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What is Nimble?
Anyone know???

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What we actually want (come on google)

r-nimble.org

NIMBLE

An R package for programming with BUGS models and compiling parts of R.

Home | What is NIMBLE? | Examples | Documentation | Download | More

NIMBLE

Write statistical models in the BUGS language from R

NIMBLE adopts and extends BUGS as a modeling language and lets you program with the models you create.

Other packages that use the BUGS language are only for Markov chain Monte Carlo (MCMC). With NIMBLE, you can turn BUGS code into model objects and use them for whatever algorithm you want. That includes algorithms provided with NIMBLE and algorithms you write using nimbleFunctions. NIMBLE extends BUGS by allowing multiple parameterizations for distributions, user-written functions and distributions, and more.

News

Version 0.4-1 released!
We have a post-doc opening.
Version 0.4 released!

Use and customize NIMBLE's statistical algorithms

NIMBLE provides MCMC, sequential Monte Carlo (particle filters), and more.

NIMBLE algorithms are written so they can adapt to different statistical models. For MCMC, NIMBLE can assign a default set of sampler choices, but you can customize the samplers from R. For example, you can choose what parameters to sample in a block, and you can easily write your own samplers and include them.

Compile your models and algorithms for fast execution.

NIMBLE generates C++ code customized to your model and algorithms, compiles it, and lets you use it from R.

You don't need to know anything about C++ to use NIMBLE's compiler. NIMBLE provides R functions to call the compiled algorithms, and you get the output back in R. (You do need to have a

Numerical
Inference for stats
Models for
Bayesian
Likelihood
Estimate

To normal people,
and some of you
(3 months ago, before taking this class),
Nimble is a Black Box.

Internal behavior of the code is unknown

Sequential Monte Carlo
Gaussian Quadrature
Synthetic Likelihood
Kalman Filter
Data Cloning
GLMM
INLA
ABC
Your Idea
Your Favourite
magicbox
Nimble
Jags Wrapper
Stan Caller
MCEM
PF
WinBUGS
OpenBUGS
JAGS
INLA
Stan
PyMC

Connecting the dots

+

=

If you think about it a little bit more ….

Nimbus 2000

Firebolt

~

sounds like NIMBLE

What is the probability of that!!!

REAL LIFE EXAMPLE

The Infamous SIR MODEL

If you Google it

$$
\begin{aligned}
\frac{dS}{dt} &= -\beta\frac{SI}{N} - \nu S \\
\frac{dI}{dt} &= \beta\frac{SI}{N} - \gamma I \\
\frac{dR}{dt} &= \gamma I + \nu S \\
N &= S + I + R
\end{aligned}
$$

Some Population
Size N

Time 1

$N_0 \sim \text{Binomial}(\text{effprop}, N)$

$I[1] = 1$

$S[1] = N_0 - I[1]$

Time 2

$N_0 \sim \text{Binomial}(\text{effprop}, N)$

$$pSI[1] = 1 - (1-\text{beta})^{I[1]}$$

$$I[2] \sim \text{Binomial}(pSI[1], S[1])$$

$$S[2] = S[1] - I[2]$$

Time t

$$pSI[t-1] = 1 - (1-beta)^{I[t-1]}$$

$$I[t] \sim Binomial(pSI[t-1], S[t-1])$$

$$S[t] = S[t-1] - I[t]$$

$$Iobs[t] \sim Binomial(reporting, I[t])$$

HOMEWORK

Already Provided:
Simulator
Source scripts

What you need to do

Complete the for loop Bugs code in nimCB.R and run NimbleCB.R

nimCB.R

Source on Save

```r
nimcode <- nimbleCode({
  ##prior distributions
  reporting ~ dunif(0,1)
  effprop ~ dunif(0,1)
  beta ~ dunif(0,0.1)

  N0 ~ dbin(effprop,N)


  I[1] ~ dbin(1,i0) ##hack to make sure you get at least 1 infectious
  S[1] <- N0 - i0
  pSI[1] <- 1 - (1-beta)^I[1]
  obs[1] ~ dbin(reporting,I[1])

  for(t in 2:numobs){
    #Write your code here
    ##only 4 lines of code
  }


})
```

If you are going to do it
and run into trouble, feel free
to email me @ lim88@mcmaster.ca
or FB message me if we are friends =P

2 Nimble
2 Nimbus
MC
MC
2 FAST 2 FURIOUS
www.wallpapersmania.com

ESS (Effective Sample Size)
Efficiency

ESS gives an estimate of the equivalent number of independent iterations that the chain represents … (human words: The bigger the better)

Efficiency = ESS/run time

The Bigger and Faster guy wins

"I live my life a quarter mile at a time. Nothing else matters:…" (Toretto, 2001)

Results

```
> print(NimbleCB$timing)
          jags         nimble   nimble_slice nimble_compile
         1.103          0.444          0.489         15.117
> print(NimbleCB$summary)
, , beta

                   mean     median          sd   CI95_low   CI95_upp    n      ess efficiency
jags         0.02002162 0.01998765 0.001042069 0.01805050 0.02214587 8000 4636.721   4203.736
nimble       0.01971684 0.01971859 0.001015840 0.01776498 0.02173398 8000 1857.813   4184.263
nimble_slice 0.01987158 0.01983412 0.001059173 0.01786280 0.02207397 8000 6368.528  13023.574

, , reporting

                  mean    median         sd  CI95_low  CI95_upp    n      ess efficiency
jags         0.7942034 0.7941767 0.01423383 0.7657995 0.8215677 8000 8000.000   7252.947
nimble       0.7941798 0.7950333 0.01445057 0.7653739 0.8218682 8000 1740.477   3919.993
nimble_slice 0.7933654 0.7937981 0.01410362 0.7647034 0.8199006 8000 7671.756  15688.662

, , effprop

                  mean    median         sd  CI95_low  CI95_upp    n      ess efficiency
jags         0.7995475 0.7999378 0.01265429 0.7740650 0.8231657 8000 8000.000   7252.947
nimble       0.7997403 0.7996030 0.01208927 0.7755943 0.8234183 8000 2000.929   4506.597
nimble_slice 0.8002278 0.8003495 0.01286927 0.7746506 0.8255620 8000 8740.990  17875.234
```

Real life
More than 3 compartments
lots of complexity
need speed