

Convergence diagnostics for a well-behaved model

Chapter 3.4: Diagnosing and improving convergence

In this example the chains **do converge** and we show how the convergence diagnostics flag convergence. The model is

$$Y_i \sim \text{Poisson}(\exp[\mu_i]) \text{ where } \mu_i \sim \text{Normal}(0, 1000).$$

There are two observations: $Y_1 = 1$ and $Y_2 = 10$.

Define the model as a string

```
model_string <- textConnection("model{  
  Y1 ~ dpois(exp(mu[1]))  
  Y2 ~ dpois(exp(mu[2]))  
  mu[1] ~ dnorm(0,0.001)  
  mu[2] ~ dnorm(0,0.001)  
}")
```

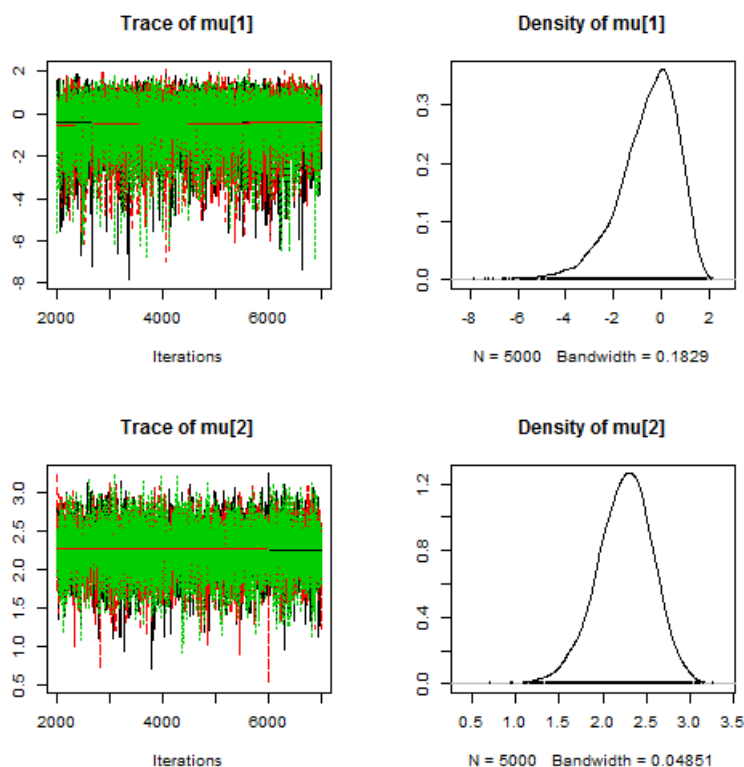
Generate posterior samples

```
inits <- list(mu=rnorm(2,0,5))  
data <- list(Y1=1,Y2=10)  
model <- jags.model(model_string,data = data, inits=inits, n.chains=3, quiet=TRUE)  
  
update(model, 1000, progress.bar="none")  
samples <- coda.samples(model,  
  variable.names=c("mu"),  
  n.iter=5000, progress.bar="none")
```

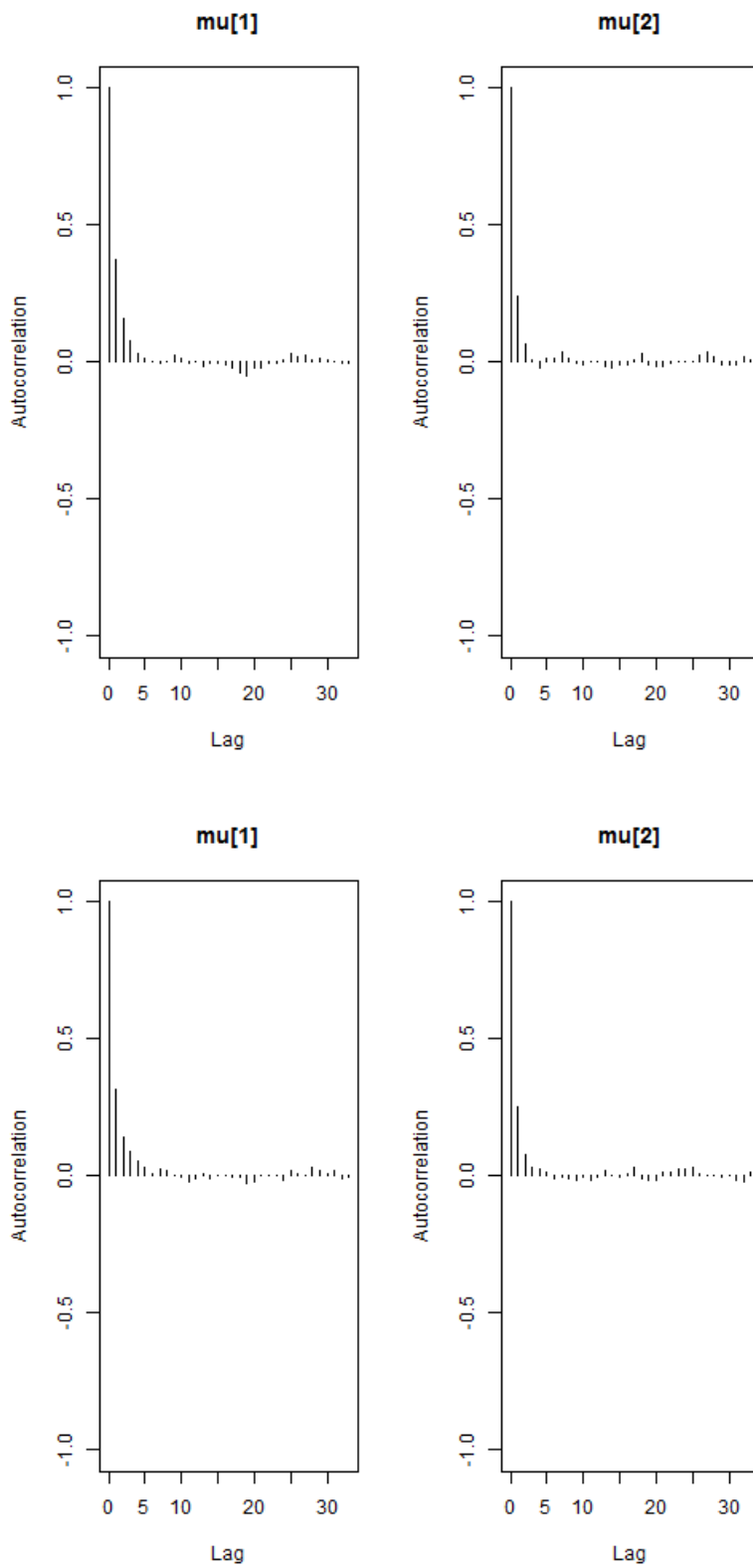
Graphical diagnostics

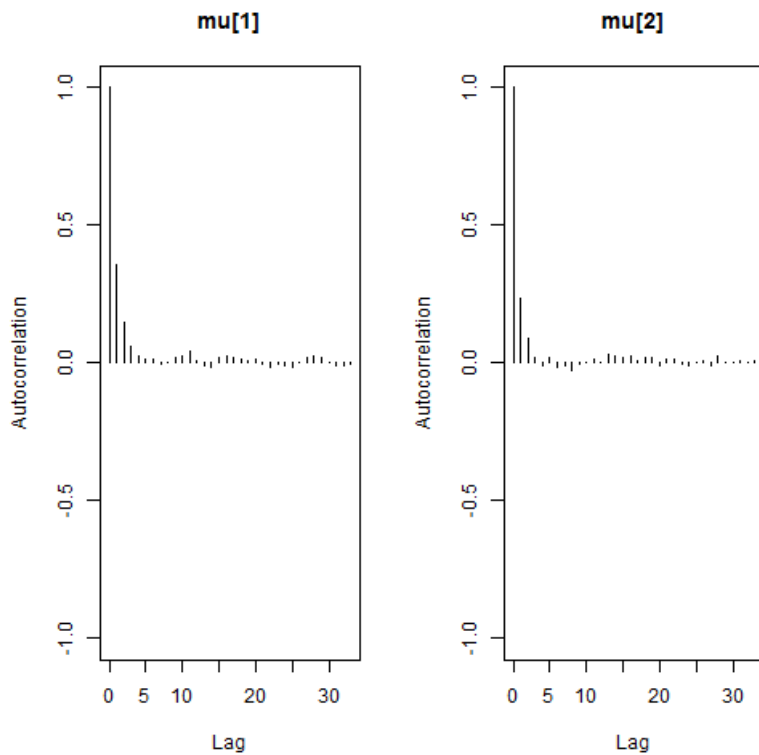
The trace plots look like bar codes, the chains (each chain is a different color) give similar estimates, and the autocorrelation is near zero for lags 5 and beyond. All of these indicate convergence.

```
plot(samples)
```



```
autocorr.plot(samples)
```





Numerical diagnostics

```
# Low autocorrelation indicates convergence
autocorr(samples[[1]],lag=1)
```

```
## , , mu[1]
##
##      mu[1]      mu[2]
## Lag 1 0.3766875 0.0009359125
##
## , , mu[2]
##
##      mu[1]      mu[2]
## Lag 1 -0.02212402 0.241158
```

```
# ESS over 1000 indicates convergence
effectiveSize(samples)
```

```
##      mu[1]      mu[2]
## 6622.200 9072.324
```

```
# R less than 1.1 indicates convergence
gelman.diag(samples)
```

```
## Potential scale reduction factors:
##
##      Point est. Upper C.I.
## mu[1]      1      1
## mu[2]      1      1
##
## Multivariate psrf
##
## 1
```

```
# |z| less than 2 indicates convergence
geweke.diag(samples[[1]])
```

```
##  
## Fraction in 1st window = 0.1  
## Fraction in 2nd window = 0.5  
##  
##      mu[1]      mu[2]  
## -0.6975 -0.4325
```

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