Title

alphawgt — Cronbach's alpha for weighted data

Methods and Formulas

Let x_i, $i = 1, \ldots, k$, denote the variables over which α ist to be calculated. If no weights are specified, calculations are done as described in [R] **alpha**. If weights are specified, the average correlation $\bar{r}$, average covariance $\bar{c}$, and average variance $\bar{v}$ are calculated as

$$\bar{r} = \frac{\sum_{i=2}^{k} \sum_{j=1}^{i-1} s_i s_j W_{ij} r_{ij}}{\sum_{i=2}^{k} \sum_{j=1}^{i-1} W_{ij}}, \qquad \bar{c} = \frac{\sum_{i=2}^{k} \sum_{j=1}^{i-1} s_i s_j W_{ij} c_{ij}}{\sum_{i=2}^{k} \sum_{j=1}^{i-1} W_{ij}}, \qquad \text{and} \quad \bar{v} = \frac{\sum_{i=1}^{k} W_{ii} c_{ii}}{\sum_{i=1}^{k} W_{ii}}$$

where r_{ij} and c_{ij} are the correlation and covariance between x_i and x_j, c_{ii} is the variance of x_i, s_i is the sign with which x_i enters the scale, and W_{ij} and W_{ii} are the sum of weights over the observations used to calculate r_{ij}, c_{ij}, and c_{ii} (the difference to the standard formulas is the usage of the sum of weights W instead of the number of observations n; note: if option casewise is specified then $W_{ij} = W_{ii}$ for all i, j).

Additionaly, the calculation of r_{ij}, c_{ij}, and c_{ii} is different from the standard case. Let $l = 1, \ldots, n$ be an indicator for the observarions of x_i and w_l be the weights. In the case of frequency weights (fweights) the variance c_{ii} and covariance c_{ij} are calculated as

$$c_{ii} = \frac{1}{W_{ii} - 1} \sum_{l=1}^{n_{ii}} w_l (x_{il} - \bar{x}_i)^2 \quad \text{and} \quad c_{ij} = \frac{1}{W_{ij} - 1} \sum_{l=1}^{n_{ij}} w_l (x_{il} - \bar{x}_i)(x_{jl} - \bar{x}_j)$$

and in the case of analytical weights (aweights) as

$$c_{ii} = \frac{1}{W_{ii} - W_{ii}/n_{ii}} \sum_{l=1}^{n_{ii}} w_l (x_{il} - \bar{x}_i)^2 \quad \text{and} \quad c_{ij} = \frac{1}{W_{ij} - W_{ij}/n_{ij}} \sum_{l=1}^{n_{ij}} w_l (x_{il} - \bar{x}_i)(x_{jl} - \bar{x}_j)$$

where $\bar{x}_i$ is the weighted mean of x_i, i.e. $\bar{x}_i = \frac{1}{W_{ii}} \sum_{l=1}^{n_{ii}} w_l x_{il}$ in the case of the variance and $\bar{x}_i = \frac{1}{W_{ij}} \sum_{l=1}^{n_{ij}} w_l x_{il}$ in the case of the covariance. The calculation of r_{ij} is

$$r_{ij} = \frac{\sum_{l=1}^{n_{ij}} w_l (x_{il} - \bar{x}_i)(x_{jl} - \bar{x}_j)}{\sqrt{\sum_{l=1}^{n_{ij}} w_l (x_{il} - \bar{x}_i)^2 \sum_{l=1}^{n_{ij}} w_l (x_{jl} - \bar{x}_j)^2}}.$$

Also See

Background: [R] **alpha**, [U] **14.1.6 weight**