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Computer Vision

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**Project 1: Image Thresholding and Blob Tracking Writeup**

~~Our goal with this lab was to create a program that would create a green screen effect on a video with a still background. We first used temporal averaging to determine the average value of each pixel over every frame of the video. We then created a frame by frame mask that identified all pixels that belonged to the background regions then cleaned up the mask with morphological operators. Finally, we used the mask to overlay another video over the original video’s background. We also tracked the location of each moving object over the duration of the video. The end result was a video that placed the mobile elements of our initial video into a new setting.~~

The primary challenge of this project was the creation of a mask that would identify the background of our video. To determine which regions of any given frame constituted the background, we took a temporal average of each pixel over every frame of the video. This gave us an image that looked almost identical to the background of the video. For each frame in the video, we subtracted the background image from the original image and calculated the RGB norm of each pixel. All pixels whose norms were less than a specified threshold value were identified as background pixels and were included in the mask. The background mask was quite messy due to noise in the original video. We addressed this issue by employing morphological operations, specifically closing followed by opening, to remove white dots from our mask and halos (unidentified background regions) around moving objects. This gave us a mask for every frame of the input video that identified the background. Having created the mask could then overlay any image or video we liked over the original video to place our moving objects in a new setting.

This method relied on three assumptions about the input video. The first assumption was that the camera that shot the video was stable since our temporally averaged background image relied on a constant background. The second assumption was that the mobile objects in the video never remained in one location for too long. This would locally alter the temporal average used to create the background and result in portions of the background being left out of the mask. The third assumption was that the color of the moving object was not too similar to the background at any point in its trajectory. Much like wearing a green shirt in front of a green screen, this would have the effect of masking regions that are not actually part of the background.

In addition to overlaying the background of the original video with another video, we also tracked the location of the moving object(s) in the video. To detect the location of the objects, we identified contours of each frame of the video.