Motion Canvas

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Abstract-

Visual pattern recognition, particularly hand gesture recognition, has been an intriguing area of research for drawing in air. This method has the potential to improve the interaction between humans and computers in various applications, leading to a more natural Human-Computer Interaction (HCI). The proposed technique consists of two main tasks: fingertip tracking and plotting the coordinates of the fingertip on the screen in a desired colour. This approach requires only a camera and eliminates the need for a keypad, pen, or glove. The air canvas concept extends beyond traditional two-dimensional rectangular canvases, as it involves virtually drawing on the air through hand gestures without touching any surface. To accomplish this, computer vision techniques in the OpenCV library are utilized. The project's objectives are achieved through finger-tip detection and tracking. The motion canvas project is particularly relevant in light of the COVID-19 pandemic, as it allows for contactless virtual drawing. This technology has the potential to become a powerful communication tool for the deaf, senior citizens, especially abled individuals, and children for educational purposes.

KEYWORDS-

Computer vision, OpenCV, hand detection, gesture recognition, drawing, canvas, finger-tip tracking, human computer interaction, naturalness, COVID-19, communication, visual pattern recognition.

1 INTRODUCTION

In today's world, remote work and online communication have become the norm, making digital tools more important than ever. One such tool is the "Motion Canvas," an application that allows users to draw and erase on a virtual canvas using hand gestures. The system detects four hand gestures: DRAW, HOVER, ERASE, and TRANSLATE, which are made by pointing the index finger out and keeping the other fingers tucked in, pointing the index and middle fingers out and keeping the ring and pinky fingers tucked in, pointing the index, middle, and ring fingers out and keeping the pinky finger tucked in, and pointing the index, middle, and ring fingers out and keeping the pinky finger and thumb tucked in, respectively.

The application uses a hand detection algorithm to track hand movements and translate them into actions on the canvas. This tool is especially useful for remote collaboration and brainstorming, where multiple users can draw and erase ideas in real-time. Additionally, the application has a cherry on the top feature: a color is generated randomly every time the user opens the application, making the experience more dynamic and exciting.

Using such technologies not only facilitates remote work but also reduces the need for physical contact and provides a more hygienic option. Overall, Motion Canvas is a promising tool that can revolutionize the way we collaborate and communicate in the digital age.

2 PROBLEM STATEMENT

The goal of this project is to create an interactive drawing canvas that allows the user to draw, erase, hover, and translate the drawing using hand gestures detected by a computer vision algorithm. The code takes input from the default webcam of the PC and uses OpenCV and Mediapipe libraries to detect hand gestures and landmarks. The program identifies specific hand gestures using a threshold value and tracks the index and middle fingers to draw or erase on the canvas. It also uses the position of the pinky finger to translate the drawing on the canvas. The program displays the drawing in real-time on the screen and allows the user to quit the program by pressing the 'q' or 'esc' key. The main objective is to create an intuitive and engaging interface for drawing that doesn't require the use of a mouse or stylus, making it more accessible and user-friendly for people with different levels of experience in drawing.

3 PROJECT SCOPE

The project aims to create a motion-controlled canvas application using hand gestures detected by a webcam. The application allows the user to draw or erase the canvas by making specific hand gestures. The canvas is displayed in real-time on the screen, and the user can control the size of the brush and eraser. The user can also switch between drawing and erasing modes by making specific gestures. In addition, the user can use hand gestures to move the canvas around the screen.

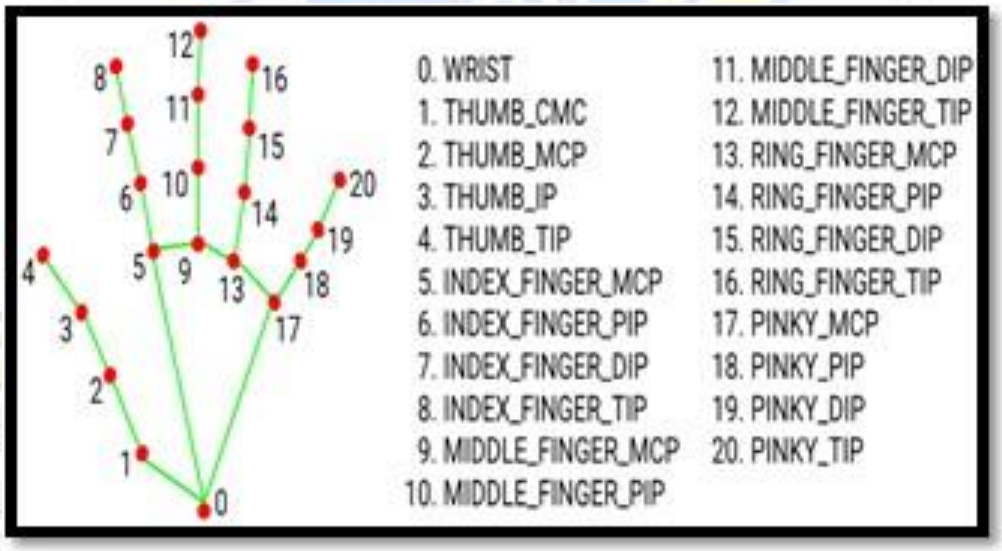
The application uses the OpenCV and Media pipe libraries to process video from the webcam and detect hand gestures. The canvas is implemented using a 2D grid of pixels, and each pixel's color is changed based on the user's actions. The canvas can be cleared, and the user can save their artwork as an image file.
The project's main goals are to provide an interactive and intuitive way for users to draw and erase on a canvas using hand gestures, and to showcase the power of computer vision and machine learning in real-time applications.

4 MOTIVATION

The driving force behind this project is to develop an innovative "motion canvas" software that enables users to effortlessly draw, erase and move the shapes on a digital canvas by simply using their hand gestures. The goal is to offer an engaging and interactive drawing experience that eliminates the need for traditional drawing tools. The project seeks to investigate the possibilities of utilizing hand gestures as a means of software control, specifically in the field of art and design. As a result, this project can serve as a game-changing tool for artists, designers and enthusiasts seeking a fresh, exciting approach to creating digital art and expressing their creativity.

5 HAND TRACKING

Hand tracking is a crucial component in various applications ranging from gesture recognition, human-computer interaction to virtual reality. In recent years, deep learning-based methods have emerged as the de facto standard for accurate and efficient hand tracking. Among these methods, the Media Pipe Hand Tracking solution developed by Google has gained significant popularity owing to its high accuracy, robustness, and real-time performance.
Media Pipe Hand Tracking leverages a powerful deep learning-based architecture known as the Blaze Palm, which uses a lightweight and efficient backbone network combined with a single-stage regression approach. This architecture is designed to achieve high accuracy and robustness with minimal computational overhead. Additionally, MediaPipe Hand Tracking provides a comprehensive set of features such as hand landmark detection, hand gesture recognition, hand segmentation and hand tracking, making it a versatile solution for various applications.
To utilize MediaPipe Hand Tracking for other tasks, developers can leverage the provided code and APIs. For example, to use hand tracking for controlling a robotic arm, developers can extract the hand landmarks detected by the MediaPipe Hand Tracking and use them as input for the robotic arm's control algorithm. Similarly, for hand gesture recognition, developers can use the pre-trained gesture recognition model provided by MediaPipe or train their own model using the hand landmarks and associated labels.
In conclusion, MediaPipe Hand Tracking is a powerful and versatile solution for accurate and efficient hand tracking in various applications. With its robust architecture and comprehensive set of features, it is an asset for developers and researchers in the field of human-computer interaction, virtual reality and robotics.



6 CODE REQUIREMENTS

This application is written in Python 3.8 and it uses the very famous OpenCV library. OpenCV is a computer vision and machine learning software library that includes many common image analysis algorithms that will help us build custom, intelligent computer vision applications.

7 VIDEO TRACKING

To perform video tracking, an algorithm analyzes sequential video frames and outputs the movementof targets between the frames. There are a variety of algorithms, each having strengths and weaknesses. Considering the intended use is important when choosing which algorithm to use. There are two major components of a visual tracking system: target representation and localization, as well as filtering and data association.

Video tracking is the process of locating a moving object (or multiple objects) over time using a camera. It has a variety of uses, some of which are: human-computer interaction, security and surveillance, video communicationand compression, augmented reality, traffic control, medical imaging, and video editing.

8 LIBRARIES

1. Python OpenCV and Numpy

OpenCV is a widely used open-source library for computer vision. It includes several ready-to-use computer vision algorithms Python is becoming the standard programming language for AI and NumPy provides data structures used to deploy OpenCV with Python. NumPy, which stands for Numerical Python, is a library consisting of multidimensional array objects and a collection of routines for processing those arrays. Using NumPy, mathematical and logical operations on arrays can be performed. NumPy is a Python package. It stands for 'Numerical Python.

2. Media Pipe:

Media Pipe Hands is a high-fidelity hand and finger tracking solution. Media pipe is a cross-platform library developed by Google that provides amazing ready-to-use ML solutions for computer vision tasks. OpenCV libraryin python is a computer vision library that is widely used for image analysis, image processing, detection, recognition, etc. Media Pipe can achieve its speed thanks to the use of multi-threading. Such development techniques are generally difficult, but Media Pipe takes the reins and does them for you, so long as you follow good graph-making practices.

Result

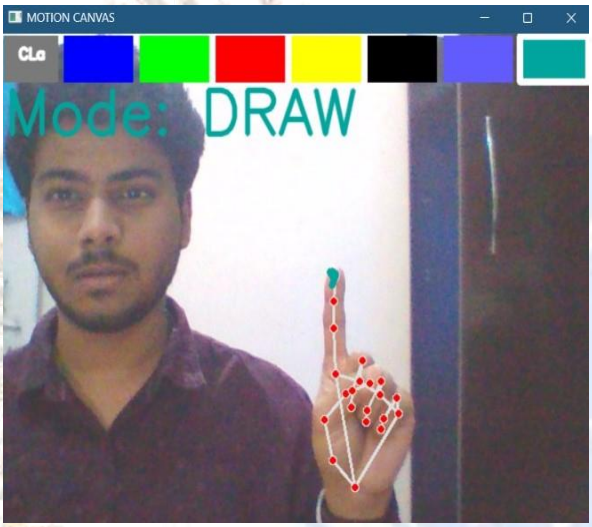


Fig 1

Fig 2

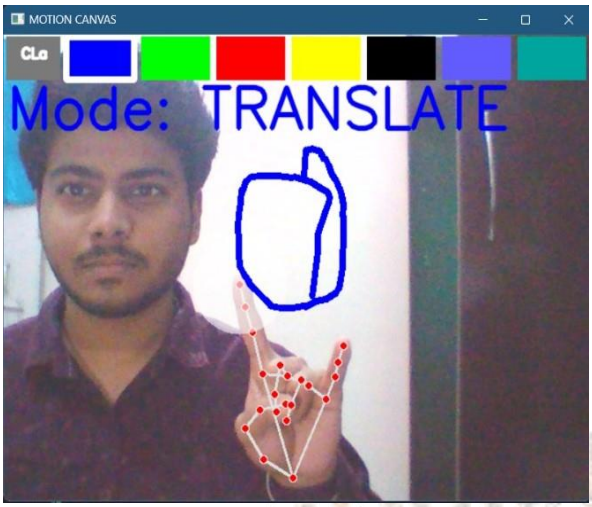


Fig 3

9 CONCLUSION

This project has the capability to challenge traditional drawing/writing methods. This project will be an excellentexample for people to interact with digital world. Air Canvas can make text come alive ! This project is basedon a visual based pointing method which allows drawing in air using camera. Hence, we are able to now draw, writein the air with the help of this project. This work can further improved by including saving users final work or watching their process as a playback animation can also be a unique feature that resembles real creativity software. Therefore, we conclude that, we have successfully implemented this project.

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