Assignment 2: Motion detection

What to do

1. You will have the video file intersection.mp4 in the videos folder. Split the video into images at 5 frames per second. Use the Linux program '$ffmpeg$'. Let's call this the dataset.

2. Write a Python file to process the generated images. In your Python file, read the first image from the dataset as background $B[0]$. Convert $B[0]$ to grayscale.

3. Write a loop to read all the other images in grayscale one by one. Each image you read will be $X[k]$. Apply the following equation.

$$B[k+1] = B[k] + c(X[k] - B[k]), \tag{1}$$

   where $B[k]$ is the current background image, $B[k+1]$ is the updated background, $X[k]$ is the new image you read in the loop, and $(X[k] - B[k])$ is the difference between the current background image and the image you read.

4. The monadic operation $c(.)$ is described below:

$$c(x) = \begin{cases} \sigma, & x > \sigma \\ x, & -\sigma \leq x \leq \sigma \\ -\sigma, & x < -\sigma \end{cases}$$

5. Use Python *numpy* library's *clip* function to easily apply the above function to your image $(X[k] - B[k])$.

6. Inside your loop, 1. At every iteration, save the image $(X[k] - B[k])$ in a separate folder, 2. concatenate the images $(X[k] - B[k])$ at every iteration in a variable and call it motion M, where
$$M[k+1] = M[k] + (X[k] - B[k]).$$

7. M[0] can be an empty image with only white-color pixels.

8. After the end of your loop, save both the updated background and the motion variable as two separate images.

9. Use ffmpeg to concatenate your individual motion images into a video.

10. (optional) Develop a colorized version of the motion image.

What to submit

Submit the background image, the motion image, the motion video, and Python code.