PROJECT REPORT

ON

ROCK PAPER SCISSORS GAME USING COMPUTER VISION

Name: Ankit Sharma

Email: kumarankitx022@gmail.com

Mobile: 7677241423

Introduction

Rock paper scissors is a very popular game played in every part of the world. This game requires two or more players to show hand sign "rock" using closed fist, "paper" using all fingers stretched and showing the palm of the hand and "scissors" using index and middle finger stretched apart and other fingers closed. In this project we can play using computer the "rock paper scissors" game for fun and enjoyment.

A player who chooses rock will win by another player who chooses scissors but loose by the player who chooses paper; a player with paper will lose by the player with the scissors.

If both players choose the same then the game is tied. Rock paper scissors game is mainly played among kids.

Motivation

The motivation behind this project is to allow player to play games and have fun that helps to relieve stress. Players can have fun and spend time playing with the computer. The main motivation behind the project is to let patients living in isolation play "rock paper scissors" with the computer. Patients in isolation gets bored and also they feel depressed being alone. So the rock paper scissors is a very simple yet enjoyable game they can play while in isolations to relieve stress, anxiety and can have fun playing with computer.

Background Research

There are various techniques available to create a rock paper scissors game using programming languages. Using Computer vision is one of the techniques that is very popular that uses computer vision algorithms to detect the hand signs for "rock","paper" and "scissors". Following are the some of the techniques that are used to create rock paper scissors game using computer vision algorithms

1. Image Classification: Image Classification is a very popular technique for image processing. It takes an input image, runs a CNN classifier model that classifies the input image into one of the classes "rock","paper" and "scissors". A collections of labelled images are used

for training the CNN model which can be later used to classify the new images for "rock", "paper" and "scissors".

2. Object Detection: Object detection is computer technology related to computer vision and image processing. It takes a bunch of images with bounding box labels of each object in the images. And then it using object detection algorithms to train the model that locates the presence of an object "rock","paper" and "scissors" in the image with the bounding box and the type of the classes of the objects in an image. The main advantage of using object detection is that it can detect multiple objects in a same frame. In the other hand an Image classification model can detect only one class in an image.

3. Image Segmentation: Image segmentation is a method in which a digital image is broken into various subgroups called Image segments which helps in reducing the complexity of the image to make further processing or analysis of the image simpler. Image segmentations is mainly used to locate objects and boundaries like lines and curves in the images. Segmentation is basically used for more accurate view of an image. It is similar to object detection but instead of bounding boxes more accurate curves of the object are shown.

4. Pose Estimation: Pose estimation is a very popular technique these days, thanks to Google's mediapipe module. Pose estimation uses the human body skeleton to classify the body pose using machine learning algorithms. The skeleton landmarks can be stored in an array and then using some machine learning algorithms like SVM or Neural networks to train a model for the classification purpose.

Methodology

In this project, the pose estimation technique is used. The hand skeleton is detected using the mediapipe module as shown in the below image.
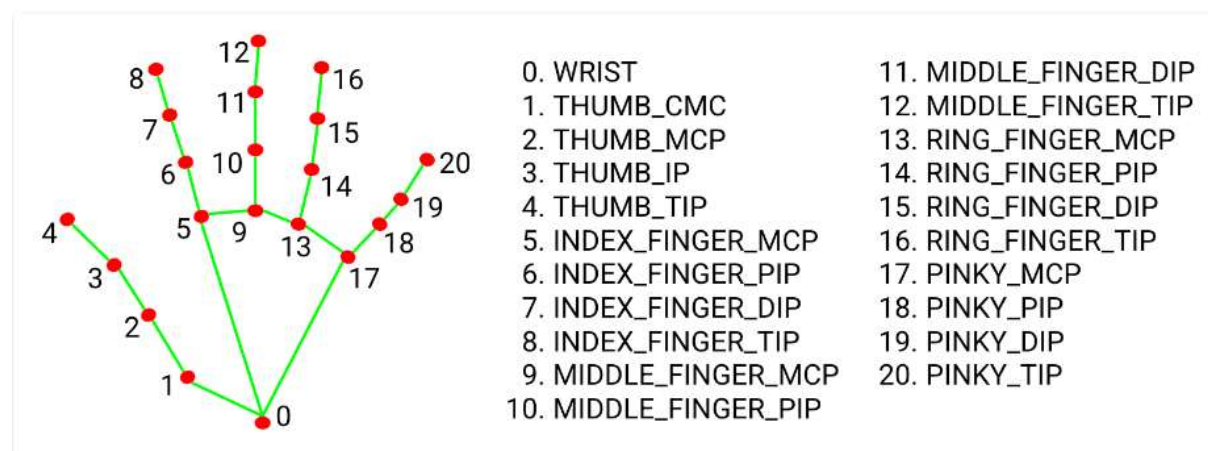

Figure 1: Medipipe hand landmarks

To detect the rock, paper scissors, the y axis of the hand landmarks are used. This way we don't need to train an image classifier model for the detection or classification purpose. Also the mediapipe module can easily be run on a CPU with good accuracy with good speed also.

The real-time video feed is captured using OpenCv and then the image frame is passed to the mediapipe hand model that gives the hand skeleton landmarks. It gives the x and y co-ordinates of the landmarks from the top left corner of the OpenCv image frame. X axis run horizontally and the Y axis runs vertically. So at the top the value of Y axis is low and at the bottom, the value of Y axis is high. This also helped to reduces the model complexity and there is no need to collect a dataset of images for each class and then train a neural network model to classify the signs.

Detecting Rock Sign:

If the following conditions satisfies for landmarks y axis then we say the hand sign is "rock":

1. Landmark 5 < Landmark 8
2. Landmark 9 < Landmark 12
3. Landmark 13 < Landmark 16
4. Landmark 17 < Landmark 20

Detecting Paper Sign:

If the following conditions satisfies for landmarks y axis then we say the hand sign is "rock":

1. Landmark 8 < Landmark 9
2. Landmark 12 < Landmark 11
3. Landmark 16 < Landmark 15
4. Landmark 20 < Landmark 19

Detecting Scissors Sign:

If the following conditions satisfies for landmarks y axis then we say the hand sign is "rock":

1. Landmark 13 < Landmark 16
2. Landmark 17 < Landmark 20
3. Landmark 8 < Landmark 6
4. Landmark 12 < Landmark 10

Computer:

The computer uses the random module in python to generate a random integer among 0, 1 and 2.

- Random number 0: rock
- Random number 1: scissors
- Random number 2: paper

Then a corresponding images is taken from the images directory to the random computer generated choice and displayed on the computer screen.
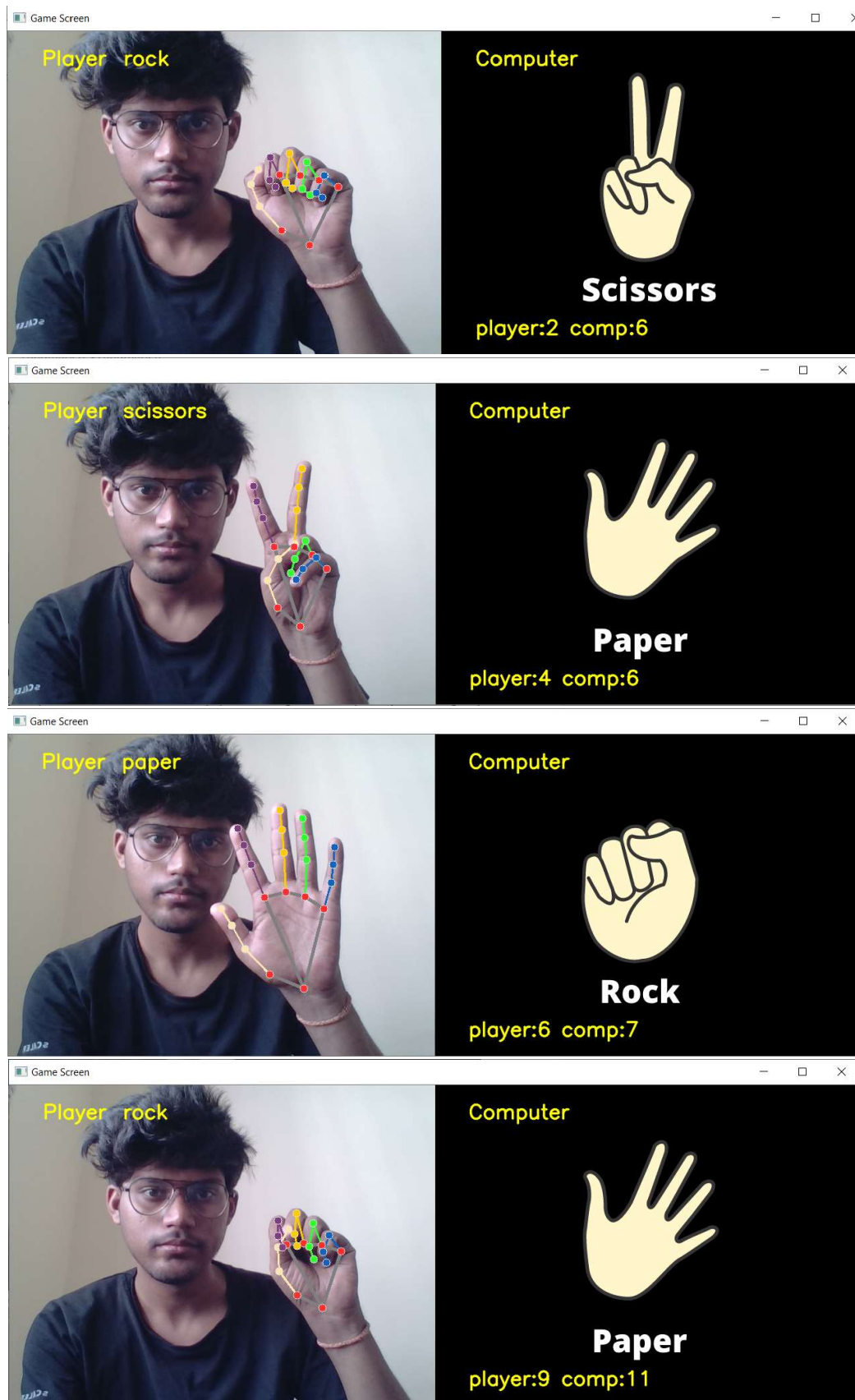
Project Snapshots:

Figure 2: Player and computer playing rock paper scissors game

Tools and Technology Used:

Tools and Technology	Version
Python	3.8
OpenCv	4.2.0.34
Mediapipe	0.8.9.1
Numpy	1.19.1
mysql-connector-python	8.0.27

Conclusion:

Using computer vision to create the rock paper scissors game is really a very interesting way that shows the capabilities of the computer vision. The rock paper scissors project uses the mediapipe module for the hand skeleton detection, which is really fast compared to the other available techniques. This makes the hand skeleton detection easier and fast also. The landmarks co-ordinates and basic mathematics is used to detect the hand sign for rock, paper and scissors. This help to reduce the complexity of the task and also there is no need to collect multiple images and train a neural network model to classify the hand signs. The model accuracy is also very good. Overall the project shows great accuracy and it is fun to play the rock paper scissors game with the computer.