Assignment: Background Subtraction

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In this assignment, you will develop a simple background subtraction program.

1. In this assignment, you are given two "videos". Each video is stored as a 4-dimensional matlab array. The first three dimensions represent rows, columns, and the red-green-blue layers of an image. The fourth dimension represents time. The videos are named train_data.mat and test_data.mat, and you can download them from the course web page. You may want to make reduced resolution versions of these videos by clipping them, sub-sampling them, or reducing the number of frames so that you can get your code working more easily. You can "play" the videos using the following sequence of matlab commands. Load these 4-dimensional arrays into matlab by just typing 'load train_data' and 'load test_data'. You should enter all the commands as a single line:
   `for i=1:100 imagesc(train_data(:,:,:,i)); drawnow; end`

2. Next, your job is to make a background model. The background model will have two parts. The first part is the average value of a pixel in a particular location over time. This should be the mean image of the training movie. The size of this mean image should be (241, 361, 3). I'll let you figure out how to create it, but I will tell you that you can do it in a single command!

3. The second part of the background model is the average distance that each pixel is from the mean value at that location. This is essentially a measure of the pixel variance. To compute this, for each pixel in a given position in each frame, compute the squared Euclidean distance to the mean pixel at that location (from the previous step). Then take the average value of this distance at each location in the image. Take the square root of each value in the average distance image. You can refer to this as you *standard deviation image*. Plot the standard deviation image.

4. Now, using your model derived from the training data, try to find moving objects in the test sequence. In particular, for some value alpha, find all of the pixels in each frame of the test sequence that are within alpha standard deviations of the mean value. For a single image, you can visualize your results by making a black and white image in which the pixels which are

"moving" are white, and the pixels which are not moving are black. You can visual your results for the whole test sequence by adding together all of the individual binary images for each frame.

5. Experiment with different values of alpha, and produce a summary image for each value of alpha. Turn in these summary images, along with your mean image and standard deviation image.