


R2WinBUGS/ R2OpenBUGS

Running code from R

BMTRY 763

R2WinBUGS

- Calling WinBUGS from R
 - Calls WinBUGS with a model file (model.txt in example)
 - Returns output in a object if required



```
bugs(data, inits, parameters.to.save, model.file =  
"model.txt", n.chains = 3, n.iter = 10000, n.burnin = 5000,  
n.thin = 1, debug = FALSE, DIC = TRUE)
```

R LIVE Demo NOW!

Map_modelWB_pred.txt

```
model
{
  for (i in 1:m)
  {
    # Poisson likelihood for observed counts
    y[i]~dpois(mu[i])
    ypred[i]~dpois(mu[i])
    mu[i]<-e[i]*theta[i]
    probexc[i]~step(theta[i]-1)
    # Relative Risk
    theta[i]~dgamma(a,b)
    r[i]<-y[i]-mu[i]
    rpred[i]<-y[i]-ypred[i]
  }

  # Prior distributions for "population" parameters
  a~dexp(10)
  b~dexp(10)

  # Population mean and population variance
  mean<-a/b
  var<-a/pow(b,2)
}
```

```
del
```

```
(i in 1:m)
```

```
  # Poisson likelihood for observed counts
```

```
  y[i]~ dpois(mu[i])
```

```
  ypred[i]~ dpois(mu[i])
```

```
  mu[i] <- e[i]*theta[i]
```

```
  probexc[i] <- step(theta[i]-1)
```

```
  # Relative Risk
```

```
  theta[i]~ dgamma(a,b)
```

```
  r[i] <- y[i]-mu[i]
```

```
  rpred[i] <- y[i]-ypred[i]
```

```
  #prior distributions for "population" parameters
```

```
  dexp(10)
```

```
  dexp(10)
```

```
  #population mean and population variance
```

```
  an <- a/b
```

```
  <- a/pow(b,2)
```


Variables

- μ [], θ [], probexc [], r [], rpred []
- a , b , mean , var

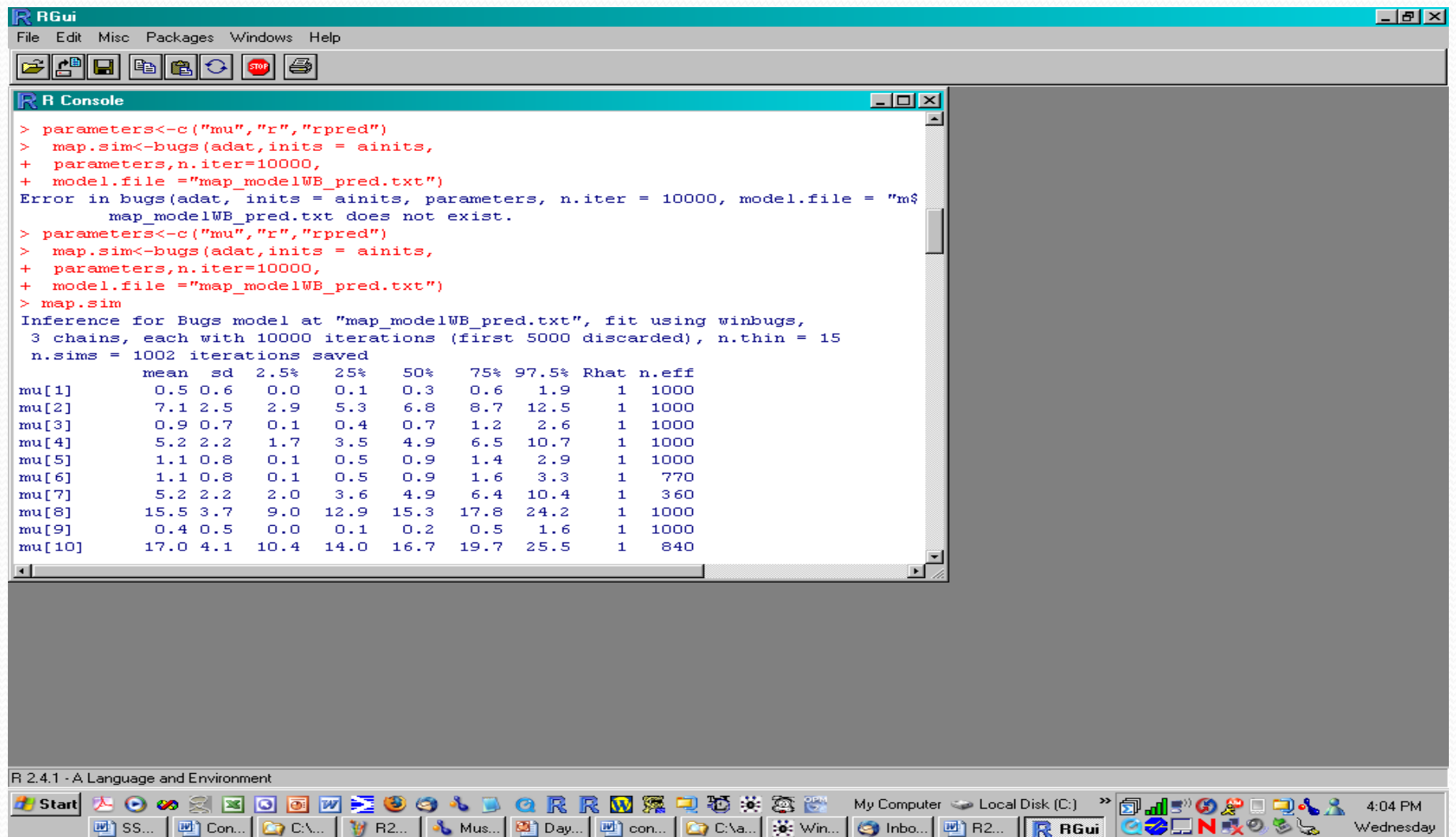
Data (in a list object)

```
adat<-list(  
m=46,  
y=c(0,7,1,5,1,1,5,16,0,17,4,0,0,1,1,7,1,3,0,0,8,2,13,7,0,8,0,3,2,4,1,  
11,0,1,2,3,3,8,6,14,3,11,6,0,1,5),  
e=c(1.129778827,6.667008775,0.650279674,6.988864371,0.95571406,1.123210345,5.908  
349156,8.539026017,0.601016062,18.92051111,  
2.272694617,1.73736337,2.019808077,1.688099759,1.747216093,  
3.221840201,1.835890594,5.221942834,0.978703751,1.254579976,  
6.407553754,2.676656232,16.57884744,3.077333607,1.087083697,  
7.606301637,1.018114641,2.15774619,2.844152512,2.955816698,  
0.985272233,9.22871658,0.38097193,1.855596038,1.579719813,  
1.579719813,2.647098065,4.791707292,4.144711859,15.70852363,  
0.765228101,11.32077795,6.256478678,1.500898035,2.085492893,  
7.297583004)  
)
```


Model running

```
parameters<-c("mu","r","rpred")  
map.sim<-bugs(adat,inits = ainit,  
parameters,n.iter=10000,  
model.file = "map_modelWB_pred.txt")
```

example



```
> parameters<-c("mu","r","rpred")
> map.sim<-bugs(adat,inits = ainits,
+ parameters,n.iter=10000,
+ model.file ="map_modelWB_pred.txt")
Error in bugs(adat, inits = ainits, parameters, n.iter = 10000, model.file = "m$
map_modelWB_pred.txt does not exist.
> parameters<-c("mu","r","rpred")
> map.sim<-bugs(adat,inits = ainits,
+ parameters,n.iter=10000,
+ model.file ="map_modelWB_pred.txt")
> map.sim
Inference for Bugs model at "map_modelWB_pred.txt", fit using winbugs,
3 chains, each with 10000 iterations (first 5000 discarded), n.thin = 15
n.sims = 1002 iterations saved

      mean sd  2.5%  25%   50%   75%  97.5%  Rhat  n.eff
mu[1]  0.5 0.6   0.0   0.1   0.3   0.6   1.9    1  1000
mu[2]  7.1 2.5   2.9   5.3   6.8   8.7  12.5    1  1000
mu[3]  0.9 0.7   0.1   0.4   0.7   1.2   2.6    1  1000
mu[4]  5.2 2.2   1.7   3.5   4.9   6.5  10.7    1  1000
mu[5]  1.1 0.8   0.1   0.5   0.9   1.4   2.9    1  1000
mu[6]  1.1 0.8   0.1   0.5   0.9   1.6   3.3    1   770
mu[7]  5.2 2.2   2.0   3.6   4.9   6.4  10.4    1   360
mu[8]  15.5 3.7   9.0  12.9  15.3  17.8  24.2    1  1000
mu[9]  0.4 0.5   0.0   0.1   0.2   0.5   1.6    1  1000
mu[10] 17.0 4.1  10.4  14.0  16.7  19.7  25.5    1   840
```

R 2.4.1 - A Language and Environment

Start | SS... | Con... | C:\a... | R2... | Mus... | Day... | con... | C:\a... | Win... | Inbo... | R2... | RGui | 4:04 PM Wednesday

Instructions

- make sure 'map_modelWB_pred.txt' is in the default directory
- Load R
- Load R2winBUGS
- Paste 'ainits'
- Paste 'adat'
- Set 'parameters'

Command issue

```
parameters<-c("mu","r","rpred")  
map.sim<-bugs(adat, inits = ainit,  
parameters,n.iter=10000,  
model.file = "map_modelWB_pred.txt")
```


OpenBUGS/JAGS

- This is an open source version of BUGS that allows the user to call separate routines (without having to load WinBUGS)
- Could be useful for large computations: is currently available for R for Windows and Linux.
- JAGS is an alternative on R

BRugs

- This is a version of BUGS where each step in the model process can be called directly from R
- It is implemented in the OpenBUGS project

Example

```
library(BRugs)
modelCheck("log-linear-Poisson-model2.txt")
modelData("adat.txt")
modelCompile(numChains=2)
modelInits(rep("inits.txt",2))
modelGenInits()
modelUpdate(10000)
samplesSet(c("theta","v","deviance"))
modelUpdate(2000)
samplesStats("*")
```

```
asd<-samplesStats("*")
```

CARBayes

- CARBayes is a R package that was developed to fit a variety of CAR models to spatial health data (by Duncan Lee)
- The package can be called using *glm* – like call on R
- The package allows a variety of linear predictor terms and also different CAR models :
 - BYM
 - Leroux
 - Localised cluster
- There is also a space-time extension of the package : CARBayesST

Model call(BYM)

```
library(CARBayes)
library(maps)
SCcounty<-map("county","South Carolina",plot=FALSE,fill=TRUE)
SCmap<-map2SpatialPolygons(SCcounty,IDs=SCcounty$names)
plot(SCmap)
W.nb <- poly2nb(SCmap)
W.mat <- nb2mat(W.nb, style="B")
form<-obs~1+offset(log(expe))
model.spatial<-S.CARbym(formula=form,
family="poisson",data=SCcg90, W=W.mat, burnin=10000,
n.sample=11000)
summary(model.spatial)
```

Nimble

- Nimble is an R package which parses BUGS code and sets up node samplers in C++
- Unlike R2WinBUGS or BRugs it does not call BUGS at all
- This makes it much faster
- A range of spatial models have been set up already
- Improper and proper CAR models available
- My GitHub repository has various examples :

<https://github.com/Andrew9Lawson/Bayesian-DM-code-examples>

Nimble example

- An example of Nimble code, for a BYM convolution model :

```
library(nimble)
LconvCode<-nimbleCode({
for(i in 1:N){
log(theta[i])<-ao+v[i]+B[i]
lambda[i]<-theta[i]*texp[i]
y[i]~dpois(lambda[i])
v[i]~dnorm(o,tauv)
}
for(k in 1:L){wei[k]<-1}
B[1:N]~dcar_normal(adj[1:L],wei[1:L],num[1:N],tauB,zero_mean=1)
ao~dnorm(o,tauo)
tauv~dgamma(2,0.5)
tauo~dgamma(2,0.5)
tauB~dgamma(2,0.5)
})
```



Nimble code example

SC_congen_90_CONV_nimble.txt



MultiBUGS

- A new version of OpenBUGS that allows distributed processing : a parallel implementation
- This should speed up certain computations in BUGS
- <https://www.multibugs.org/>
- User interface is the same as OpenBUGS but an option now allows user to specify nodes and distribution.

LinBUGS/LinBAYES

- A linux version of OpenBUGS is widely operational and a new version has just been released:

<http://www.openbugs.net/>

- A Mac version can be run using Wine

LinBUGS/LinBAYES

- A linux version of OpenBUGS
- Is not widely operational but a new version has just been released:
<http://www.openbugs.info/w/UserContributedCode>
- Another implementation is available from:
<http://www.linbayes.org/linbayes/overview.shtml>
 - Claims to be stable; supports, in one box, OpenBUGS and JAGS

SAS/R

- There is now a SAS proc that can run MCMC for GLMs
- Doesn't currently have the full range of models available to WinBUGS of course (*no spatial models*)
- R also has libraries that can be called from R programs that do MCMC (e. g. `mcmcpack`)

MATBUGS

- A script writing utility for MATLAB
- Similar to R2WinBUGS

STATA

- Functionality also available for STATA:
 - winbugsfromstata
 - <http://www2.le.ac.uk/departments/health-sciences/research/gen-epi/Progs/winbugs-from-stata>