Hybrid (onsite and online) statistics course

Introduction to Generalised Additive Models (GAM) and Generalised Additive Mixed-Effects Models (GAMM)

Provided by: Highland Statistics Ltd

Hosted by: Climate Transformation Programme Earth Observatory Singapore (EOS), Nanyang Technological University, Singapore

This course provides a practical introduction to generalised additive models (GAMs) and generalised additive mixed-effects models (GAMMs) using the mgcv package in R.

Starting with the fundamental ideas behind smoothers, it progresses to modelling non-linear relationships, incorporating random effects and analysing hierarchical data.

Short theory presentations are combined with extensive hands-on exercises using real ecological, environmental, biological, aquaculture and fisheries datasets. The emphasis is on practical modelling skills, sound statistical decisions and interpretation of results, rather than mathematical derivations.

Participants will learn how to:

- fit, interpret and visualise GAMs and GAMMs;
- choose suitable basis dimensions and assess smoother complexity;
- model interactions involving smoothers;
- include random effects and nested or crossed hierarchical structures;
- implement hierarchical GAMs and GAMMs;
- analyse continuous, count, binary and proportional response variables;
- and carry out model selection and validation using DHARMa and other diagnostic tools.

Hybrid (onsite and online)

Dates: 15 - 19 February 2027.

Teaching times: 09.00 - 16.00 (SGT)

Price: £500.

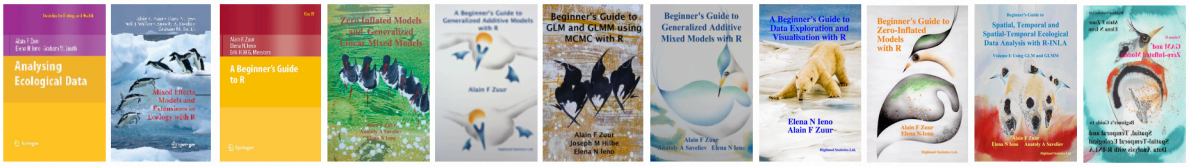
Included: 1 hour face-to-face video chat about your data.

Instructors:

- Dr. Alain Zuur
- Dr. Elena Ieno

Authors of 12 books and providers of over 250 courses

The course covers Gaussian, Poisson, negative binomial, Bernoulli, binomial, beta, Gamma and Tweedie models.



COURSE CONTENT

Module 1 — Introduction to GAMs
The first module provides a short revision of data exploration and multiple linear regression before introducing the main ideas behind GAMs. Singing-whale data are used to demonstrate how smoothers can represent non-linear relationships and how a GAM can be extended from one covariate to multiple covariates.

Topics include:
- revision of data exploration and multiple linear regression;
- introduction to smoothers and GAMs;
- fitting a GAM with one smoother;
- fitting GAMs with multiple explanatory variables; and
- interpreting and visualising estimated smoothers.

Module 2 — Gaussian GAMs and GAMMs
This module examines GAMs for continuous response variables and introduces generalised additive mixed-effects models. A short revision of linear mixed-effects models is followed by applications involving grouped and repeated observations.

Topics include:
- Gaussian GAMs;
- revision of linear mixed-effects models;
- random effects and dependency between observations;
- Gaussian GAMMs; and
- combining smooth effects and random effects.

Module 3 — GAMs for count data
This module introduces GAMs for count data. Queen conch data are used to compare Poisson and negative binomial models and to demonstrate how non-linear covariate effects can be incorporated. Topics include:
- Poisson GLMs and GAMs;
- overdispersion;
- negative binomial GLMs and GAMs;
- choosing between Poisson and negative binomial distributions; and
- model validation for count data.

Module 4 — GAMMs for count, binary and proportional data
This module extends GAMMs to more complex response variables and hierarchical datasets. Applications include spider species richness, minke-whale diving behaviour, cowbird occurrence and temporal trends in illegal elephant killing.

Topics include:
- Poisson and negative binomial GAMMs;
- Bernoulli GAMMs;
- binomial models for proportional count data;
- smooth temporal trends;
- random effects; and
- nested hierarchical structures.

Module 5 — Beta, Gamma and Tweedie GAMMs
This module introduces additional distributions for continuous and semi-continuous response variables. Applications include grassland plant evenness, barn-owl behaviour and fisheries catch-per-unit-effort.

Topics include:
- beta GAMs for proportional data;
- Gamma GAMMs for positive continuous data;
- Tweedie GAMMs for data containing zeros and positive continuous values;
- nested and crossed random effects; and
- conditional, marginal and population-level fitted values.

GENERAL INFORMATION

Course materials and additional online learning

Participants receive 12 months' access to the course website, including downloadable datasets, annotated R solution scripts and on-demand videos explaining the analyses, modelling decisions and interpretation of results. Videos can be watched at any time and as often as required during the access period.

The taught course focuses on Modules 1–5, covering GAMs and GAMMs. Two additional modules on spatial and spatio-temporal data analysis are available on the course website for independent study, with exercises and on-demand videos. These topics will not be covered during the taught sessions.

Individual support

Participants can use the online discussion board to ask questions and interact with the instructors and other participants. Each participant also receives a one-hour individual face-to-face video consultation with one or both instructors to discuss their own data or statistical questions. This is provided as a single session at a mutually convenient time and must be used within 12 months of receiving access to the course website.

Background knowledge

Participants should have a working knowledge of R and a basic understanding of regression and generalised linear models. Short revisions of multiple linear regression and linear mixed-effects models are included.

Participants unfamiliar with GLMs and distributions such as the binomial, negative binomial, beta, Gamma or Tweedie are advised to complete our introductory course, "Data Exploration, Regression, GLM and GAM", first.

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.
- Course participants will be given access to the course website with all the videos, data sets, R solution code and course material.
- Depending on participants' background knowledge and the pace of the course, we may not cover all exercises during the taught sessions; all exercises and accompanying videos will remain available on the course website for independent study.

Registration and payment is either via invoice/bank transfer or via credit card payment.

INFORMATION ON COURSE CONTENT

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