# Optimum Global Thresholding

For each region, the following property holds.

$$q_1(k) = \sum_{i=0}^{k} p(i) \qquad q_2(k) = \sum_{i=k+1}^{L-1} p(i)$$

$$m_1(k) = \frac{\sum_{i=0}^{k} ip(i)}{\sum_{i=0}^{k} p(i)} = \frac{1}{q_1(k)} \sum_{i=0}^{k} ip(i) \qquad m_2(k) = \frac{\sum_{\boxed{i=k+1}}^{L-1} ip(i)}{\sum_{i=k+1}^{L-1} p(i)} = \frac{1}{q_2(k)} \sum_{\boxed{i=k+1}}^{L-1} ip(i)$$

$$\sigma_1^2(k) = \frac{1}{q_1(k)} \sum_{i=0}^{k} [i - m_1(k)]^2 p(i) = \frac{1}{q_1(k)} \sum_{i=0}^{k} i^2 p_i - m_1^2(k)$$

$$\sigma_2^2(k) = \frac{1}{q_2(k)} \sum_{i=k+1}^{L-1} [i - m_2(k)]^2 p(i) = \frac{1}{q_2(k)} \sum_{i=k+1}^{L-1} i^2 p(i) - m_2^2(k)$$

For an entire image,

$$m_G = \sum_{i=0}^{L-1} ip(i), \qquad \sigma_G^2 = \sum_{i=0}^{L-1} [i - m_G]^2 p(i)$$

$$\boxed{\begin{aligned} &q_1(k) + q_2(k) = 1 \\ &q_1(k)m_1(k) + q_2(k)m_2(k) = m_G \end{aligned}}$$