Image Processing Report

"Rock Paper Scissors"

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Introduction

For the course of image processing, I was asked to make a project about a subject of my own choosing that its main goal is to familiarise with processing images and OpenCV.

In this report I will show you how I used topics learned in this course as well as other resources to make my project which is a game of "Rock Paper Scissors". I will then explain my strategies, my results and ideas for improvements.

Context

In the Image Processing course, we leaned in 3 sessions how to use OpenCV and NumPy to modify and interact with images and our own camera feed. The fourth session consists of creating a project using those tools. I chose the creation of a "Rock Paper Scissors" game because games are fun, and who doesn't like games.

So by using differents assets amongst:

- Changing the size, colour, orientation, dimentions and form of an image.
- Identifying parts of an image
- Detecting shapes and movement in an image
- Combining images and logical operations

I created a game of Rock Paper Scissors with some of those assets.

Identification and challenges

To achieve this goal there were some objectives that were crucial for this to function.

I had to get access to my camera feed and be able to use it to find what I need.

I had to find a way to isolate the hand (or two hands if two players want to play), then isolate every finger from each hand, then isolate every part of the finger to be able to distinguish everything part of the hand and its movement.

After that I had to differenciate the gestures between Rock, Paper and Scissors.

And for the last part I had to put some scoreboard or a visual representation of what my program sees and displays.

Strategy

So for the strategy I began by trying to isolate the hand like in the last exercise of the third sessions, I managed to isolate the hand but i stugled to dissosiate every finger and its bendable parts, and the movement management was a problem so I couldn't make its detection smooth.

So I went on the Internet looking for guides or any tools that could help me with that and I found Mediapipe, which had implelented hand and gesture recognition.
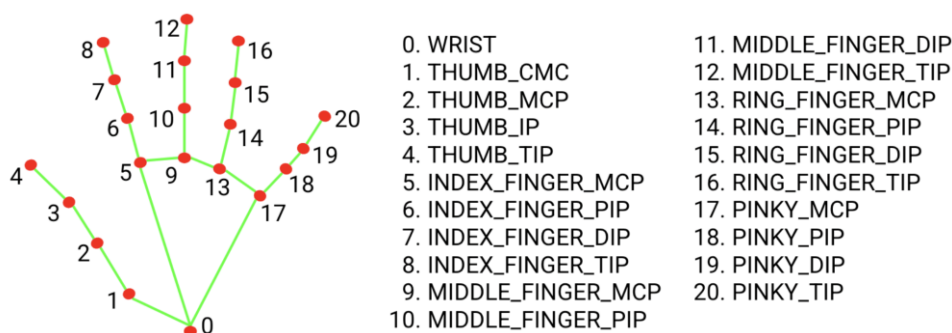
I red about that and the parameters used in the code and learned how to use it.

With the documents and ressources that I found I began experimenting and managed to properly identify the hand and the position of each finger.

But my code wasn't really organised and a bit clunky, so i searched againg if there were some examples of the usage of mediapipe and found a video with not that complicated coding and the objectives that I needed. I folowed its instructions and managed to reproduce what it showed and my hand gesture recognition was working.

With that I was able to recognise if with my hands I made rock, paper or scissors and make it into a game of "Rock Paper Scissors" for 2 players with visual indications of the fingers and how my code responded to each gesture.

I then took the code further and to show my understanding of the concepts used in my project, I added a scoreboard and another gesture whitch is the "thumbs up" that was used to begin the game. To be able to add my gesture I had to read about what the parameters needed to make my gesture in the documents that is on the bottom of the report and I created my "thunbs up" gesture usig a graph of the position of every part of the hand. I then added some other texts some colours and the game was done.

0. WRIST	11. MIDDLE_FINGER_DIP
1. THUMB_CMC	12. MIDDLE_FINGER_TIP
2. THUMB_MCP	13. RING_FINGER_MCP
3. THUMB_IP	14. RING_FINGER_PIP
4. THUMB_TIP	15. RING_FINGER_DIP
5. INDEX_FINGER_MCP	16. RING_FINGER_TIP
6. INDEX_FINGER_PIP	17. PINKY_MCP
7. INDEX_FINGER_DIP	18. PINKY_PIP
8. INDEX_FINGER_TIP	19. PINKY_DIP
9. MIDDLE_FINGER_MCP	20. PINKY_TIP
10. MIDDLE_FINGER_PIP	

Results and discussion

The game was functional and the hand gestures were recognised by the program without much of a struggle, they were smooth and precise enough for the game to function. There is a scoreboard displayed on the screen at all times and the sceen showed every information needed to play the game.

But it wasn't perfect, there were elements that could be better:

- The hand recognition is only functionning if the hand gestures are upright
- There are some positions of the fingers that could count as rock, paper or scissors because the code mainly focuses on the 3 last fingers of the hand (the middle,ring and pinky fingers except rock and thumbs formations)
- The program gets mixed up if the players dissapear or reappear in the frame.

Improvements

To tackle those issues i came up with these solutions:

- For the orientation of the gesture recognition I could stick a plane to each hand that calculates the fingers position with the cetner or the bottom of the hand as the origin so it

could be recognisable in any orientation and if it loses track of a player it recognise if it was on the left or right part of the screen or if it was a right or left hand.

- For the gestures that are recognised as paper, rock or scissors that aren't any of those I could define some sort of a hit box that every point of each finger has to be in to be counted as one of the positions and those hit boxes will have to rotate witch the hand and be glued to its reference plane so it can work in every position.
- I could make an end game if any of the players obaint a required score.
- I could implement a menu and other gestures or movements to navigate in the game menus and maybe turn on/off some visual effects or change colour of the hand and other aesthetics.
- I could add a single player mode with the comuter generating random gestures or other game mods.
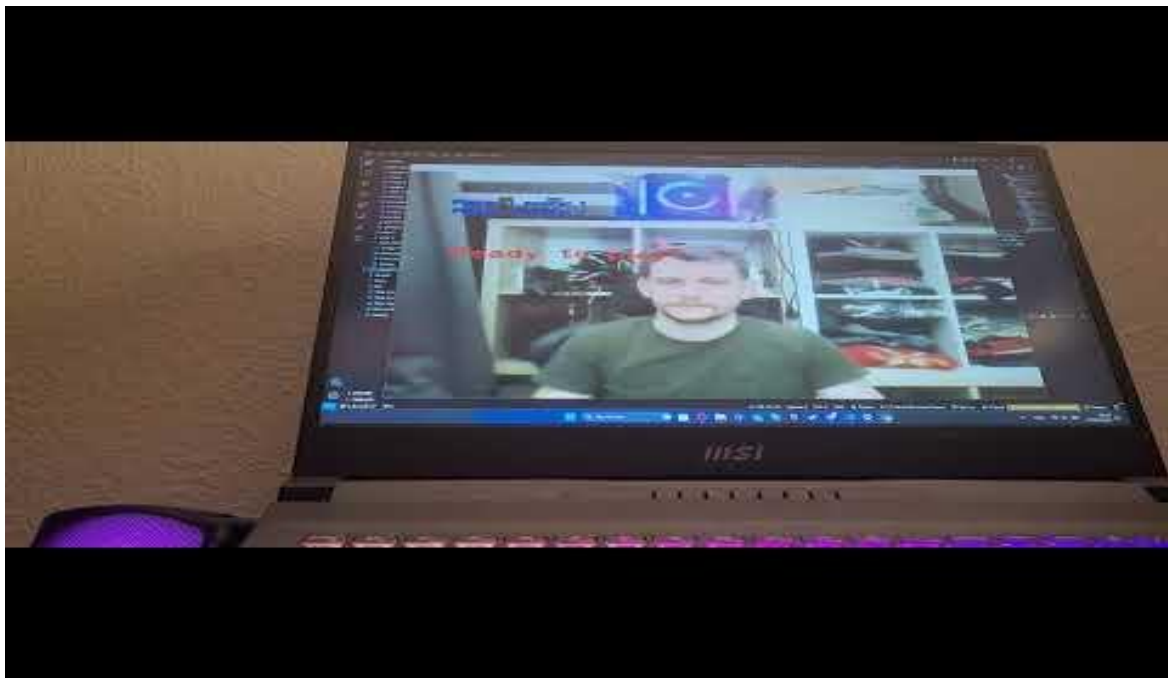- I could add sounds to have an audio feedback if a point is made or for the countdown

Disclosure and anexes

My Git repository:

https://github.com/Sz-Adrian/Projet-Image-Processing/tree/main/Computer%20Vision%20Project%20Adrian%20Szydlowski%2018303

My demonstration video link:

https://youtu.be/YwDRFmi1Mmw

I used asseds learned in the course like OpneCV, NumPy and external ressources.

To be able to make this project I used Mediapipe and based my code on a youtube video that the links are below.

Documentations about MediaPipe:

https://developers.google.com/mediapipe/solutions/vision/gesture_recognizer/python

https://developers.google.com/mediapipe/solutions/vision/gesture_recognizer

Youtube video:

https://www.youtube.com/watch?v=5Hh7tOcgP0U