

Online live course using Zoom
**Introduction to linear mixed-effects models,
 multivariate GLMM and GLLVM**

Provided by: Highland Statistics Ltd

The central theme of this course is the analysis of multiple correlated response (or dependent) variables using GLMs and GLMMs. Instead of applying multiple univariate GLMMs, we will discuss multivariate GLMMs for datasets with a relatively small number of response variables and generalised linear latent variable models (GLLVMs) for datasets with a relatively large number of response variables.

During the course, we cover a large number of exercises with examples such as trait variables from turtle hatchlings from multiple clutches, biomass data from fish species sampled at multiple sites, count data from 250 freshwater benthic species sampled at 200 sites, abundances of multiple parasite species on fish, counts of 60 different debris types in water samples, abundances of multiple spider species in traps, multiple morphometric variables sampled from honeybees, and absence/presence of diet variables from faecal samples of brown bears.

In all these examples, we can analyse each variable with a univariate GLMM. Although these analyses are relatively simple, there are also some problems:

- **Extra Work:** Individual analyses are computationally less efficient and require separate validation, interpretation, and reporting.
- **Lack of Multivariate Relationships:** Analysing the variables individually neglects the interconnected relationships and interactions between them.
- **No Shared Variation:** Univariate models might overlook consistent residual patterns across species, while multivariate models can capture shared variations due to common environmental factors.
- **Multiple Testing:** Conducting separate analyses increases the risk of Type I errors, especially when the response variables are highly correlated.
- **Loss of Community-Level Insights:** Analysing species separately misses out on a comprehensive, community-level viewpoint and can lead to inconsistent conclusions.

Online live course

Dates:

- 7 - 11 October 2024.

Times:

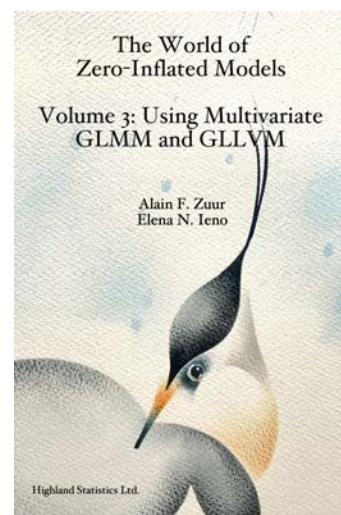
- 13.00 - 19.00 UK time
- 08.00 - 14.00 EST time

Price: £500.

Included: 1 hour face-to-face video chat about your data.

Instructors:

- Dr. Alain Zuur.
- Dr. Elena Ieno.



COURSE CONTENT

Preparation material with on-demand video:

- Exercise on linear regression.
- Exercise on Poisson and negative binomial GLM.
- Matrix notation.
- DHARMA for model validation.

Monday:

- General introduction.
- Short theory presentation on linear mixed-effects models.
- Exercise using linear mixed-effects models.
- Theory presentation on multivariate GLMM.
- Exercise on multivariate GLM.

Tuesday:

- Exercise on multivariate GLMM.
- Theory presentation on generalised linear latent variable models (GLLVM).
- Two exercises on GLLVM for count data (Poisson/negative binomial GLLVM).

Wednesday:

- One exercise on GLLVM for count data.
- Theory presentation on constrained GLLVM (reduced rank regression and concurrent ordination).
- Two exercises on constrained GLLVM.

Thursday:

- Three exercises using GLLVM with Tweedie, Gamma, and Gaussian distributions. The Tweedie distribution can be used for continuous data with zeros (e.g., biomass), and the Gamma distribution for continuous data without zeros.

Friday:

- Catching up
- Two exercises using GLLVM with Bernoulli and beta distributions. The Bernoulli distribution can be used for the analysis of absence/presence data and the beta distribution for proportional data.
- Time allowing: Adding spatial correlation.

PRE-REQUIRED KNOWLEDGE

You need to have a good understanding of data exploration, multiple linear regression, and Poisson and negative binomial GLMs. Working knowledge of R is required. Familiarity with linear mixed-effects models is not required but is an advantage.

GENERAL

- Please ensure that you have system administration rights to install R, and R packages on your computer. Instructions what to install is on the course website.
- We reserve the right to change the exercises. Pdf files of all theory material will be provided. All exercises consist of data sets and annotated R scripts. Access to the course website is for 12 months. The material covered from Monday to Friday does not contain on-demand video (yet).

For terms and conditions, see:

<https://www.highstat.com/index.php/component/hikashop/checkout/termsandconditions/step-3/pos-6/tmpl-component>

GENERAL INFORMATION

COURSE FEE: £500







Credit card payments are charged in GBP currency.

VAT charge:

- UK participants are charged a 20% VAT.
- Non-EU participants (including Norway and Switzerland) are not subject to VAT.
- We do not charge VAT to EU participants who provide their institutional VAT number.
- EU participants who do not provide a VAT number will be charged VAT at their national rate.

COURSE TIMES:

- Monday (7 October 2024) - Friday (11 October 2024):
 - 13.00 - 19.00 UK time (BST). This is 08.00 - 14.00 EST time.
 - Including a 45 minute lunch break and two 20 minutes breaks.

 Aberdeen, United Kingdom BST (UTC +1)	Mon, 7 Oct 2024	14:00
 New York, NY, USA EDT (UTC -4) 5 hour(s) behind	Mon, 7 Oct 2024	09:00
 Montréal, Canada EDT (UTC -4) 5 hour(s) behind	Mon, 7 Oct 2024	09:00
 Amsterdam, Netherlands CEST (UTC +2) 1 hour(s) ahead	Mon, 7 Oct 2024	15:00
 Berlin, Germany CEST (UTC +2) 1 hour(s) ahead	Mon, 7 Oct 2024	15:00
 Mexico City, Mexico CST (UTC -6) 7 hour(s) behind	Mon, 7 Oct 2024	07:00

FREE 1-HOUR FACE-TO-FACE MEETING

The course fee includes a 1-hour face-to-face meeting with one or both instructors. The meeting needs to take place within 12 months after the course. You can discuss your own data, but we strongly advice that the statistical topics are within the content of the course. The 1-hour needs to be consumed in one session, and will take place at a mutual convenient time.

CANCELLATION POLICY:

Once participants are given access to course exercises with R solution codes, pdf files of certain book chapters, and pdf files of presentations, all course fees are non-refundable.

REGISTRATION

<http://highstat.com/index.php/courses>
highstat@highstat.com

Dr. Alain F. Zuur
Highland Statistics Ltd.
9 St Clair Wynd,
AB41 6DZ Newburgh,
UK

