

ST346-15 Generalised Linear Models for Regression and Classification

24/25

Department

Statistics

Level

Undergraduate Level 3

Module leader

Elke Thonnes

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module runs is optional for students with their home department in Statistics . It may be possible for students from other courses to take this module as an Unusual Option, subject to permission from the module leader and the home department.

Pre-requisites: ST221 Linear Statistical Modelling or ST231 Linear Statistical Modelling with R.

Leads to: further modules that require statistical modelling, especially ST332 Medical Statistics.

Module aims

Regression is a typical problem in statistical learning and it involves explaining the behaviour of some response variable in terms of its relationship to a collection of possible explanatory variables. The ultimate aim is to do this via a modelling framework that provides both interpretability as well as uncertainty quantification.

The linear modelling course, ST221, gave an introduction to this problem. This course extends this framework to a broader range of problems and data types, e.g. binary and count data. The course will begin by introducing the Generalised Linear Model (GLM) and describe the model fitting

process, variable selection, model validation, interpretation and uncertainty quantification.

This will be followed by topics that further extend the modelling possibilities to cases where model assumptions are not met e.g. overdispersion, random effect models, quasi-likelihood methods.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Introduce Generalised Linear Models as an extension of the standard linear model from ST221 under the umbrella of maximum likelihood estimation.
2. Covering model selection, parameter uncertainty and model validation for GLMs.
3. Extend this framework further to models that can handle overdispersion and be more robust to model selection e.g. random effects and quasi-likelihood models.

Learning outcomes

By the end of the module, students should be able to:

- identify an appropriate modelling approach for different types of response variable.
- select a model and analyse it in a principled way and verify the model assumptions.
- give clear uncertainty quantification for both parameter estimates as well as for model predictions.
- understand the key modelling assumptions and have a good understanding of how to make basic extensions to the standard GLM when issues like overdispersion are present.
- both apply and understand the theory and computation of GLMs

Subject specific skills

- Demonstrate facility with rigorous statistical modelling methods.
- Evaluate, select and apply appropriate statistical modelling techniques.
- Demonstrate knowledge of and facility with formal statistical modelling concepts, both explicitly and by applying them to the solution of problems.
- Create structured and coherent arguments communicating them in written form.
- Construct logical arguments with clear identification of assumptions and conclusions.
- Reason critically, carefully, and logically.

Transferable skills

- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally

and creatively to look beyond the obvious. Know how to learn from failure.

- Self awareness: Reflect on learning, seeking feedback on and evaluating personal practices, strengths and opportunities for personal growth.
 - Communication: Present arguments, knowledge and ideas, in a range of formats.
 - Professionalism: Prepared to operate autonomously. Aware of how to be efficient and resilient. Manage priorities and time. Self-motivated, setting and achieving goals, prioritising tasks.
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Study

Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (20%)	2 sessions of 1 hour
Seminars	5 sessions of 1 hour (3%)	
Private study	85 hours (57%)	
Assessment	30 hours (20%)	
Total	150 hours	

Private study description

Weekly revision of lecture notes and materials, wider reading, practice exercises and preparing for examination.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D4

	Weighting	Study time	Eligible for self-certification
Assignment 2	10%	15 hours	No

	Weighting	Study time	Eligible for self-certification
The assignment will contain a number of questions for which solutions and / or written responses will be required. The number of words noted refers to the amount of time in hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST346 Assignment 2 should not exceed 15 pages in length.			
Assignment 1	10%	15 hours	No
The assignment will contain a number of questions for which solutions and / or written responses will be required. The number of words noted refers to the amount of time in hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST346 Assignment 1 should not exceed 15 pages in length.			
In-person Examination	80%		No
The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.			

- Answerbook Pink (12 page)
- Students may use a calculator

Assessment group R4

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No
The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.			

- Answerbook Pink (12 page)
- Students may use a calculator

Feedback on assessment

Marked assignments will be available for viewing at the support office within 20 working days of the submission deadline. Cohort level feedback and solutions will be provided, and students will be given the opportunity to receive feedback via face-to-face meetings.

Solutions and cohort level feedback will be provided for the examination.

Availability

Pre-requisites

To take this module, you must have passed:

- All of
 - [ST221-12 Linear Statistical Modelling](#)

Courses

This module is Core for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics

This module is Optional for:

- Year 3 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
 - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
 - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
 - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
 - Year 5 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- Year 3 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- Year 3 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics

This module is Option list B for:

- Year 3 of USTA-G302 Undergraduate Data Science

- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

This module is Option list D for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics

This module is Option list E for:

- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
 - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
 - Year 4 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)