

## Practical Data Analysis with BUGS using R

This course is a revision of previous courses in “Bayesian Data Analysis” that was given in Copenhagen in 2006 and 2008 and in Stockholm in 2007. The course was revised in the light of the experiences with the former versions. It is now more advanced; the background for the MCMC and in particular linear mixed models and generalized mixed linear models are now covered in more depth, both with respect to philosophical aspects and practical computation. Technically it has been revised to cover the use of JAGS too, which allows users of Linux and MacOS to runs MCMC-simulations more seamless than previously.

The name “PDAwBuR” reflects the fact that the BUGS machinery is widely used with uninformative priors to evaluate likelihood functions.

## Tentative programme

### Course schedule:

Day	Time	Lectures	Practicals
Mon	Morning	1.5	2.0
	Afternoon	1.5	2.0
Tue	Morning	1.5	2.0
	Afternoon	1.0	2.5
Wed	Morning	1.5	2.0
	Afternoon		Free
Thu	Morning	1.0	2.5
	Afternoon	1.0	2.5
Fri	Morning	1.0	2.5
	Afternoon	1.0	2.5
total		11.0	20.5

### Monday 13 August 2012

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09:00 – 09:30	Registration & coffee.
09:30 – 10:15	<b>Lecture 1:</b> Introduction to Bayesian analysis: The binomial model as an example. (LG)
10:15 – 10:30	<b>Lecture 0:</b> Getting R and BUGS running. (BxC)
10:30 – 11:00	<b>Morning Tea</b>
11:00 – 12:30	<b>Practical 1:</b> Bayesian analysis in R: Discrete prior distribution in the DRUGS example. Illustration of posterior = likelihood $\times$ prior. The effect of data and prior variance using Beta probability functions in R. (BxC)
12:30 – 13:30	<b>Lunch</b>
13:30 – 14:30	<b>Lecture 2:</b> Introduction to MCMC and the BUGS programming language. (BxC/SH)
14:30 – 16:00	<b>Practical 2:</b> Simple analyses in BUGS using the binomial distribution, example of restricted uniform or beta prior distribution with narrow prior support for a range of parameters values. (BxC/SH)

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**Tuesday 14 August 2012**

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09:00 – 09:30	<b>Recap of Monday</b>
09:30 – 10:00	<b>Lecture 3:</b> Demonstrating the Gibbs sampler with a multiparameter problem and some data. The role of DAG-able models for the BUGS machinery to work. (SH)
10:00 – 10:30	<b>Practical 3:</b> The Gibbs sampler and the Metropolis-Hastings sampler with a bivariate normal example. (SH)
10:30 – 11:00	<b>Morning Tea</b>
11:00 – 11:30	<b>Lecture 4:</b> Poisson model for count data and rates. (LG)
11:30 – 12:30	<b>Practical 4:</b> Estimating the rate and time trend of asthma deaths in Australia using a Poisson model. (LG)
12:30 – 13:30	<b>Lunch</b>
13:30 – 14:00	<b>Lecture 5:</b> The normal model, multiparameter problems and the conceptually simple Bayesian approach. (LG)
14:00 – 14:45	<b>Practical 5:</b> Speed of light example showing the use of posterior predictive checking. First introduce a noninformative prior distribution for the mean and then an informative distribution - does this influence our opinion as to whether the lowest observations are outliers? (LG)
14:45 – 15:15	<b>Lecture 6:</b> Multiparameter generalized linear models. (LG)
15:15 – 16:30	<b>Practical 6:</b> Airline fatalities and posterior prediction of future fatalities: Several models: 1) Linear in log rate, 2) Linear in rate (problems with prior spec.) [1&2 simple in R.]. 3) Some parametric model of rate decay. (BxC/LG)

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**Wednesday 15 August 2012**

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09:00 – 09:30	<b>Recap of Tuesday</b>
09:30 – 10:00	<b>Lecture 7:</b> Monitoring convergence and the need to run multiple chains. (LG)
10:00 – 10:30	<b>Practical 7:</b> Problems with convergence - an example? (SH/LG)
10:30 – 11:00	<b>Morning Tea</b>
11:00 – 11:30	<b>Lecture 8:</b> Hierarchical models. (LG)
11:30 – 13:00	<b>Practical 8:</b> Meta-analysis of clinical trials as an example of a hierarchical model. (LG)
13:00 –	Afternoon free!

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**Thursday 16 August 2012**

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09:00 – 09:30	<b>Recap of Wednesday</b>
09:30 – 10:00	<b>Lecture 9:</b> Fetal growth example of linear mixed model. (LG)
10:00 – 10:30	<b>Morning Tea</b>
10:30 – 12:30	<b>Practical 9:</b> Fitting linear mixed models in <b>R</b> and BUGS: Fetal growth (head circumference) as a quadratic mean, random linear function of gestational age. Compare with SAS/ <b>R</b> /Stata approach. Reporting essential. (LG)
12:30 – 13:30	<b>Lunch</b>
13:30 – 14:15	<b>Lecture 10:</b> Generalised linear mixed models (GLMMs) in BUGS. (LG)
14:15 – 16:00	<b>Practical 10:</b> Illustration of GLMMs using clustered binary data from GPs, also twin and family data with genetically structured covariance. (LG)
18:00 – 22:00	Course dinner.

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**Friday 17 August 2012**

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09:15 – 09:30	<b>Recap of Thursday</b>
09:45 – 10:30	<b>Lecture 11:</b> Model comparison using DIC. (LG)
10:30 – 11:00	<b>Morning Tea</b>
11:00 – 12:30	<b>Practical 11:</b> Comparing models in BUGS using DIC. (LG)
12:30 – 13:30	<b>Lunch</b>
13:30 – 14:15	<b>Lecture 12:</b> Comparing methods of measurement in Stata, SAS, GenStat, <b>R</b> and BUGS. (BxC)
14:15 – 15:30	<b>Practical 12:</b> Comparing methods of measurement using the MethComp package — reporting (BxC)
15:30 – 16:00	Wrapping up, closure, evaluation and farewell

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