Information for participants Bayes course Leipzig '15

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Lecturers

- Florian Hartig
- Felix May

Course plan

The course runs from 9.00 to 17.00, with a one-hour lunch break around 12.30

1. Day 1 - morning (FH)

- Intro Bayes, and difference to "conventional" stats
- Priors
- Posterior interpretation
- MCMC sampling

2. Day 1 - Afternoon (FM)

- Intro Jags
- Binomial model in JAGS
- Regression in JAGS

3. Day 2 - Morning (FH)

- Mixed and generalised linear mixed models in JAGS
- Model checking, Bayesian p-values

4. Day 2 - Afternoon (FH)

- Hierarchical models
- Spatial models
- Outlook INLA
- Bayesian Model selection / Model averaging
- Approximate Bayesian Computation (ABC)

Preparations and installation of software

- If you want to prepare for the course in advance (we do not expect that you will, but just in case), have a look at the recommended reading material here, in particular the nice and free Bayes intro by Michael Clark

- Please make sure the following software is installed on your laptops

- R
- Rstudio
- JAGS
- The R packages rjags and R2jags
- Check that everything runs fine by running the following code

```
# Test of the R2jags system
# Modified from the help file of the jags function


# An example model file is given in:
model.file <- system.file(package="R2jags", "model", "schools.txt")
# Let's take a look:
file.show(model.file)
# you can also write BUGS model as a R function, see below:

#=================#
# initialization  #
#=================#

# data
J <- 8.0
y <- c(28.4,7.9,-2.8,6.8,-0.6,0.6,18.0,12.2)
sd <- c(14.9,10.2,16.3,11.0,9.4,11.4,10.4,17.6)


jags.data <- list("y","sd","J")
jags.params <- c("mu","sigma","theta")
jags.inits <- function(){
  list("mu"=rnorm(1),"sigma"=runif(1),"theta"=rnorm(J))
}

## You can input data in 4 ways
## 1) data as list of character
jagsfit <- jags(data=list("y","sd","J"), inits=jags.inits, jags.params,
                n.iter=10, model.file=model.file)

## 2) data as character vector of names
jagsfit <- jags(data=c("y","sd","J"), inits=jags.inits, jags.params,
                n.iter=10, model.file=model.file)

## 3) data as named list
jagsfit <- jags(data=list(y=y,sd=sd,J=J), inits=jags.inits, jags.params,
                n.iter=10, model.file=model.file)

## 4) data as a file
fn <- "tmpbugsdata.txt"
dump(c("y","sd","J"), file=fn)
jagsfit <- jags(data=fn, inits=jags.inits, jags.params,
                n.iter=10, model.file=model.file)
unlink("tmpbugsdata.txt")
```

```
## You can write bugs model in R as a function

schoolsmodel <- function() {
  for (j in 1:J){                      # J=8, the number of schools
    y[j] ~ dnorm (theta[j], tau.y[j]) # data model:  the likelihood
    tau.y[j] <- pow(sd[j], -2)        # tau = 1/sigma^2
  }
  for (j in 1:J){
    theta[j] ~ dnorm (mu, tau)        # hierarchical model for theta
  }
  tau <- pow(sigma, -2)               # tau = 1/sigma^2
  mu ~ dnorm (0.0, 1.0E-6)            # noninformative prior on mu
  sigma ~ dunif (0, 1000)             # noninformative prior on sigma
}

jagsfit <- jags(data=jags.data, inits=jags.inits, jags.params,
                n.iter=10, model.file=schoolsmodel)


#================================#
# RUN jags and postprocessing   #
#================================#
jagsfit <- jags(data=jags.data, inits=jags.inits, jags.params,
                n.iter=5000, model.file=model.file)

# display the output
print(jagsfit)
plot(jagsfit)

# or to use some plots in coda
# use as.mcmmc to convert rjags object into mcmc.list
plot(as.mcmc(jagsfit))
```