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Date: October 2024

Year & Section: BSCS IS 4B

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Advanced Feature Extraction and Image Processing

Task 1: Harris Corner Detection:

The first task starts by loading and converting an image to grayscale, then applying the Harris Corner Detection algorithm to identify corner points. The corners are highlighted in red for easy visibility, and the resulting image displays these corners on the original image, showcasing the algorithm's effectiveness in identifying significant points of interest.

Task 2: HOG (Histogram of Oriented Gradients) Feature Extraction:

This task focuses on extracting gradient-based features to analyze the image's structure. The image is loaded first and converted to a grayscale one. The HOG descriptor is applied to compute gradient orientations. The output displays the HOG features in a visually structured format, highlighting the directional gradient patterns and showing how HOG captures edge and contour information.

Task 3: FAST (Features from Accelerated Segment Test) Keypoint Detection:

For this task, it uses the FAST algorithm to detect keypoints quickly. After converting the image to grayscale, FAST identifies keypoints, which are highlighted in green. The result visualizes these points on the original image, drawing the algorithm's ability to detect areas of interest, even in a complex background.

Task 4: Feature Matching using ORB and FLANN:

This task demonstrates feature matching between two images using the ORB (Oriented FAST and Rotated BRIEF) detector combined with the FLANN (Fast Library for Approximate Nearest Neighbors) matcher. After loading the image and converting it to grayscale image, next is to extract and match keypoints. The output image shows the matched features between the two images, connected by lines. This output gives a clear comparison, showing how well ORB and FLANN can align similar features in different images.

Task 5: Image Segmentation using Watershed Algorithm:

The last task is the image segmentation using Watershed algorithm to separate the foreground from the background in an image. The process begins with grayscale conversion and binary thresholding, followed by refining segmentation regions. The Watershed algorithm then segments the image, marking boundaries in pink, resulting in an output that separates the main object which is the person from the background.