areas of the world.[4] It affects 3–7% of the population;[4] however, up to 20% may have some degree of symptoms. While dyslexia is more often diagnosed in men, it has been suggested that may be it affects men and women equally. Some believe that dyslexia should be the best considered as a different way of learning, with both positives and negatives. Dyslexia is thought to have two types of cause, one related to language processing and another to visual processing. It is considered a cognitive disorder, not a problem with intelligence. The latter usually cover a variety of reading skills, writing and deficits, and difficulties with distinct causes rather than a single condition. The British Dyslexia Association define describes dyslexia as "a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling" and it is characterized by "difficulties in phonological awareness, verbal memory and verbal processing speed".

Researchers have been trying to find the neurobiological basis of dyslexia since the condition was first identified in early 1881. For example, some have tried to associate the common problem among dyslexics of not being able to see letters clearly to abnormal development of their visual nerve cells and their brain. Modern techniques such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) have shown a correlation between both functional and structural differences in the brains of children with reading difficulties specially affected on dyslexia.

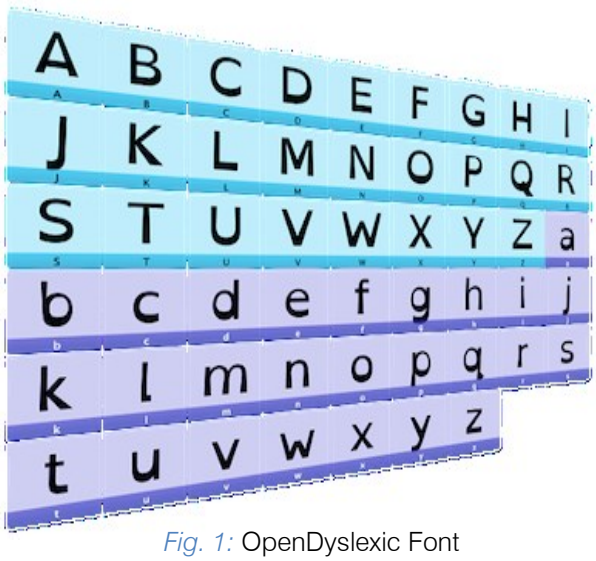

Fig. 1: OpenDyslexic Font

Some dyslexics that show less electrical activation in parts of the left hemisphere of the brain involved with reading, such as the inferior frontal gyrus, inferior parietal lobule, and the middle and ventral temporal cortex and some other important parts of the brain. Over the past years, brain activation studies using PET to study language have produced a breakthrough in the understanding of the neural basis of language. Neural bases for the visual lexicon and for auditory verbal short-term memory components have been proposed, with some implication that the observed neural manifestation of developmental dyslexia is something related to task-specific. fMRIs in dyslexics have provided important data which point to the interactive role of the cerebellum and cerebral cortex as well as other brain structures.

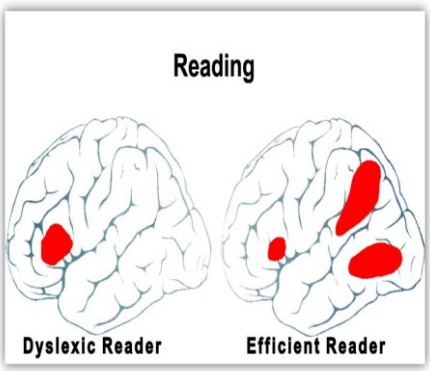

Fig. 2: Dyslexia Brain

b) Dyslexic Reader

Text recognition in images and videos is a research area which attempts to develop a computer system with the ability to automatically read the text from images. These days there is a huge demand in storing the information available in paper documents format in to a computer storage disk and then later reusing this information by searching process. One simple way to store information from these paper documents in to computer system is to first scan the documents and then store them as images. But to reuse this information it is very difficult to read the individual contents and searching the contents form the documents line-by-line and word-by-word. The challenges involved in this the font characteristics of the characters in paper documents and quality of images. Due to these challenges, computer is unable to recognize the characters while reading them. Thus there is a need of character recognition mechanisms to perform Document Image Analysis (DIA) which transforms documents in paper format to electronic format. In our application we provide a Real-time facility.

c) OCR and Mobile Vision API

OCR is process of classification of optical patterns contained in a digital image and in videos. The character recognition is achieved through segmentation, feature extraction and classification and preprocessing. This section starts with a brief background and history of OCR systems. Then the different techniques of OCR systems such as optical scanning, image acquisition, location segmentation, pre-processing, segmentation, representation, feature extraction, training and recognition and post-processing. The different applications of OCR systems are highlighted by the current status of the OCR systems. Finally, the future of the OCR systems is presented in our application. Optical character recognition (OCR) is process of classification of optical patterns contained in a digital image corresponding to alphanumeric or other characters. The character recognition is achieved through important steps of segmentation, feature extraction and classification. OCR has gained increasing attention in both academic research and in industry. It has been man's ancient dream to develop machines which replicate human functions. One such replication of human functions is reading of documents encompassing different forms of text. Over the last few

years machine reading has grown from dream to reality through the development of sufficient Optical character recognition (OCR) systems. OCR technology enables us to convert different types of documents such as scanned paper documents, pdf files or images captured by a digital camera into editable and searchable data. OCR systems have become one of the most successful applications of technology in pattern recognition and artificial intelligence fields. Though many commercial systems for performing OCR exist for a wide variety of applications, the available machines are still not able to compete with human reading capabilities with desired accuracy levels. The field of data science the data scientists help address this challenge. In recent years, recognition of text from natural image and video frame has got increased attention among the researchers due to its various complexities and challenges. Because of lower resolution, blurring effect, complex background, different fonts, color and variant alignment of text within images and video frames, etc., text recognition in such scenario is difficult. Most of the current approaches usually apply a binarization algorithm to convert them into binary images and next OCR is applied to get the most sufficient recognition result. Here, we present a novel approach based on color channel selection for text recognition from scene images and video frames. In the approach, at first, a color channel is automatically selected and then selected color channel is considered line-by-line for text recognition. Our text recognition framework is based on Hidden Markov Model (HMM) which uses Pyramidal Histogram of Oriented Gradient features extracted from selected color channel that are hidden from our eyes. From each sliding window of a color channel our color-channel selection approach analyzes the image properties from the sliding window and then using a Support Vector Machine (SVM) classifier is applied to select the color channel that will provide the best recognition results in the sliding window as we required.

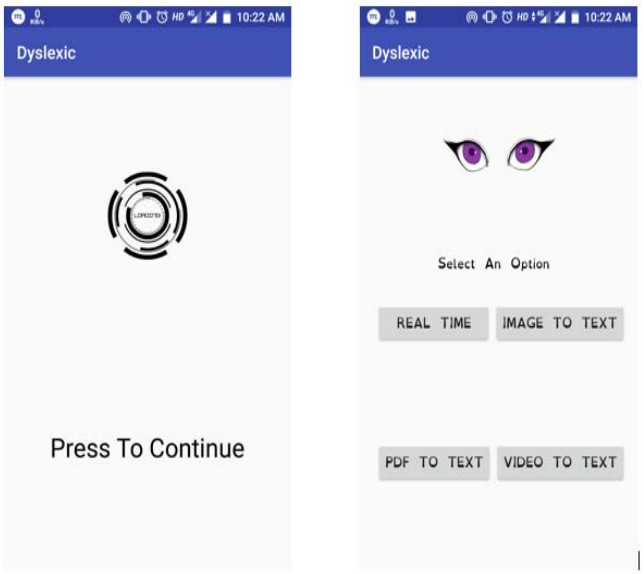

Fig. 3: Interface of the application

Google APIs is a set of application programming interfaces (APIs) in computer networks developed by Google which allow communication with Google Services and their integration to other services. Examples of these include Search, Gmail, Translate or Google Maps or Social Medias. Third-party apps can use these APIs to take advantage of or extend the functionality of the existing services that provide the facility to know about the application deeply. The APIs provide functionality like analytics, machine learning as a service or access to user data when permission to read the data is given. Another important example is an embedded Google map on a website, which can be achieved using the Static maps API, Places and GPS. API or Google Earth API. Usage of some of the APIs requires authentication and authorization using the OAuth 2.0 protocol for authorized accessing. OAuth 2.0 is a simple protocol. To start, it is necessary to obtain credentials from the Developers Console with their permission. After that the client app can request an access token from the Google Authorization Server, and uses that token for authorization when accessing a Google API service.

d) Real-Time Activity

In Real-Time activity we just focus the camera to which we want to read. In our application the corresponding text is converted in to OpenDyslexic font.

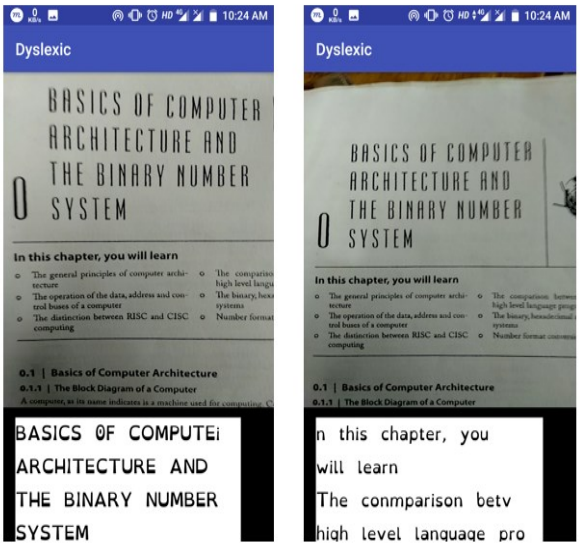

Fig. 4: Real-time Activity

e) Image to text

The need to convert scanned image to the corresponding text arises from the fact that scans are neither text searchable nor editable. This is a problem in settings such as offices that have to deal with high volume scanning and large batches of documents. While using OCR databases of files for specific data you can convert scanned image to text with to render it text searchable. OCR, which stands for optical character recognition, is a software tool that can recognize the text from a scan image or video and then convert the file into a text file. Once OCR has been performed on the scans we can use the search function to quickly locate the information, saving time and resources.

In our application OCR is used to extract text from images, and this text is displayed to the user in OpenDysexic font. As soon as the text is retrieved an additional option is given to the user which enables them to get the text to be read out loudly. The main issue by using OCR alone is that, it only process the image as it is loaded. But there exist chances that the text in the image can be in a different angle or the image can be taken with the camera placed in a different angle. In any of these cases the image needs to be rotated. So in our application we included the process of rotating image in all possible combinations and retrieving every possible text from it. To improve the performance we used multithreading which enabled us to keep one thread focused completely in rotating and placing each images in a queue while another thread pops out an image and performs the optical character recognition.

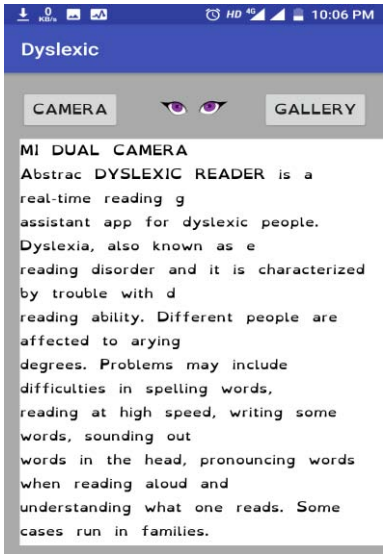

Fig. 5: Image-to-Text

f) PDF to Text

Another area where an assistance can be given to the dyslexic people is on the visualization of pdf documents. Our application provides a simple interface which enables the user to select a pdf file from the storage. The document s then processed and the text from the file is retrieved. The retrieved text is then displayed to the user in OpenDyslexic font. Also the entire text is read out clearly which enables the user to understand or recognize certain parts which they feel difficult to understand even in dyslexic font.

Fig. 6: PDF-to-Text

g) Video to Text

In the field of computer vision, text detection and recognition have gained plenty of attentions in recent years. The reason for such interest is due to easy availability of large amount of digital information from videos and scene images which contain very useful information like street name, location's address, traffic warning etc. Therefore, text extraction and recognition from this digital information are very effective and important in different text-based application like data mining, retrieval of images/videos from the large database etc. So we extended the extraction of text from images to extraction of text from videos. In our application we first extract all possible frames and then place them in a queue. The images from these queue is popped out and is later used for optical character recognition which enables the extraction of text from video. But to display the text along with video being played, the above mentioned method produces too much delay. To overcome this performance degradation multithreading is used. One thread is used to retrieve all possible frames and push them onto the queue while another thread pops each image from the queue and perform optical character recognition.

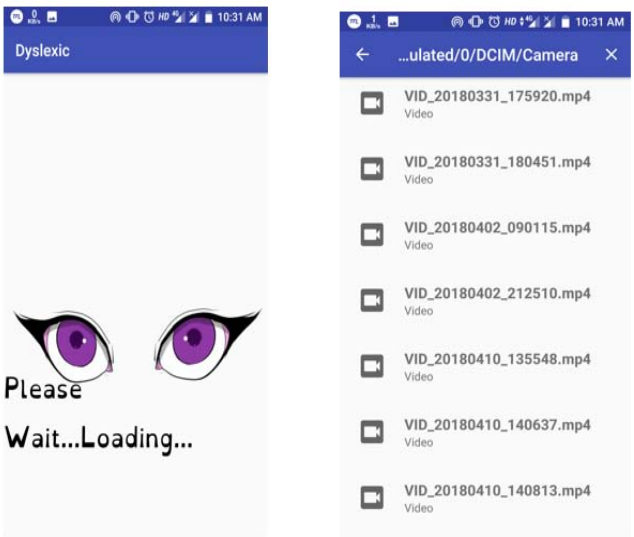

Fig. 7: Video-to-Text

IV. Conclusion and Future Work

The main objective of the proposed system that uses Google's mobile vision API & OCR. The detected text is then displayed to the user in Open Dyslexic font. Mobile vision API is regarded as the best real time OCR API for mobile devices. It provides good detection accuracy and real time detection capability. Though it does not feature real time detection, it has higher accuracy than mobile vision API. The mobile vision API is used for real time OCR and extracting text from small text areas such as sign boards etc. We extend image-to-text retrieval in to video-to-text retrieval. It can be performed by extracting the frames of videos, retrieving the text from the video and displayed it in the OpenDyslexic font. The performance can be improved by using threads in multitasking. The performance degradation is avoided by using multiple threads.

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We believe that by providing DPI Enhancement, De-skewing and Edge detection the pre-processing can be improved to more accurate level. Instead of using the provided trained data the accuracy of tesseract can be further improved by training new data. We can increase the overall performance of the app by implementing tesseract using NDK.

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