SELF-LEARNING BASED TRAINING DEVICE FOR PEOPLE WITH ALZHEIMER'S AND VISUALLY CHALLENGED

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Abstract— Alzheimer's disease frequently exhibits symptoms of visual impairment (AD). Visual interventions have the potential to help AD patients operate better, according to recent studies. Determining the profile of visual abnormalities in AD and potential processes driving these deficits are therefore necessary. Alzheimer's disease (AD) is a long-term, irreversible brain disorder that gradually impairs one's ability to think and remember things. Alzheimer's disease is one of the most frequent causes of dementia. Dementia is the loss of cognitive functioning, which includes thinking, remembering, and reasoning, as well as behavioral ability to the point where it affects day-to-day activities. In the medical industry, image processing is frequently used to identify disorders and support clinicians' observation-based decision-making. The objective of the study is to detect Alzheimer's disease as early as possible, allowing patients to receive treatment before their brains undergo irreversible changes. To process the brain's Magnetic Resonance Imaging (MRI), we suggest the image processing method. We propose a camera-based detection system that enables individuals with vision problems or Alzheimer's disease to read written labels or books, recognise the names of things in real-time, and recognise the names of well-known individuals using face identification and sign languages. To read the texts from books, we convert the image to text using an OCR (Optical Character Recognition) approach. after text has been created from the images. By using machine learning, we will be able to convert sign language, recognised faces, and live objects into text. The projected output will be converted to audio using the Text to Speech API.

I. Introduction

Artificial intelligence is the capacity of robots to replicate or enhance human intelligence, including logic and experience-based learning (AI). Artificial intelligence is now used in a variety of different products and services, despite having been used in computer programmes for a very long time. To recognise the objects in an image, certain digital cameras, for instance, use artificial intelligence algorithms. Researchers predict that in the future, artificial intelligence will be used in smart energy grids and many other cutting-edge applications. AI uses techniques from probability theory, economics, and algorithm design to resolve problems in the real world. The field of AI also makes use of mathematics, psychology, languages, and computer science. Tools for modeling and solving the resulting problems are provided by mathematics, and tools for creating and constructing algorithms are provided by computer science.

Alzheimer's disease frequently exhibits symptoms of visual impairment (AD). Visual interventions have the potential to help AD patients operate better, according to recent studies. Determining the profile of visual abnormalities in AD and potential processes driving these deficits are therefore necessary. Alzheimer's disease (AD) is a long-term, irreversible brain disorder that gradually impairs one's ability to think and remember things. Alzheimer's disease is one of the most frequent causes of dementia. The loss of cognitive abilities, such as thinking, remembering, and reasoning, as well as behavioral skills to the extent that it interferes with day-to-day activities is known as dementia. In the medical industry, image processing is frequently used to identify disorders and support clinicians' observation-based decision-making.

The brain shrinks and brain cells die as a result of Alzheimer's disease, a neurologic degenerative illness. The most common form of dementia, Alzheimer's disease affects a person's ability to operate independently and is characterized by a continuous decline in cognitive, behavioral, and social skills. Alzheimer's patients can't take care of themselves and need regular assistance. We have created a technique that will help them by employing image processing to analyze a brain MRI in order to find early signs of Alzheimer's disease. They may now be able to recognize their family members using face recognition and sign language, detect items and text using object character recognition, and convert the output to audio utilizing text-to-speech API thanks to a few new additions. So, we are using an innovative and artificial intelligence camera-based detection system for visually impaired and Alzheimer's patients in order to develop these ideas.

II. Proposed System

In this proposed system we have 4 configurations that are being performed, they are: -

1. Family Facial Recognition
2. Optical Character Recognition
3. Real-Time Object Detection
4. Sign to Speech using Tensor Flow and Keras Pre-trained Model

FAMILY FACIAL RECOGNITION –

It involves two steps that is enrollment and testing. These have three common steps: Face acquisition, pre-processing, and feature extraction. The only extra step in enrollment is that after the three pieces of information are processed, they are collected as a database. The enrollment and testing together are made as classifiers, in which we have two parts that are once after the patient recognizes the face of the family member and if it is matching with the database, we get an output of "Yes" which means it is matched but if it is not matched then we get an output of "No" that is not matched. This facial recognition recognizes the family member's face and captures the facial identity and stores the data and helps the Alzheimer's patient by wearing this camera to help them recognize the family member.

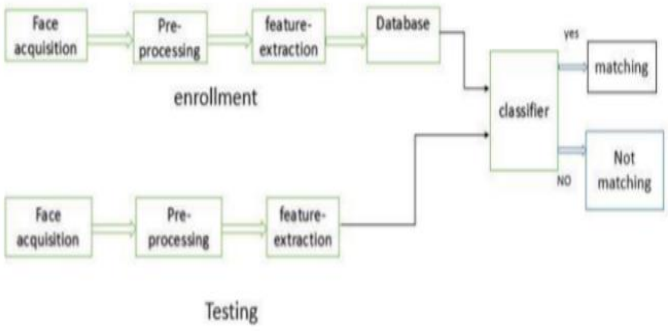


Figure 1. System Architecture of Family Facial Recognition

OPTICAL CHARACTER RECOGNITION –

On wearing the camera, the first step involved is Image Acquisition i.e., the act of obtaining an image from a source. After obtaining the image then the image is pre-processed and after that, the features are extracted from the image. The extracted image is then translated to text as the following stage, and the text is then presented as the last step. This method helps Alzheimer's to identify objects and read labels on books or objects.

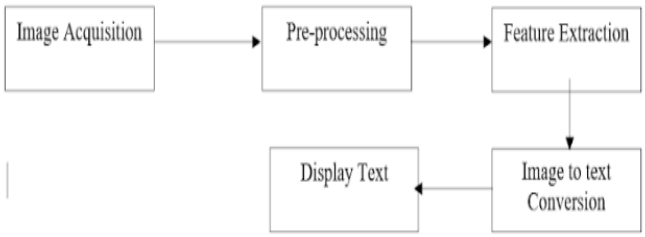


Figure 2. System Architecture of Optical Character Recognition

REAL-TIME OBJECT DETECTION-

On wearing the camera, the first step involved is Image Acquisition i.e., the act of obtaining an image from a source. After obtaining the image then the image is pre-processed and after that, the features are extracted from the image. The next step is that all the database is collected and stored and it checks if the object is recognized and matched. The last step is that the output is displayed, whether the recognized object is matched and found in the database or not. This method helps Alzheimer's patients to recognize real-time objects like balls, cars, glasses, etc. The output is in the form of text converted to Audio.

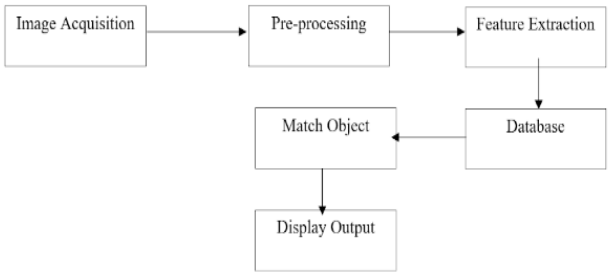


Figure 3. System Architecture of Real-time Object Detection

SIGN TO SPEECH USING TENSOR FLOW AND KERAS PRE-TRAINED MODEL-

On wearing the camera, the first step involved is Image Acquisition i.e., the act of obtaining an image from a source. After obtaining the image then the image is pre-processed and after that, the features are extracted from the image. The next step is that all the database is collected and stored. After which the predicted signs are recognized and checked if it is matched with the database and the output is displayed. This helps Alzheimer's patients to identify sign languages and it converts them to text and finally to audio for the patients.

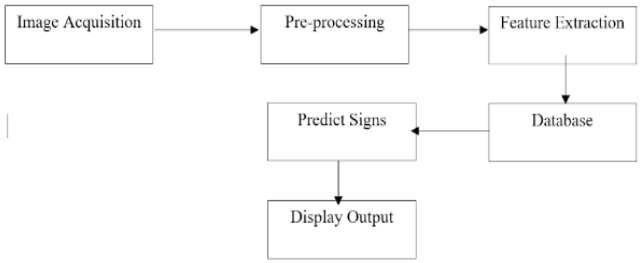


Figure 4. System Architecture of Sign to Speech

3.1. Hardware components

An optical device that can record an image is a camera. The majority of cameras can capture 2D images, and some can even capture 3D ones. The majority of cameras are essentially sealed boxes with a tiny hole (the aperture) for light to pass through so that they can be used to take pictures on surfaces that are sensitive to light (usually a digital sensor or photographic film). Cameras employ a number of strategies to control the amount of light that reaches the light-sensitive surface. Lenses focus on the light entering the camera. You can either make the aperture larger or smaller. The length of time the photosensitive surface is exposed to light is controlled by a shutter mechanism. The still-image camera is the main tool in photography. Images that have been taken can later be reproduced using photography, digital imaging, or photographic printing. Cinematography, videography, and filmmaking are related artistic disciplines in the world of moving-image cameras.

3.2. Software components

An integrated development environment (IDE) for Python is called IDLE (Integrated Development and Learning Environment). The IDLE module is by default included in the Python installer for Windows. Linux Python distributions do not by default include IDLE. It must be set up utilizing the appropriate package managers. Similar to Python Shell, IDLE enables the creation, editing, and execution of Python programs as well as single-statement execution. The fully featured text editor in IDLE, which offers features like syntax highlighting, autocompletion, and smart indent, may be used to write Python scripts. Moreover, it contains a debugger with step and breakpoint capabilities.

For image processing, machine learning, and computer vision, people use the enormous open-source package known as OpenCV. Today, it contributes significantly to real-time operation, which is essential in contemporary systems. With it, one can search for faces, objects, and even human handwriting in images and movies. When used with a number of libraries, like as NumPy, Python can process the OpenCV array structure for analysis. To identify an image pattern and its many features, we use vector space and mathematical operations on these features. The first version of OpenCV was 1.0. Because it is offered under a BSD license, OpenCV is free for both academic and business use. It features C++, C, Python, and Java interfaces and supports Windows, Linux, Mac OS, iOS, and Android. When OpenCV was created, real-time applications for increased processing effectiveness were the main focus. Everything is written in C/C++ that has been optimized to take advantage of multi-core processing.

III. Result and Analysis

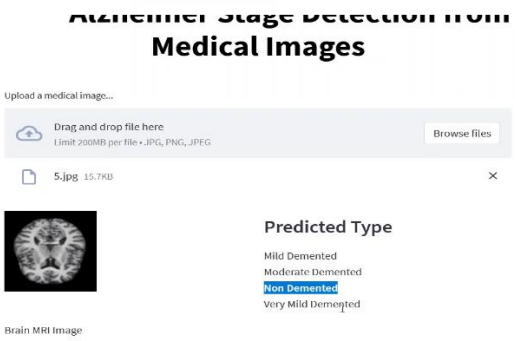


Figure 5. MRI images

Figure 5, shows that when you drop in the MRI images of the patient into the medical images uploading box then it analysis the state of the patient. There are four different forms of mental states: Extremely mild delusional, Mildly delusional, Moderately delusional, and Non-demented. As a result, we can determine the patient's exact condition and whether they have Alzheimer's disease based on the provided photographs. The patient's expected type is "NON-DEMENTED," according to this graph.

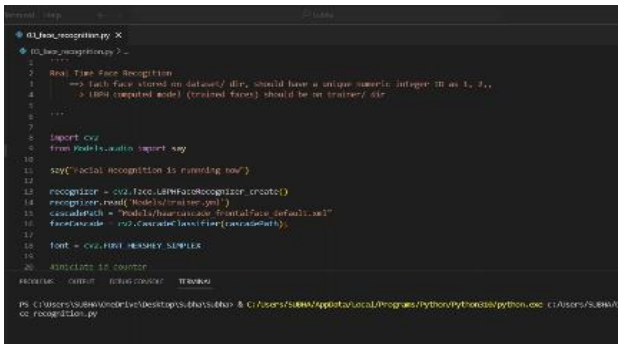


Figure 6. The input of Facial Recognition

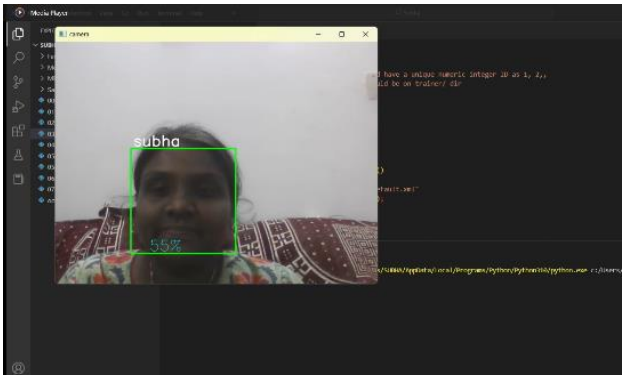


Figure 7. The output of Facial Recognition

Figure 6, shows that when a person looks in front of the camera the camera reads the person's face and recognizes it.

Figure 7, shows that once the face is identified with the database then immediately an audio plays stating the person's name.

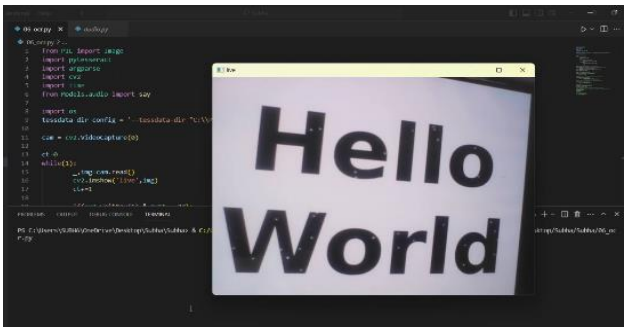


Figure 8. OCR input

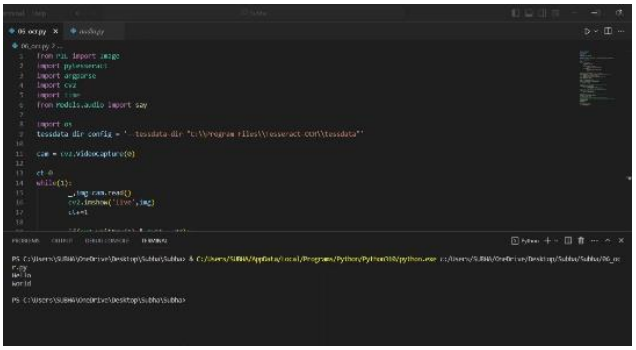
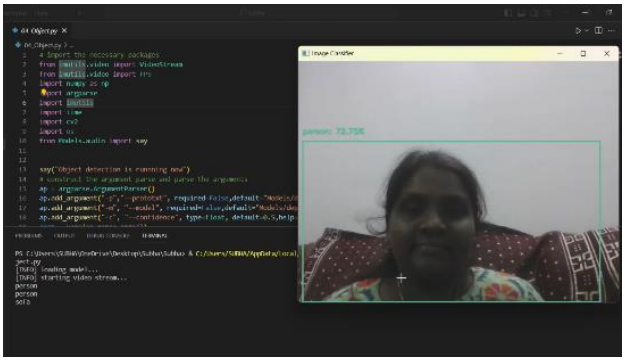


Figure 9. OCR output

Figure 8, shows that when a word on a book or label is brought in front of the camera and the camera recognizes it.

Figure 9 shows that once the word is recognized the output of the word is displayed as well as an audio is heard stating what the word is. For example- "Hello world".



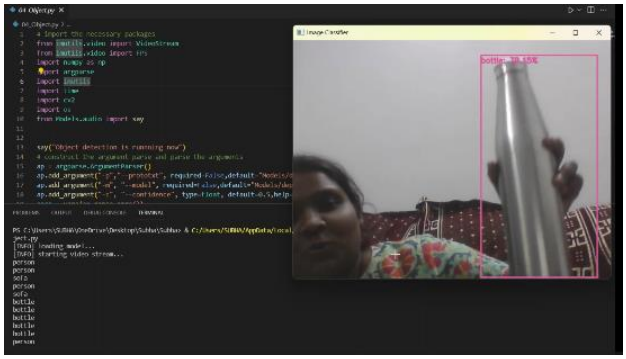
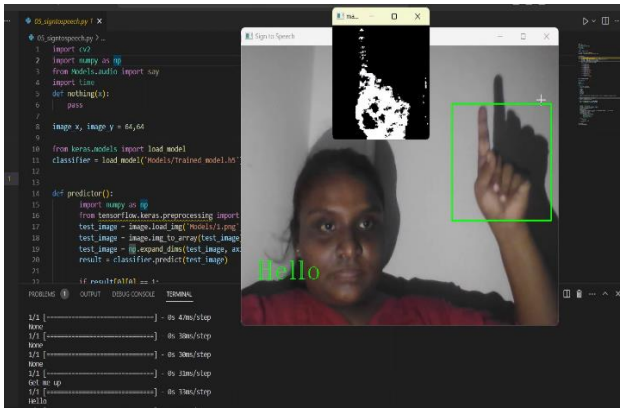


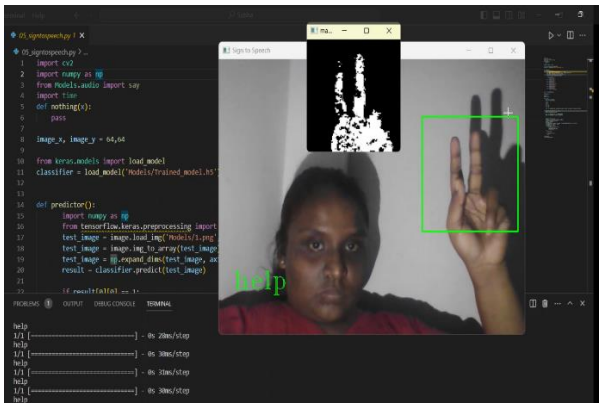
Figure 10. Real-time Object detection

Figure 10, shows that when a person comes in contact with the camera then it immediately detects the person and the audio plays stating it's a person, while it is the same way for a bottle.

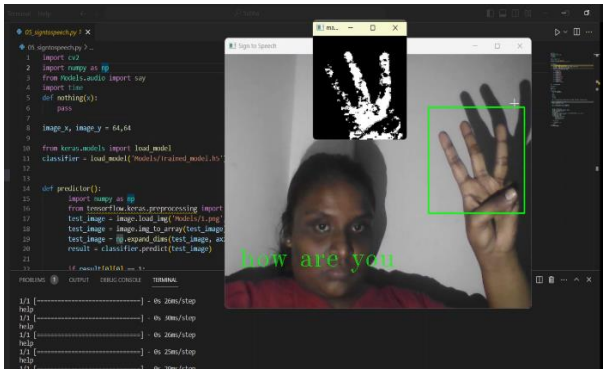
So, using this camera we can help Alzheimer's patients recognize family members, real-time objects, Object character recognition, and Sign to speech.



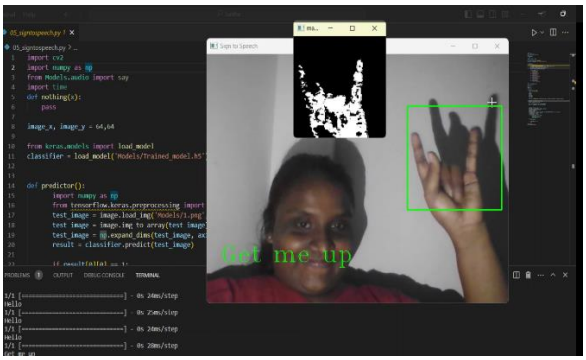
(A)



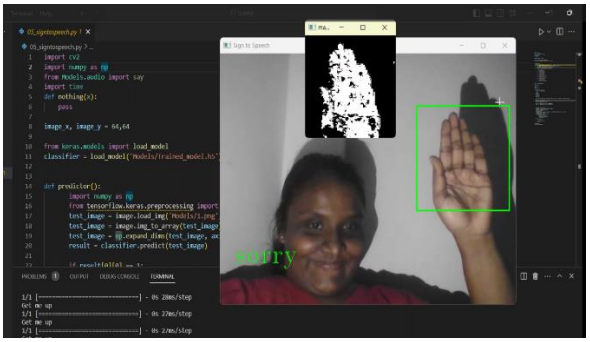
(B)



(C)



(D)



(E)

Figure 11 (A – E). Sign to Speech Output

Figure 11 A, shows that when a person in front of the camera raises one finger demonstrating a sign, it means "HELLO".

Figure 11 B, shows that when a person in front of the camera raises two fingers demonstrating a sign, it means "HELP".

Figure 11 C, shows that when a person in front of the camera raises three fingers demonstrating a sign, it means "HOW ARE YOU".

Figure 11 D, shows that when a person in front of the camera raises the thumb, index finger, and pinky finger demonstrating a sign, it means "GET ME UP".

Figure 11 E, shows that when a person in front of the camera raises all five fingers demonstrating a sign, it means "SORRY".

IV. Conclusion

Because of this, we can determine the type of Alzheimer's in our research, Early Detection of Alzheimer's Using MRI Imaging, by looking at the uploaded images. FamilyMember Recognition for Identifying People in the Home, Realtime Object Detection to Identify Objects and Pets, Gesture Recognition for Immediate Audio based Support also known as Signal to speech, OCR – Optical Character Recognition to Help Read books, labels, and words, etc. are achieved and made easy for the patients to utilize so that they don't require anyone to assist them at any time. It is also helpful for doctors to identify Alzheimer's at an early stage and help the patient recover from it before any irreversible changes take place in their brain. So, this project is very much helpful for both the patients as well as the doctors to deal with Alzheimer's.

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