Video Gesture Tracker

1. Data Processing:

The input video data is preprocessed and prepared using the following steps:

The video file path is provided as input to the cv2.VideoCapture function to read the video file.
A background subtractor (MOG2) is created using cv2.createBackgroundSubtractorMOG2() to extract the foreground objects.
Video output is initialised using cv2.VideoWriter to create a new video file for annotated frames.

2. Model Selection/Development:

The chosen model for background subtraction is the MOG2 (Mixture of Gaussians) background subtractor, which is a widely used method for extracting moving objects from videos. This model is suitable for this application due to its effectiveness in detecting foreground objects in varying lighting conditions and handling gradual illumination changes.

3. Detection Algorithm:

The detection algorithm consists of the following steps:

Foreground mask generation: The background subtractor is applied to each frame to obtain a binary foreground mask.
Contour detection: Contours of foreground objects are detected using cv2.findContours.
Contour filtering: Contours with an area greater than a predefined threshold (min_area) are considered as potential detections.
Bounding box creation: A bounding box is drawn around each detected contour.
Text overlay: Text indicating "DETECTED" is overlaid on each bounding box.

4. Annotation:

Text annotation is implemented using cv2.putText to overlay the text "DETECTED" on the video frames where gestures are detected. The text is placed slightly above each bounding box.

5. Documentation:

The approach follows a standard pipeline for video-based gesture detection:

Assumptions: The code assumes that the input video contains a person performing gestures against a relatively static background.
Challenges: Challenges may include variations in lighting, occlusions, and noise in the background. The MOG2 background subtractor helps mitigate some of these challenges by adaptively modeling the background.
Addressing Challenges: To address challenges, appropriate parameter tuning for the background subtractor and contour filtering thresholds may be necessary. Additionally, techniques such as morphological operations can be applied for noise reduction and smoothing of the foreground mask.