



COMPUTER GRAPHICS AND VISUALIZATION

CS402.3

Coursework -2025

ROCK-PAPER-SCISSORS HAND GESTURE GAME

Group No – 15

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CONTENTS

01. Introduction

02. Image Processing Concepts Used

03. Testing Results

04. Why These Steps Were Used

05. How To Run

06. Challenges Faced

07. Individual Contributions

08. Conclusion

09. Acknowledgement

01. INTRODUCTION

This project implements an interactive and engaging Rock-Paper-Scissors game that leverages real-time hand gesture recognition through a computer's webcam. By utilizing advanced computer vision techniques, the system captures and processes live video feed to detect and classify player gestures whether rock, paper, or scissors with high accuracy. The application not only facilitates a fun and competitive gaming experience but also provides real-time visual feedback on the image processing pipeline, offering users an educational glimpse into the underlying machine learning and computer vision algorithms that power gesture detection.

02. IMAGE PROCESSING CONCEPTS USED

2.1 Grayscale Conversion

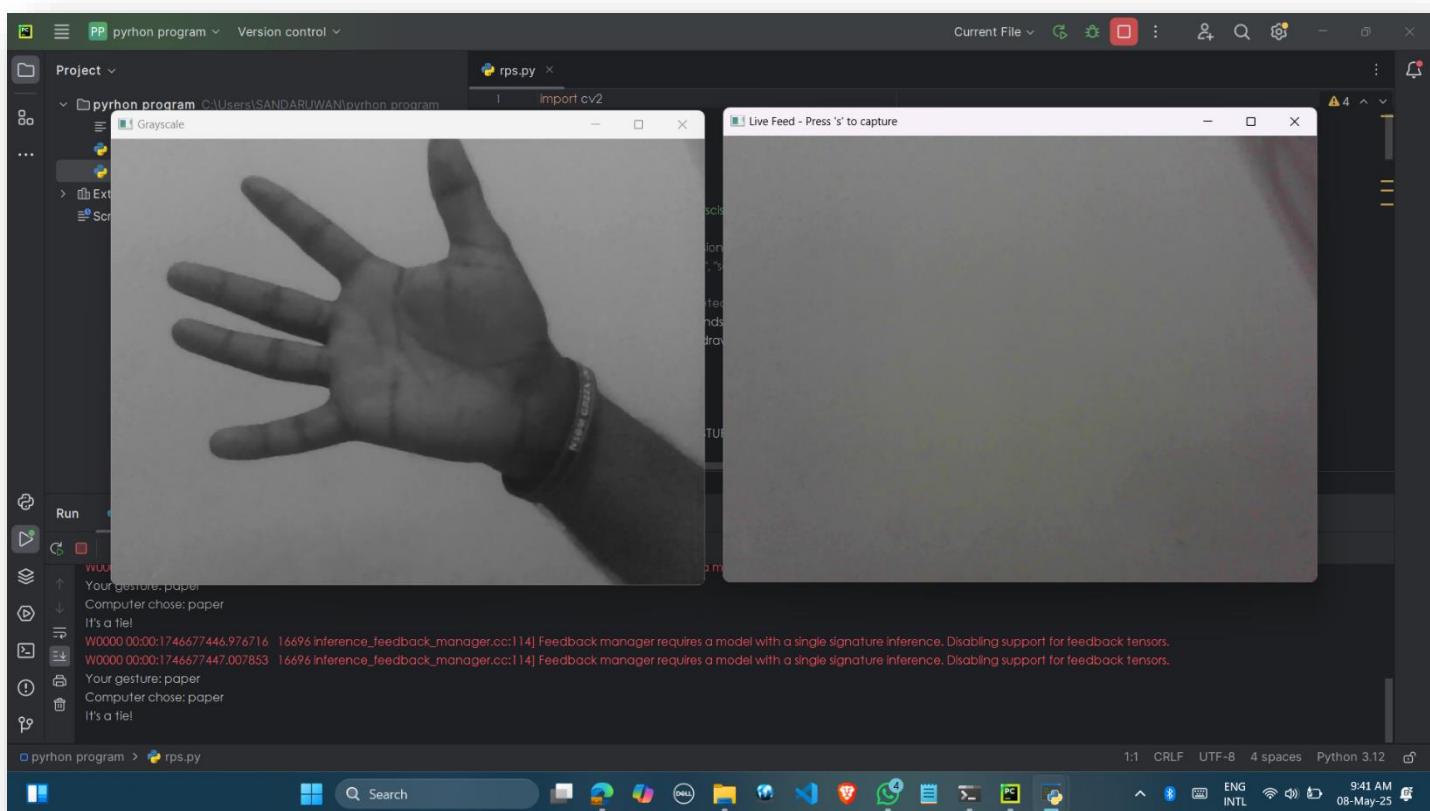
What ?

Converts the BGR image to grayscale using OpenCV.

Why?

Simplifies the image and reduces complexity before thresholding.

Screenshot:



2.2 Thresholding

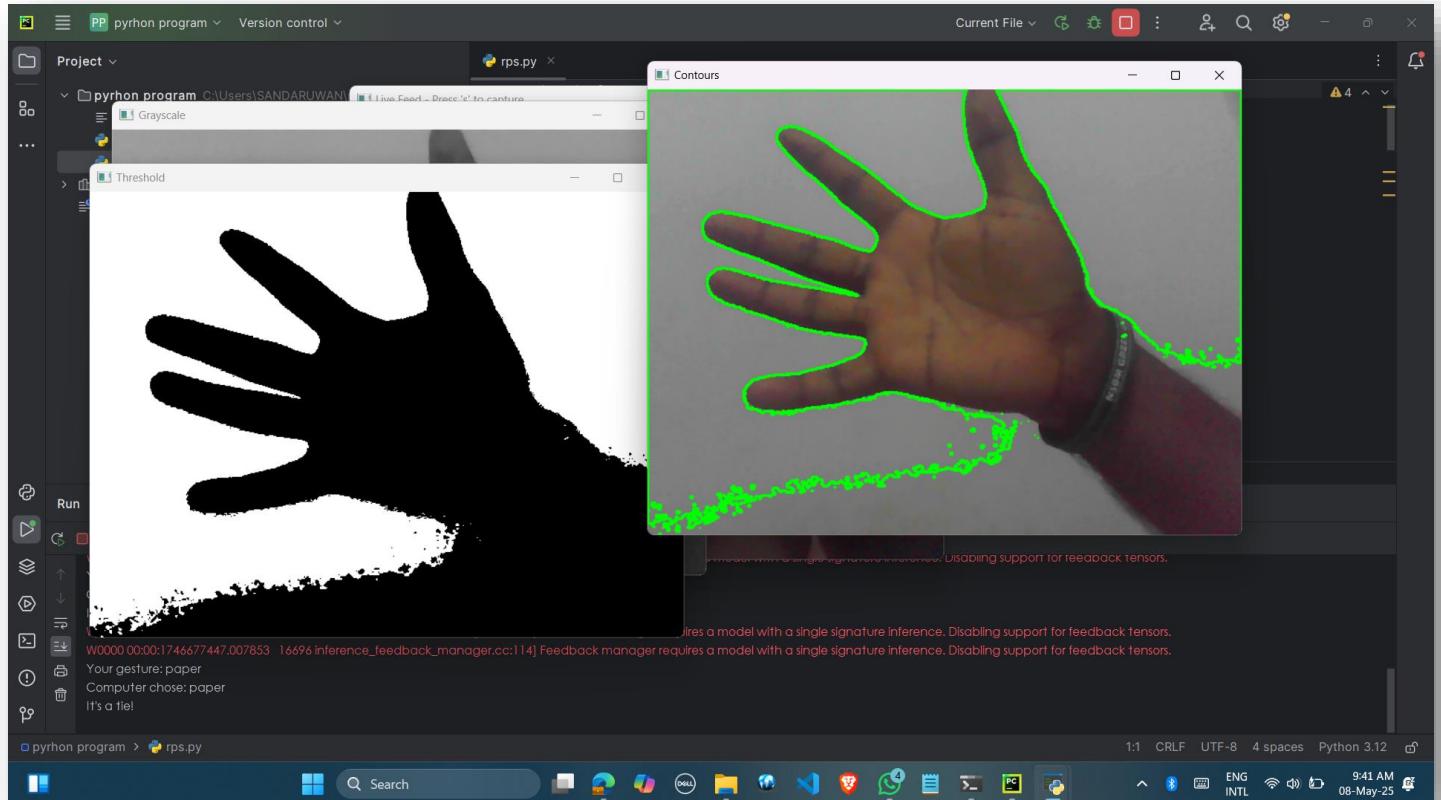
What ?

Converts grayscale to a binary image using a fixed threshold value.

Why ?

Helps isolate the hand from the background.

Screenshot:



2.3 Contour Detection

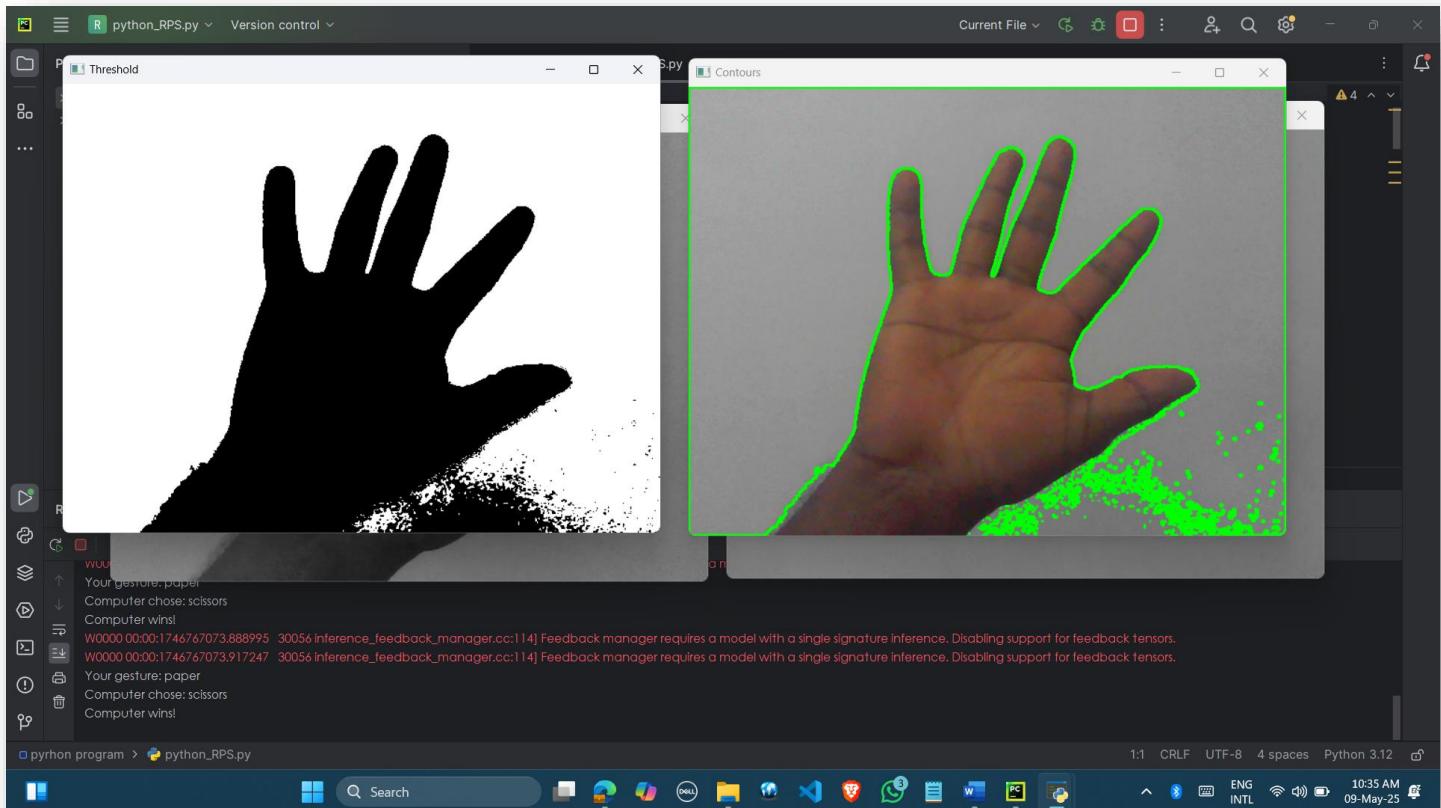
What ?

Finds boundaries of white blobs (i.e., hand) in the thresholded image.

Why ?

Visualizes the shape of the hand and gesture.

Screenshot:



2.4 Hand Landmark Detection (Media Pipe)

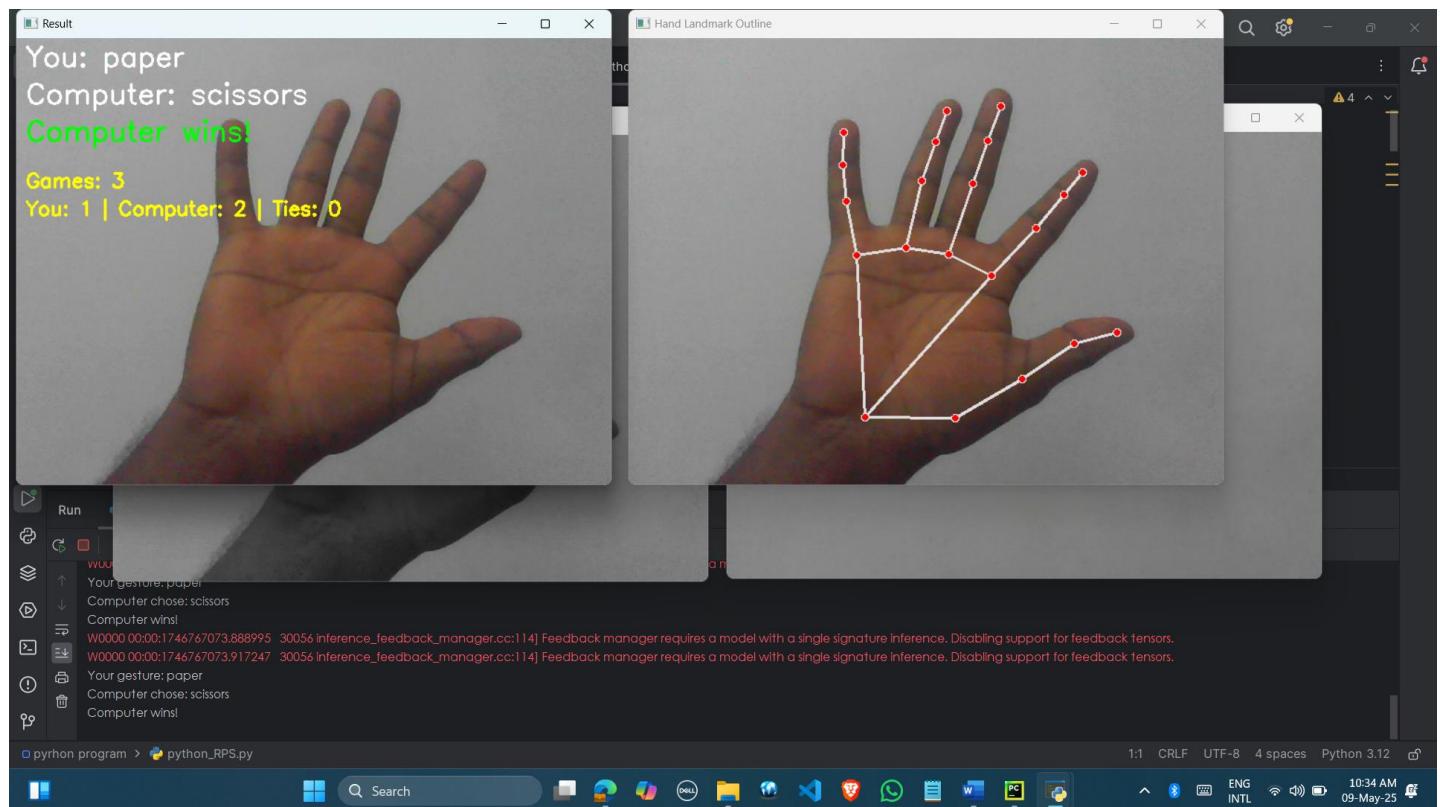
What ?

Identifies 21 hand landmarks using Google's Media Pipe.

Why ?

Allows us to analyze finger positions to classify gestures.

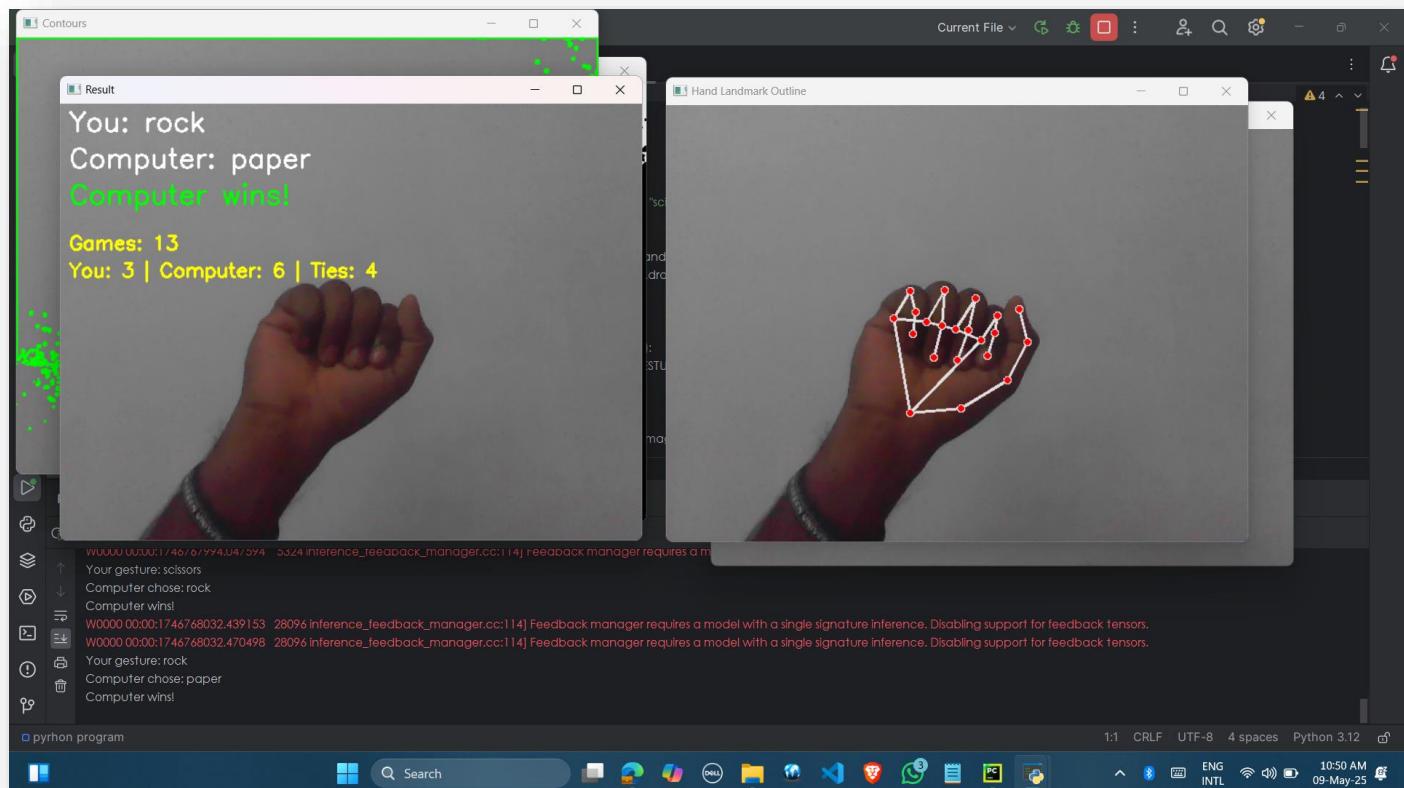
Screenshot:



3.1 Input: Rock Gesture

Correctly classified as Rock

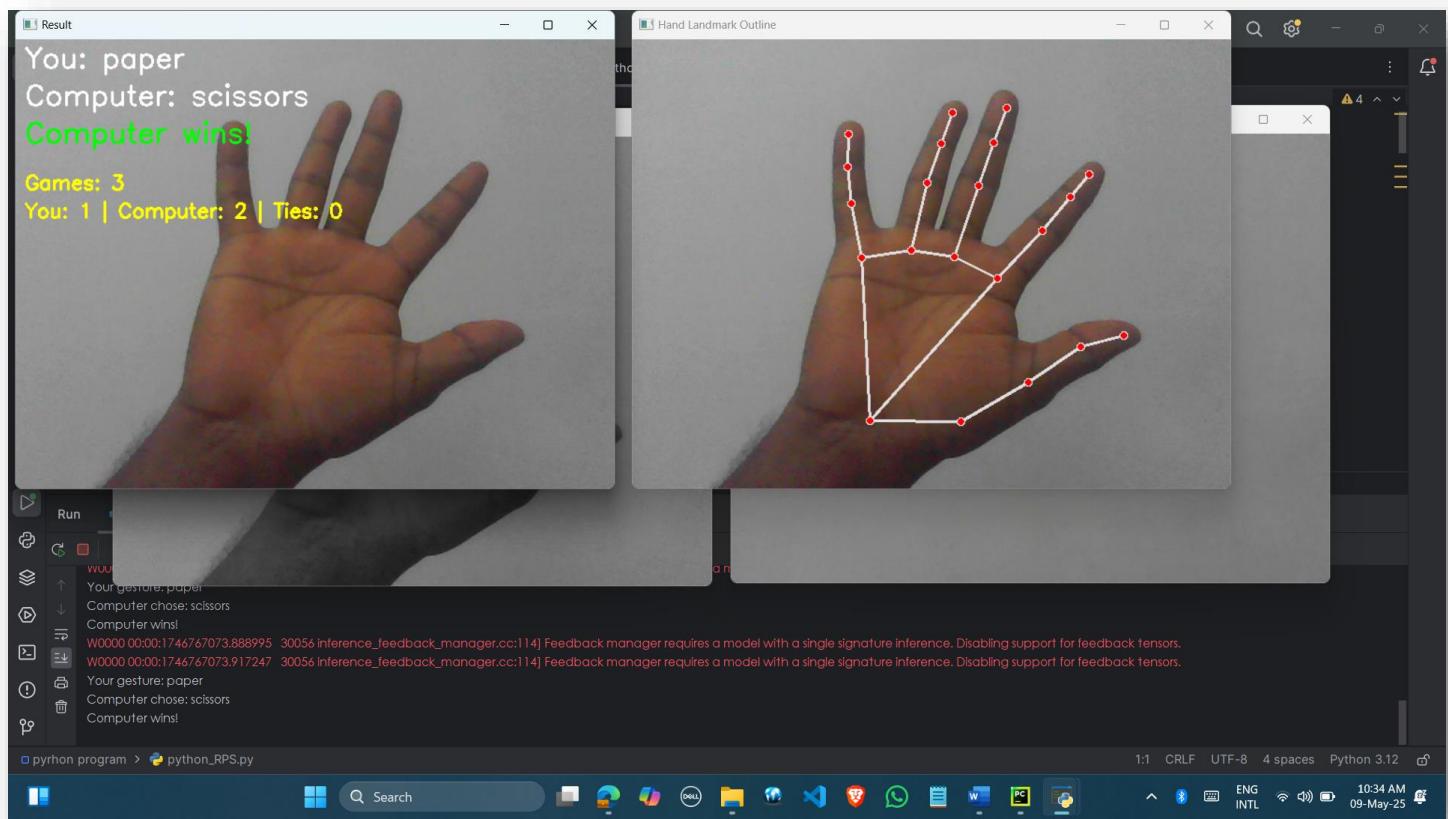
Screenshot:



3.2 Input: Paper Gesture

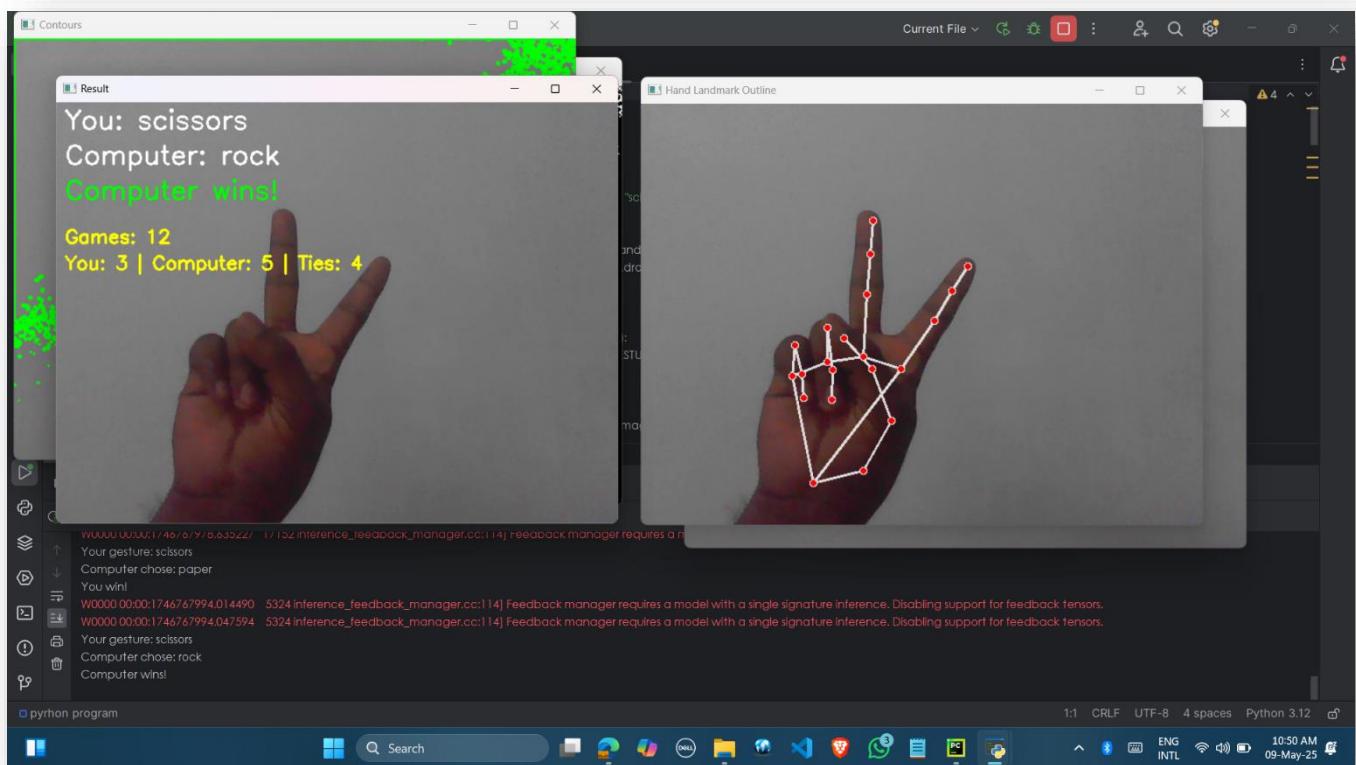
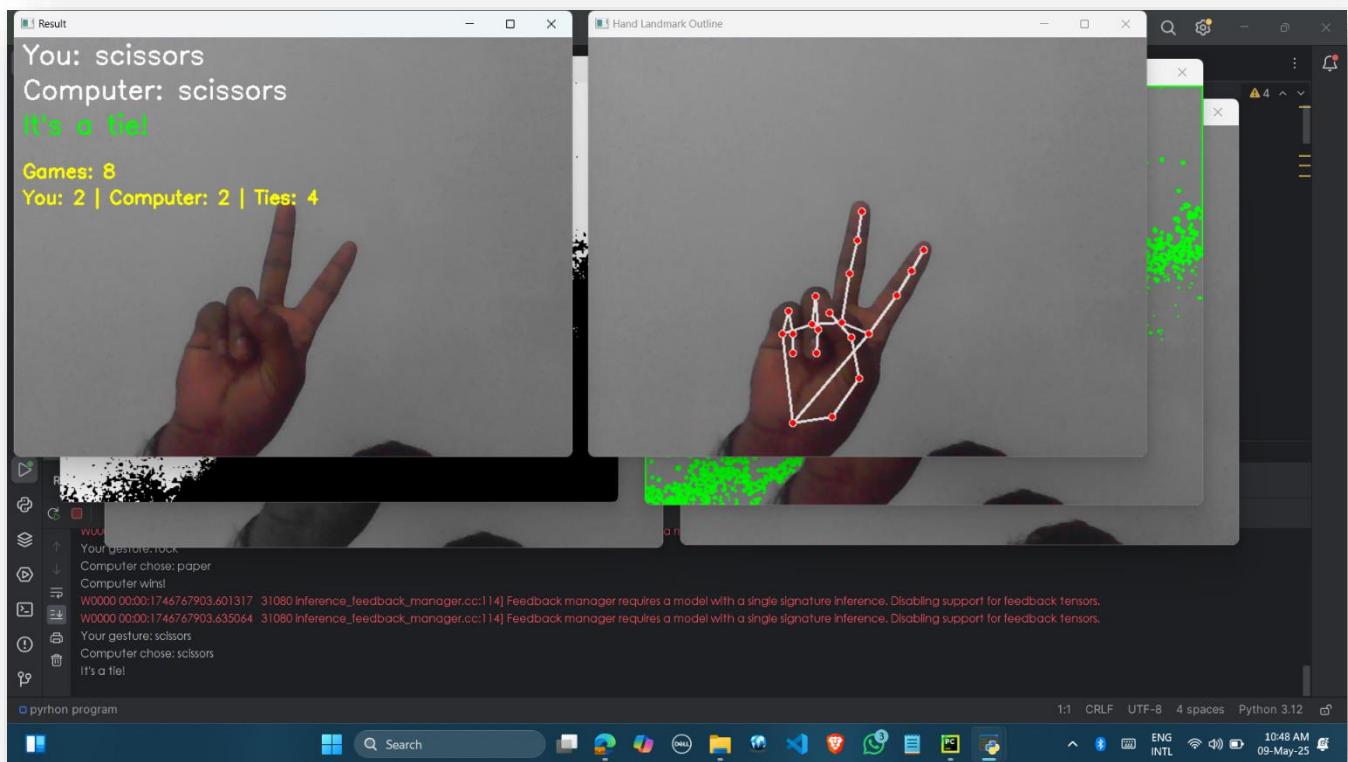
Correctly classified as **Paper**

Screenshot



3.3 Input: Scissors Gesture

Correctly classified as **Scissors**



04. WHY THESE STEPS WERE USED

- ✓ Grayscale simplifies processing by removing color noise.
- ✓ Thresholding helps separate hand from the background clearly.
- ✓ Contours provide visual feedback on hand shape.
- ✓ Media Pipe provides high-accuracy, real-time hand landmark detection.
- ✓ Combined, these steps enable accurate, real-time gesture classification.

05. HOW TO RUN

01. Clone or download the project.

02. Install the requirements:

```
pip install -r requirements.txt
```

03. Run The Game :-

Open Your Command Prompt Inside the folder of the python_RPS.py file located on,
Then run this command,

```
python python_RPS.py
```

How to Play

- Make a hand gesture for **Rock, Paper, or Scissors**.
- Say "**Rock, Paper, Scissors, Shoot!**" and press **s** to capture your gesture.
- The computer randomly selects a move.
- The program determines the winner and displays the result.
- Press **q** to quit the game.

06. CHALLENGES FACED

- ☒ Hand recognition fails under poor lighting conditions.
- ☒ Similar gestures (e.g., one-finger vs. two-finger) are hard to separate.
- ☒ Background clutter affects contour detection.
- ☒ Media pipe performance varies on low-end hardware.
- ☒ Difficulty in detecting the thumb position reliably.

07. INDIVIDUAL CONTRIBUTIONS

Member Name	SID	Role	Contribution Summary
W P S Sandaruwan	22807	Developer & Integrator	Main game flow, integration of modules, UI elements
J M T P Devinda	22804	Image Processing Lead	Grayscale, thresholding, contour visualization
A C J D Silva	22795	Media Pipe Specialist	Hand gesture classification logic
H M C S Henepola	22792	Game Logic Developer	Winner decision logic, random computer move, test cases
A M C N Karandawala	22798	Documentation & Testing	Screenshots, testing scenarios, written documentation, image annotation

08. CONCLUSION

This project successfully demonstrates how image processing and how these techniques can be used to develop a fun and interactive application. The game not only entertains but also educates users on computer vision techniques step-by-step. This project could be expanded in the future with a GUI or additional gestures (Lizard-Spock extension).

09. ACKNOWLEDGEMENT

We would like to extend our heartfelt gratitude to **Dr. Rasika Ranaweera**, our respected lecturer for the **Computer Graphics and Visualization** module, for his unwavering support, guidance, and encouragement throughout our academic journey.

His insightful lectures and deep knowledge in the field of computer graphics have greatly enhanced our understanding and inspired us to explore practical applications, such as this hand gesture recognition game. The clarity and depth of his teaching enabled us to confidently apply image processing and visualization concepts in our project.

We are truly grateful for his mentorship and for fostering an environment of innovation and critical thinking, which contributed immensely to the successful completion of this work.

***** Thank You *****