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REAL-TIME PEOPLE DETECTION AND COUNTING USING OPENCV AND HOG-SVM

HOG (Histogram of Oriented Gradients) Descriptor:

- The **HOG descriptor** is used to extract features from images. It's commonly applied in human detection tasks due to its ability to capture edge structures and local shape information.
- Combined with a **pre-trained SVM classifier** (Support Vector Machine), it effectively detects people in images and video streams.

Real-Time Video Processing:

- The project utilizes the laptop's **webcam** to capture live video feed. This real-time processing involves analyzing each frame to detect the presence of people.
- Frames are resized to 640x480 to ensure faster processing without compromising detection accuracy.

Person Detection:

- The model uses the hog.detectMultiScale() function to detect people. This function runs the HOG descriptor across the image and identifies regions that match the patterns for a person.
- The detection operates in real-time with adjustable parameters such as:
    - **winStride**: Step size in pixels for sliding the detection window.
    - **padding**: Adds padding to the detected region for improved accuracy.
    - **scale**: Controls image scaling to detect people at different sizes.

Bounding Boxes:

- Detected individuals are highlighted using **red bounding boxes** (cv2.rectangle()).
- Each detected person is enclosed in a rectangle, making them visually distinct.

People Count:

- The system dynamically counts the number of people in the frame (person_count = len(rects)) and displays the count on the video feed using cv2.putText().
- This feature is useful for applications like crowd monitoring, security systems, or occupancy management.

OpenCV’s Versatility:

- The project showcases the power of **OpenCV**, a popular computer vision library that provides various pre-built functions for image processing, object detection, and real-time video analysis.
- The use of a pre-trained model allows for quick and easy setup without the need for extensive machine learning knowledge.

Performance Considerations:

- **Processing Speed**: While the HOG + SVM method is reliable, it might not be the fastest for large-scale applications. For faster performance, more advanced techniques like **YOLO (You Only Look Once)** or **MobileNet SSD** could be considered.
- **Frame Rate**: The system's frame rate depends on the hardware (camera quality, CPU/GPU), the size of the video frame, and the efficiency of the detection algorithm.

Customizations:

- The detection accuracy and speed can be adjusted by tweaking parameters like the window stride, padding, and scaling factor in the hog.detectMultiScale() function.
- Additional improvements can be made by integrating **background subtraction** techniques or utilizing **deep learning**-based models (e.g., MobileNet, YOLO) for more accurate detection in complex environments.

Reference:

https://github.com/noorkhokhar99/OpenCV-People-Counting-