ANCOVA and repeated measure
(STATS546.2: Applied analysis of variance (work in progress))

Anonymous

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Analysis of covariance

Analysis of covariance (ANCOVA) is a mixture of ANOVA and a regression

A covariate, e.g. age, temperature, weight, number of employees, pre-study attitude etc, is added to ANOVA to reduce the error.

The covariate should not be influenced by the treatment.

The ANCOVA model

A model with one factor and one covariate

$$y_{ij} = \alpha_i + \beta x_{ij} + \epsilon_{ij}$$

Sometime it can be useful to center the covariate variable.

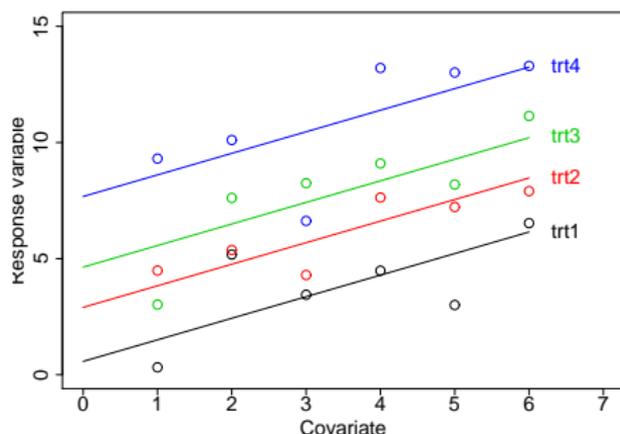$$y_{ij} = \alpha_i + \beta(x_{ij} - \bar{x}..) + \epsilon_{ij}$$

ANCOVA and regression

$$y_{ij} = \alpha_i + \beta x_{ij} + \epsilon_{ij}$$

This model is in fact multiple regression lines with the same slope but with different intercepts.

If $\beta = 0$ the the model reduces to one-way ANOVA model.

If $\alpha_1 = ... = \alpha_g$ the the model reduces to simple linear regression model.

Expected values

The expected values are not all the same in each treatment group because now we have a covariate.

So we get

$$E[y_{ij}] = \alpha_i + \beta x_{ij}$$

instead of

$$E[y_{ij}] = \alpha_i$$

$$: \alpha_1 = ... = \alpha_g$$

H_1 : not all α_i are equal

it is of interest whether there is a relationship between the covariate and the response variable

ANOVA table

Assumptions

- Normality of the errors
- Equal variance of the errors among groups
- Equal slopes of the covariate among groups
- Linear relationship between response variable and the covariate
- Independent errors

Example

Extended ANCOVA

Example 2

Repeated measures

Reapeted measures vs repeated observasions vs replications

The importance of randomization

Model for repeated measure with one factor

Hypothesis

F-test

Is the model appropriate?

Comparison of treatments

Example - Potatoes

Four different strains of potato were tested in processing of precooked potatoes by Matís and the Agricultural university of Iceland.

Strains of potatoes:

- Annabelle
- Belana
- Gullauga
- Premier

Questions were:

- What strain of potato taste the best?
- What strain of potato has the best appearance?

Example - Potatoes