

Pouce

Hand Gesture Controller using MediaPipe

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1 Introduction

What is Pouce?



Pouce is a real-time hand gesture recognition and visualization tool.

- Built with [MediaPipe](#) for robust hand landmark detection.
- Uses [OpenCV](#) for interactive feedback and visualization.
- Written in Python, managed with `uv`.

The project name “Pouce” (French for “Thumb”) highlights the central role of finger interaction in the system.

Core Technologies



MediaPipe

Provides a high-fidelity hand landmarker model that tracks 21 3D landmarks.

OpenCV

Handles camera stream processing and UI rendering.

NumPy

Powers the canvas and mathematical operations for gesture detection.

2 Features

Overview of Modes



Pouce offers three distinct interactive modes:

1. **Energy Ball:** A visual effect tied to finger distance.
2. **Finger Count:** Real-time counting of extended fingers.
3. **Air Painter:** Drawing on a virtual canvas using pinch gestures.

3 Technical Implementation

Gesture Detection Logic



The system identifies gestures by calculating distances and angles between landmarks:

- **Pinch Detection:** Measures the Euclidean distance between the thumb tip (landmark 4) and index tip (landmark 8).
- **Finger Extension:** Uses a combination of angles and relative distances from the wrist to determine if a finger is extended.

```
def _pinch_distance(hand) -> float:  
    thumb_tip = hand[THUMB_TIP]  
    index_tip = hand[INDEX_TIP]  
    return math.hypot(thumb_tip.x - index_tip.x,  
                      thumb_tip.y - index_tip.y)
```

Mode 1: Energy Ball



Interactive visualization between the thumb and index finger.

- **Visual:** A glowing ball appears at the midpoint of the pinch.
- **Interaction:** Pinching triggers a screenshot.
- **Feedback:** Displays the raw distance value for debugging.

Mode 2: Finger Count



Detects and counts extended fingers on multiple hands.

- **Support:** Handles up to 2 hands simultaneously.
- **Handedness:** Correctly identifies Left vs Right hand.
- **Precision:** Uses MCP (Metacarpophalangeal) joint angles for accurate extension detection.

Mode 3: Air Painter



Turns your hand into a virtual brush.

- **Draw:** Pinch to start drawing on the screen.
- **Brush:** Follows the index finger tip.
- **Clear:** Show all 5 fingers to reset the canvas.