



Course and Workshop

Data Analyses in Life Sciences Using Linear Models with

Linear models are widely used for data analyses. Since the seminal work of R. A. Fisher (1890 – 1962) on the analysis of variance (ANOVA), the class of linear models has gradually expanded and now belongs to the standard repertoire of statistical methods used by life scientists. Thanks to the development of user friendly and powerful statistical software, models for non-normal responses or for non-independent (e.g. hierarchical) data structures are now applicable also for non-mathematicians. Today, life scientists, especially ecologists, are expected to be familiar with normal linear models (LM), linear mixed models (LME), generalised linear models (GLM), and generalised linear mixed models (GLMM). These four types of models form the basis for a variety of more complicated models, such as generalised additive models (GAM), GAMM, mixture models, multivariate methods, two-level ecological models (such as occupancy or point count models), population models, or survival analysis.

Participants of the course will get a sound introduction to linear models including LM, LME, GLM, and GLMM, using the free statistical software R (www.r-project.org).

Worked examples will include:

- graphical data exploration (various plotting functions)
- fit of the model to data (R-Functions *lm*, *lmer*, *glm*, *glmer*)
- assessment of model fit and model assumptions (diagnostic plots of residuals)
- visualization of the results and drawing conclusions (*summary*, *anova*, *predict*, *sim*)

In addition, course participants will be free to apply linear models to their own data.

For drawing conclusions we will primarily use Bayesian methods (R-Function *sim*) because in hierarchical and more complicated models this is the only exact way to draw conclusions (see e.g. Bolker et al. 2008, TREE 24:127-135), and because probabilities of meaningful hypotheses can be estimated. The course follows Gelman & Hill 2007, Data Analysis Using Regression and Multilevel/Hierarchical Models, Cambridge University Press.

Date: 23. – 27. January 2012
Location: Swiss Ornithological Institute SOI, Sempach (Switzerland)
Teachers: Fränzi Korner-Nievergelt, oikostat GmbH, Ettiswil and SOI
Stefanie von Felten, oikostat GmbH, Trimbach
Tobias Roth, Hintermann & Weber AG, Reinach

Contents: Day 1: Short introduction to R
Overview frequentist and Bayesian statistics
Normal linear model (LM: ANOVA, ANCOVA, regression)

Day 2: Linear mixed effects model (LME)
Fixed and random effects

Day 3: Generalised linear model (GLM)
Logistic regression, binomial and Poisson-model

Day 4: Generalised linear mixed model (GLMM)
Including random effects in a GLM
Overdispersion

Day 5: Participants work on their own (or example) data and give short presentations

Course form: Lectures and exercises
The number of participants is limited to 20.
Participants are expected to bring their own laptop with the last version of R installed.

Course hours: 9 00 to 17 30 including two coffee breaks and a one hour lunch break.

Prerequisite: Make sure you are familiar with the following terms: mean, standard deviation, standard error, and t-test (e.g. chapter 5 in Dalgaard 2008, Introductory Statistics with R, Springer).
Basic knowledge in R programming is not required but advantageous (e.g. chapters 1-5 in Crawley 2007, The R-book, Wiley, chapters 1, 2 and 4 in Dalgaard 2008)

Costs: Student price CHF. 800.-/ regular price CHF 1100.-

Registration and information: Fränzi Korner-Nievergelt, fraenzi.korner@oikostat.ch



Schweizerische Vogelwarte
Station ornithologique suisse
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Travel and accommodation:

Train connections (note that the time table may change in December 2011!):

from Zurich: departure from Zurich 7:30 to Olten
departure from Olten 8:06 to Sempach-Neuenkirch (arrival 8:39)

departure from Sempach-Neuenkirch 18:19 to Olten
departure from Olten 18:59 to Zurich (arrival 19:30)

from Berne: departure from Berne 7:34 to Olten
departure from Olten 8:06 to Sempach-Neuenkirch (arrival 8:39)

departure from Sempach-Neuenkirch 18:01 to Sursee
departure from Sursee 18:18 to Berne (arrival 19:00)

departure from Sempach-Neuenkirch 18:19 to Olten
departure from Olten 18:58 to Berne (arrival 19:25)

from Basel: departure from Basel 7:28 to Olten
departure from Olten 8:06 to Sempach-Neuenkirch (arrival 8:39)

departure from Sempach-Neuenkirch 18:19 to Olten
departure from Olten 19:05 to Basel (arrival 19:32)

Accommodation possibilities (please arrange yourself!):

Guest house of Swiss Ornithological Institute, 3 min from the SOI, double-bed rooms, CHF 10.-/person and night, fraenzi.korner@vogelwarte.ch

Very low standard private accommodation at Fam. Korner-Nievergelt in Ettiswil, warm (!) sleeping bag required, CHF 0.-/night, 30 min by bus and train from the SOI (ticket around CHF 16.-/day), fraenzi.korner@oikostat.ch

Private accommodation at the house of Stefanie von Felten, Olten, sleeping bag required, CHF 0.-/night, 30 min by train from SOI (ticket around CHF 30.-/day), steffi.vonfelten@oikostat.ch

Hotels:

Hotel Adler, Sempach, single (CHF 80-90.-), and double room (CHF 130-140.-), 15 min from SOI, adler.sempach@bluewin.ch

Gasthaus Krone, Sempach, single (CHF 65-110.-), and double room (CHF 110-140.-), 15 min from SOI, info@gasthauskrone.ch

Gasthaus Sempacherhof, Sempach Station, single (CHF 98.-), and double room (CHF 145.-), 15 min from SOI, sempacherhof@bluewin.ch

For further addresses: http://www.sempach.ch/docs/dokumente_korporation/Hotelliste.pdf



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