$$\omega_1(t) = \sum_{i=1}^{t} P(i)$$

$$\omega_2(t) = \sum_{i=t+1}^{I} P(i) \qquad \omega_1(t) + \omega_2(t) = 1$$

$$\mu_1(t) = \sum_{i=1}^{t} \frac{i P(i)}{\omega_1(t)}, \quad \mu_2(t) = \sum_{i=t+1}^{I} \frac{i P(i)}{\omega_2(t)}$$

$$\mu_T = \sum_{i=1}^{I} \frac{i P(i)}{1}$$

$$\Rightarrow \quad \sigma_1^2(t) = \sum_{i=1}^{t} [i - \mu_1(t)]^2 \frac{P(i)}{\omega_1(t)}$$

$$\sigma_2^2(t) = \sum_{i=t+1}^{I} [i - \mu_2(t)]^2 \frac{P(i)}{\omega_2(t)}$$

$$\sigma_T^2 = \sum_{i=1}^{I} [i - \mu_T(t)]^2 \frac{P(i)}{\omega_1(t) + \omega_2(t)}$$

$$\sigma_b^2 = \sigma_T^2 - \sigma_w^2(t)$$

$$= \sum_{i=1}^{t} [i - \mu_1(t)]^2 P(i) + \sum_{i=t+1}^{I} [i - \mu_2(t)]^2 P(i)$$

$$- \sum_{i=1}^{t} [i - \mu_1(t)]^2 \frac{P(i)}{\omega_1(t)} - \sum_{i=t+1}^{t} [i - \mu_2(t)]^2 \frac{P(i)}{\omega_2(t)}$$

$$\sigma_b^2 = \sum_{i=1}^{t} \frac{P_i}{\omega_1(t)} \left[\omega_1(t)(i-\mu_T(t))^2 - (i-\mu_1(t)) \right] + \sum_{i=t+1}^{I} \frac{P(i)}{\omega_2(t)} \left[\omega_2 (i-\mu_T(t)) \right.$$

$$\left. - (i-\mu_2(t) \right.$$

$$\sigma_b^2 = \omega_1(t)(\mu_T - \mu_1(t))^2 + \omega_2(t)(\mu_T - \mu_2(t))^2$$

$$\sigma_b^2 = \omega_1(t)\,\omega_2(t)\,(\mu_1(t) - \mu_2(t))^2$$