Otsu's Segmentation Report

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1 Otsu's Segmentation Method

Otsu's Segmentation method is a thresholding technique used for image segmentation. It aims to find an optimal threshold value that separates the pixels in an image into foreground and background regions. This method is particularly useful for grayscale images.

1.1 Algorithm Steps

1. Compute the histogram of the input image.
2. Normalize the histogram to obtain probabilities for each intensity level.
3. Initialize variables: w_0, w_1, μ_0, and μ_1.
4. Iterate through all possible threshold values t:
   (a) Update the weights w_0 and w_1.
   (b) Update the means μ_0 and μ_1.
   (c) Calculate the between-class variance $\sigma^2_{\text{between}}$.
   (d) If $\sigma^2_{\text{between}}$ is greater than the maximum variance, update the maximum variance and the threshold value.
5. The obtained threshold value is the optimal threshold for image segmentation.

1.2 Mathematical Equations

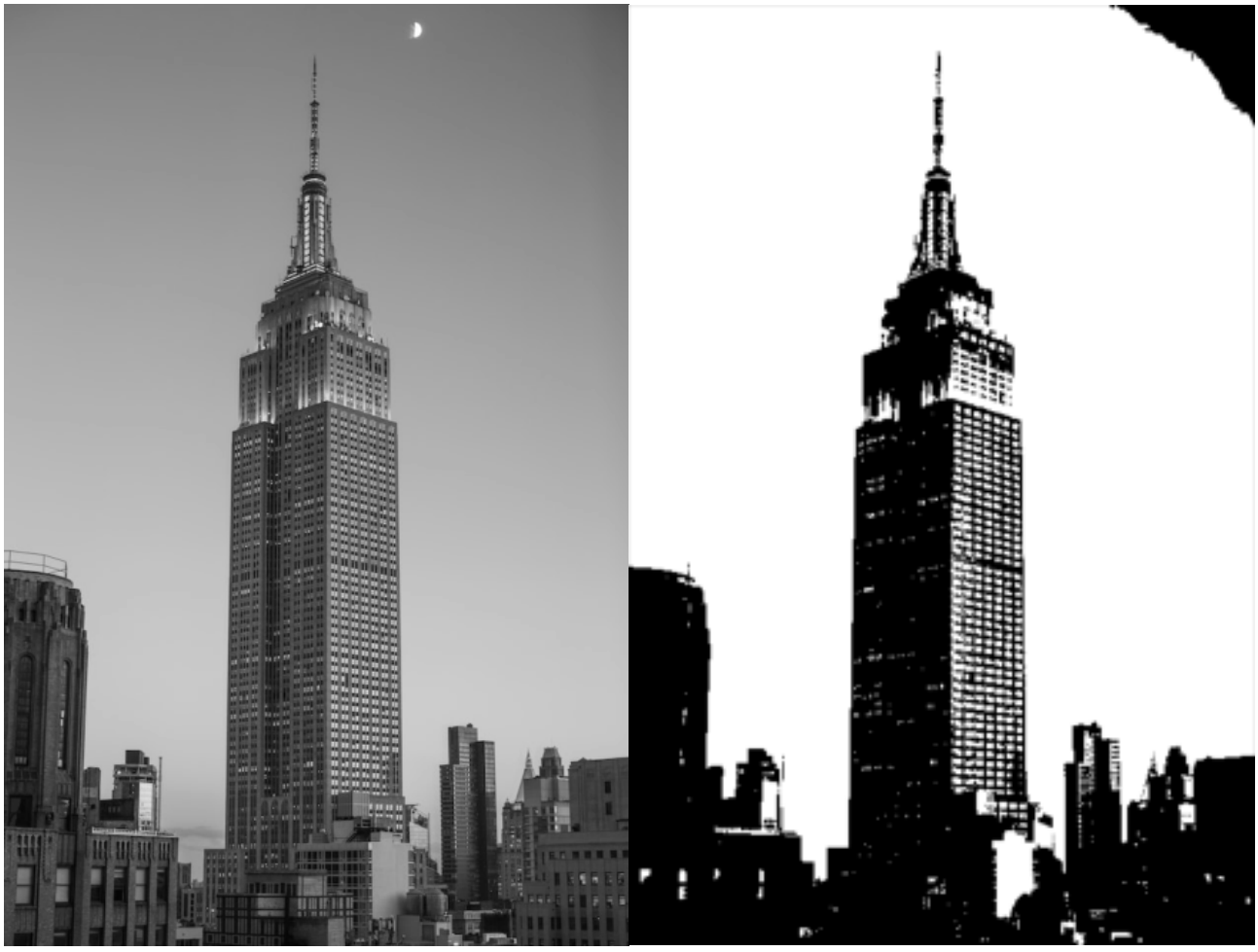
$$
\begin{aligned}
P_i &= \frac{H_i}{N} \quad \text{(Normalized histogram probabilities)} \\
w_0 &= \sum_{i=0}^{t} P_i \\
w_1 &= 1 - w_0 \\
\mu_0 &= \frac{\sum_{i=0}^{t} i \cdot P_i}{w_0} \\
\mu_1 &= \frac{\sum_{i=t+1}^{L-1} i \cdot P_i}{w_1} \\
\sigma^2_{\text{between}} &= w_0 \cdot w_1 \cdot (\mu_0 - \mu_1)^2
\end{aligned}
$$

1.3 Conclusion

Otsu's Segmentation method provides an automatic way to determine an optimal threshold for image segmentation. It maximizes the between-class variance, effectively separating the foreground and background regions in an image.

1.4 Results

The optimal threshold obtained for the input image : 114



Input Image Segmented image

Figure 1: Otsu's Method Of Segmentation