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MSAI 495

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Machine Problem 7

Introduction:

The goal of this assignment was to use the Hough Transform to detect straight lines in images.

Algorithm:

1. Summed Squares Difference:
   a. Calculate and sum the squared differences between the template and the image.
2. Cross Correlation:
   a. Compute and sum the element-wise product of the template and image.
3. Normalized Cross Correlation
   a. Adjust both the template and image by subtracting their respective means.
   b. Calculate the sum of the product of these mean-adjusted values.
   c. Normalize this sum by the geometric mean of the squares of the mean-adjusted values, handling division by zero.
4. Face Tracking
   a. Choose a comparison function (SSD, cross correlation, or normalized cross correlation)
   b. Select an initial region to track from the first image.
   c. Iterate over possible positions within a defined search window and extract sub-images of the image.
   d. Compare the extracted region with the template using the chosen function. Update the best match tracker if a better match is found.
   e. Return the coordinates and value of the best match found within the search window after searching the full image.

Results:

I was successfully able to track the face in the video using all three methods. SSD and Normalized Cross Correlation performed best, while the regular Cross Correlation struggled to track the face for large portions of the video. Additionally, Normalized Cross Correlation struggled when the woman was not in front of the blue background. SDD worked well while the woman was in front of both the blue background and the wood. All three methods struggled when to woman moved further from the camera and her face became smaller in the frame.

Once the man's face entered the frame, SSD was able to continue to track the woman's face, while both Cross Correlation methods struggled.