Science DynamicsMasterclass
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12 - One-way Analysis of Variance

Probability of type 1 error

$$\alpha_{FW} = 1 - (1 - \alpha)^K$$

where K is number of conceptually linked tests

alpha FW (family-wise)

ANOVA one-way analysis of variance

ANOVA...

one grouping variable(or factor) and dependent variable that is ratio-leveled

MS=SS/df

MS=SS/df

mean squares=sum of squared deviations/ degrees of freedom

$$MS_B = \frac{SS_B}{df} = \frac{\sum_{j=1}^{K} N_j \left(\bar{X}_j - \bar{\bar{X}}\right)^2}{K-1}$$

MSB

MSB

mean squares between groups, Nj is the number of values in group j, Xj equals the mean of the values in group j, X equals the mean of the group means

$$MS_W = \frac{SS_W}{df} = \frac{\sum_{i,j} \left(X_{i,j} - \bar{X}_j\right)^2}{N-K}$$

MSW

$$index\ of\ separation = \frac{MS_B}{MS_W}$$

Index of Separation between groups

the f-ratio

CAVE:

Assumptions of the one-wayANOVA

- null hypothesis is true
- scores are independent of each other
- parent populations are normally distributed
- parent populations have equal variances

parent populat...

Levene's test sigma must be higher than alpha

p-value associated with F

SPSS

SPSS

ANOVA F-ratio of X have p-value - the output of the test, SST=total variability

Effect Size

R^2

- 0.01 small effect
- 0.09 medium effect
- 0.25 large effect
- SPSS

Effect Size

SSb/SSt=x. X *100 = percent of the variance in (e.g. dexterity is explained by treatment)

Post-hoc Processing

Turkey's Honestly Significant Difference (HSD)

$$q = \frac{\bar{X}_j - \bar{X}_k}{\sqrt{\frac{MS_w}{n}}}$$

$$n' = \frac{K}{\left[\frac{1}{n_1} + \frac{1}{n_2} + \cdots + \frac{1}{n_k}\right]}$$

when groups do not have common sample size we use this equation

using this procedures increases risk of Type 1 error

Fisher's Least Significan Difference(LSD)

SPSS

Bonferroni adjustment

Example