E9 241: Digital Image Processing **Fall 2020**

Assignment 1

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Problem 2: Otsu Thresholding

Otsu thresholding computes $t^* \in \{1, 2, \cdots, K\}$ such that:

$$t^* = \arg\ \min_t \sigma_W^2(t), \tag{0.1}$$

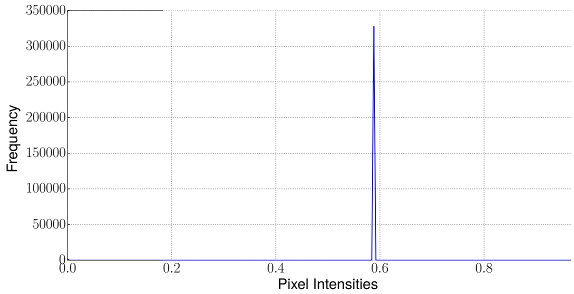
where σ_W^2 is the within class variance of the image. The within class variance is a second order statistic that depends on the class means and class conditionals. However, the between class variance $\sigma_B^2(t)$ is such that: $\sigma_W^2(t) + \sigma_B^2(t) = \sigma_T^2$ and it can be shown that the between class variance depends only on the first order statistics. Hence,

$$t^* = \arg\ \max_t \sigma_B^2(t). \tag{0.2}$$

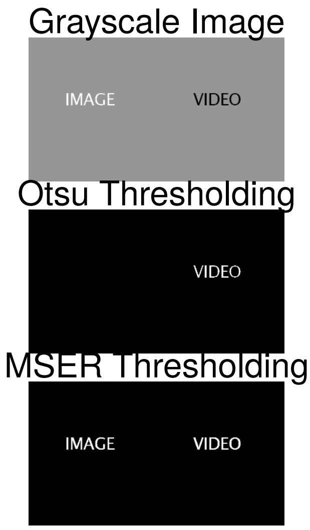
Therefore, it is to be expected that (0.1) is computationally slower than (0.2). Empirically, the run-time for (0.1) is one order slower than (0.2).

Problem 6: Maximally Stable Extermal Regions

The histogram of the test image has an impulse at a centre gray level and some tail ends at the extreme. Otsu Thresholding finds a simple threshold that separates the histogram of a grayscale image. This method works well when the distribution is bimodal. Hence, a single level binarisation is not sufficient to extract the two words in the given grayscale image. Since MSER sweeps through a range of thresholds, all connected components are individually extracted with a separate threshold and hence the final binarised image contains all the text in the grayscale image.



(a) Histogram of the grayscale image.



(b) Grayscale and thresholded images.