CPE 428 write up 1
Conrad Chan
4/11/2020

Part I:
2.Print the shape of the Numpy array containing the image -- what do the sizes of the dimensions mean?
The sizes of the dimensions consist of a tuple of 3 values. For example, the tuple returned from the shape is (240, 320, 3). The number means that the image is a matric of 240 by 320, and each element in the matric contains an array of 3 values. 240 x 320 is the image size. The 3 values in the array are corresponding to the RGB intensity.

3.Print the image itself -- what do these numbers mean?
Printing the image displays all the pixels in the 240x320 matrics. There are 1 or 3 values in each element in the matrics depending on whether the image is color or gray.

Part II:
4.Show the average image, what we will call the "background" image. The cars have disappeared! Why?
The average image is calculated by taking the mean value of all the frames in the video. Since the values of a single-pixel in the image only changes when a car passes by, and the time a car passed by is relatively short in the whole video time frame, so the value of a single-pixel remains the background image color most of the time, hence the mean value of the pixels turn out to be very close to the background image color.

Part III:
5.How well does each technique work? What could be improved about the output?
The threshold images from both binary mask and Otsu's methods are able to separate the moving cars from the background image.
The threshold image from the binary mask method also turns out to have similar quality as the Otsu's method with the optimal threshold value.
On the other hand, Otsu's method is less sensitive to the threshold value than the binary mask method, the image remains the same quality even with a wide range of threshold value.
To improve the output, we may apply the cv2.findContours function to specify the region of interest (ROI) before applying the threshold to the image. Then we can apply the threshold function only within the ROI and blackout anything beyond the ROI. We may also blur the image using cv2.blur function to filter out the background noise.