Title:

Air Pad using Python and OpenCV

Name of the team members

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Research Paper Summary

The research paper relevant to our project is named “Air Canvas Application using OpenCV and Numpy in Python”. The research paper is written by Prof. S.U. Saoji, Nishtha Dua, Akash Kumar Choudhary and Bharat Phogat published the International Research Journal of Engineering and Technology(IRJET) in August 2021.

The main goal of conducting this project mentioned by them is to remove the necessity of any drawing tools or stationary and use the concept of digital art for communication. Even in the age of digital art, this project avoids the use of a keyboard, touch-screen surface, electronic hand gloves, stylus, digital pen, etc. This project uses only finger tips to create a colorful written process which vey much feasible for any sort of communication.

This paper uses the following methodology for conducting the project:

1. Fingertip Detection Model
2. Fingertip Recognition Dataset Creation
3. Fingertip Recognition Model Training

There are some challenges and limitations to the project. The existing system works only with the finger and has no highlighter, color, or anything related. Identifying from RGB images without a depth sensor and identifying and characterizing objects such as fingers is a major challenge. The system writes from above using a single RGB camera. It is not possible to track the up and down movement of the pen because it cannot measure depth. Therefore, the entire fingertip trajectory is traced, and the resulting image is ridiculous and unrecognized by the model.

The main point of interest in choosing this paper is the detailed discussion of the project and its methodology. The project itself is very unique and has a lot of potential

applications as the world is moving forward to more portability and easy going. This paper has so many reference papers that also help in its genuinity and moreover help in conducting our project. By following this paper we can get an idea about the methodology that needs to be applied in our project.

Project Description

The main goal of this project is to create an environment where users do not need any drawing pad or touch screen to draw or write anything. The user just needs to use their fingertips in the air to write an alphabet or draw something. During the COVID-19 lockdown, we had to go through online classes. In live classes, it is very difficult to draw without a drawing pad or touch screen on the whiteboard or on the screen because not everyone has a pad or touch screen with them. So to ease this problem we are proposing this model which will help everyone. The users just have to use their fingers in front of their camera and write in the air. The model will automatically detect the movement of the finger and show whatever the user is writing or drawing.

We will mainly use OpenCV computer vision techniques to build this project. We are using python in this project because of its exhaustive libraries and easy-to-use syntax.
Detect and track the colors used to achieve the goal. Color markers are detected and a mask is generated.

Firstly, Object color tracking is at your fingertips. First, the incoming webcam image must be converted to the HSV color space for fingertip color object detection. It will convert the incoming image to HSV space, which is a very suitable and perfect color space for color tracking. Now we will create a trackbar to align the HSV values in the required color range of the object of the color that we have placed on the finger. Then a range will be created from the trackbar which is a numpy structure used to pass to the cv2.inrange() function. This function returns the mask on the colored object. This mask is a black and white image with white pixels in the desired color position.

Secondly, Detecting the mask contour of a colored object. After detecting the mask in the Air, it is time to locate its center to draw the line. Here in the code, we do some morphological manipulation on the mask, to remove impurities and easily detect edges.

Thirdly, Drawing Lines Using Contour's Position. The real logic behind this Computer Vision project is we are going to form a python deque. It is a data structure that will store the position of the contour on each successive frame and we will use these stored points to create a line using OpenCV's drawing functions. Now we will use the position

of the border to decide if we want to click a button or if we want to draw on the sheet. We will lay out some buttons at the top of the area, if the pointer gets to their area we will fire their modal. We will have four buttons on the area, drawn with OpenCV.

Finally, We will plot all the points on the locations stored in the deques, with the corresponding color.

Algorithm that will be used for this project:

1. Start reading the frame and convert the captured frame to HSV color space. (Only color recognition)
2. Prepare the canvas frame and place the corresponding ink button on it.
3. Adjust the value on the track bar to find the colored marker mask.
4. Preparation of mask by morphological operation. (Erosion and expansion)
5. Recognize contours, find the center coordinates of the largest contours, and give them

An array of consecutive frames. (Array for drawing points on the canvas)

6. Finally, drag the points stored in the array to the frame and canvas.

As the baseline tools, we will be using Python, Numpy and OpenCV.

Team members Strengths

The main strength of the team is Teamwork. The team members are well proficient in research and coding applications. The members will be using their research skills and coding strengths in building an accurate productive project.