Klemera and Doubal's (KD) Method

In this method, BA is defined as being equal to CA plus a random term which has a zero mean and a variance s^2_{BA} using the following equations.

$$BA_{EC} = \frac{\sum_{j=1}^{m}(x_j - q_j)\left(\frac{k_j}{s_j^2}\right) + \frac{CA}{s_{BA}^2}}{\sum_{j=1}^{m}(\frac{k_j}{s_j})^2 + \frac{1}{s_{BA}^2}} \quad (10)$$

$$s_{BA}^2 = \frac{\sum_{j=1}^{n}((BA_{Ei} - CA_i) - \sum_{i=1}^{n}(BA_{Ei} - CA_i)/n))^2}{n} - \frac{1 - r_{char}^2}{r_{char}^2} \times \frac{(CA_{max} - CA_{min})^2}{12m} \quad (11)$$

$$BA_E = \frac{\sum_{j=1}^{m}(x_j - q_j)\left(\frac{k_j}{s_j^2}\right)}{\sum_{j=1}^{m}(\frac{k_j}{s_j})^2} \quad (12)$$

$$r_{char} = \frac{\sum_{j=1}^{m}\frac{r_j^2}{\sqrt{1-r_j^2}}}{\sum_{j=1}^{m}\frac{r_j}{\sqrt{1-r_j^2}}} \quad (13)$$

BA calculated by KD uses equation (10), where

m is the total number of biomarkers.

s_j represents the root mean squared error of a biomarker regressed on CA.

k_j and q_j is the slope and intercept of each biomarker regressed on CA.

In order to calculate BA, s_{BA}^2 needs to be obtained using equation (11-13), where n is the total number of subjects and

r_j is the correlation coefficient between each marker and CA.