02424 Assignment 2: 2023

This is the second of three mandatory assignments for the course 02424. It must handed in using Campusnet (time and date is given at Campusnet). The submissions most contain one collected attached file in Portable Document Format (PDF), other document formats will not be accepted.

When writing the report please explain carefully what you did in each step, back up your statements with quantitative measures when possible, explicitly write down all models used in mathematical notation, and last keep it short and concise.

Part A: Clothing insulation level

The problem and data

The level of clothing a person is wearing at office is one of the key factors influencing their level of comfort [1]. In addition, the level of comfort influences the need for cooling and/or heating.

The data include clothing insulation levels (`clo`) worn by subjects of three experimental studies in the Laboratory of Occupant Behavior, Satisfaction, Thermal comfort and Environmental Research (LOBSTER) [2]. In addition the data include indoor operating temperature (`tInOp`), outdoor air temperature (`tOut`), subject id (`subjId`), day (`day`) that is a counter within subjects (most subject come in 3 days and in that case we have a counter from 1-3), and time difference between observations (within day and subject) (`time`).

Models

The first part of the assignment concerns modeling of clothing insulation level based on Indoor operating temperature and outdoor temperature (i.e. you should ignore `subjId`, `day` and `time` in this part). The general idea is to investigate if it is possible to find generalized or general linear models that are better suited for the problem.

1. Find sutiable generalized linear models for clothing insulation level and compare the results. Also illustrate the differences between some of the models.
2. Make a residual analysis, as part of this you should investigate if the variation/dispersion in clothing level differes between men and women.

3. Give an interpretation of your model, including some graphical presentation.

4. Fit the model but including `subjId` rather than `sex` and conclude.

5. Make a residual analysis that include analysis of within day autocorrelation (you assume that the sampling frequency is constant).

6. Set up a model that estimate the optimal weight/dispersion parameter for men and women, also make a profile likelihood plot for this parameter.

7. Write a small conclusion of your findings in Part A.

Part B: Ear infection in swimmers

The data set `earinfect.txt` contains data from an observational study in New Zealand from 1990 where ocean swimmers (some frequent swimmers other occasional swimmers) were asked to count the number of ear infections they got in 1990. The variables in the data set are:

`swimmer`	Indicates if the swimmer is a frequent or an occasional ocean swimmer
`location`	Indicates the usually chosen swimming location: beach or non-beach
`age`	The age of the swimmer: 15-19, 20-24, 25-29
`sex`	The gender of the swimmer male or female
`infections`	Number of self diagnosed ear infections in 1990
`persons`	Number persons in that group

The goal is to find whether location, age, whether the swimmer is a frequent or occasional swimmer or interactions between these have any effects on the number of ear infections. When a final model has been found write out the model and interpret the parameters of the model.

1. Describe the content of this dataset in words.

2. Explain why a linear model would be unappropriate.

3. Explain why a model with an offset might be appropriate.

4. Fit a full model. What can you say about its goodness of fit (explain).

5. Try to reduce this model by successive likelihood ratio tests. Explain how you proceed to compare two models.

6. Report your best model (formula, goodness of fit).

When a final model has been found write out the model and interpret the parameters of the model.

References

[1] Fanger, P.O. (1970). *Thermal Comfort Analysis and Applications in Environmental Engineering*. McGraw-Hill, New York.

[2] Schweiker, M. and Wagner, A. (2015). *A framework for an adaptive thermal heat balance model (ATHB)*. Building and Environment (94), Elsevier Ltd.