library(rjags); library(loo); library(rstan); library(MCMCvis)

setwd("C:/R files BHMRA")

attach("DS\_7\_1.Rdata")

set.seed(1234)

**#**

**# SPIKE-SLAB**

**#**

cat(" model { for (i in 1:n) {y[i] ~ dnorm(mu[i],tau)

mu[i] <- beta0+sum(beta.terms[i,1:p])

LL[i] <- -0.5\*log(6.283/tau)-0.5\*tau\*pow(y[i]-mu[i],2)

for (j in 1:p) {beta.terms[i,j] <- beta[j]\*x[i,j]}}

# priors

tau ~ dgamma(1,0.001)

beta0 ~ dnorm(0,0.0000001)

omega ~ dunif(0,1)

for (j in 1:p) {beta[j] ~ dnorm(0,tau.beta[j])

# selection on coefficient precision

tau.beta[j] <- equals(gam[j],1)\*Tau.beta[j] +equals(gam[j],0)\*Tau.beta[j]/v0

gam[j] ~ dbern(omega)

Tau.beta[j] ~ dexp(1)}}

", file="diabM1.jag")

**# initial values and estimation**

ini1 = list(tau=1,beta0=150,beta=rep(0,64),Tau.beta=rep (1,64),omega=0.5,gam=rep(1,64))

ini2 = list(tau=0.1,beta0=100,beta=rep(0,64),Tau.beta=rep (2,64),omega=0.2,gam=rep(1,64))

INI = list(ini1,ini2)

M1 = jags.model(inits=INI,data=DS\_7\_1,n.chains=2, file="diabM1.jag")

**# monitor hyperparameters**

MCMCsummary(coda.samples(M1,c("beta","omega"),n.iter=2500))

S1 = coda.samples(M1,c("beta","omega","gam"),n.iter=2500)

summary(S1)

**# Fit measures**

dic.samples(M1, n.iter=1000,type="pD")

S1.LL = coda.samples(M1,c("LL"),n.iter=2500)

waic(as.matrix(S1.LL))

loo(as.matrix(S1.LL))

**#**

**# LASSO**

**#**

cat(" model { for (i in 1:n) {y[i] ~ dnorm(mu[i],inv.sig2)

mu[i] <- beta0+sum(beta.terms[i,1:p])

LL[i] <- -0.5\*log(6.283\*sig2)-0.5\*pow(y[i]-mu[i],2)/sig2

for (j in 1:p) {beta.terms[i,j] <- beta[j]\*x[i,j]}}

# prior on regression coefficients

for (j in 1:p) {# direct Lasso prior

# beta[j] ~ ddexp(0,lambda/sig)

# scale mixture Lasso prior

beta[j] ~ dnorm(0,1/(sig2\*eta2[j]))

eta2[j] ~ dexp(lambda^2/2)}

# Other Priors

inv.sig2 ~ dgamma(1,0.001)

sig2 <- 1/inv.sig2

lambda ~ dunif(0.001,100)

beta0 ~ dnorm(0,0.0000001)}

", file="diabM2.jag")

**# Initial values and estimation**

ini1 <- list(inv.sig2=1,beta0=100,beta=rep(0,64),lambda=1)

ini2 <- list(inv.sig2=0.1,beta0=150,beta=rep(0,64),lambda=2)

INI <- list(ini1,ini2)

M2 <- jags.model(inits=INI,data=DS\_7\_1,n.chains=2, file="diabM2.jag")

gelman.diag(coda.samples(M2,c("beta","lambda"),n.iter=2500))

S2 <- coda.samples(M2,c("beta","lambda"),n.iter=2500)

summary(S2)

**# Fit measures**

dic.samples(M2, n.iter=1000,type="pD")

S2.LL <- coda.samples(M2,c("LL"),n.iter=2500)

waic(as.matrix(S2.LL))

loo(as.matrix(S2.LL))

#

**# HORSESHOE rstan**

**#**

model <- '

data { int<lower=0> n;

int<lower=0> p;

matrix[n,p] x;

vector[n] y;}

parameters { vector[p] beta;

vector<lower=0>[p] lambda;

real<lower=0> tau2;

real<lower=0> sigma;}

transformed parameters {vector<lower=0>[p] kappa;

real<lower=0> tau;

tau = sqrt(tau2);

for (i in 1:p) kappa[i] = 1/(1+lambda[i]\*lambda[i]);}

model { lambda ~ cauchy(0, 1);

tau2 ~ inv\_gamma(1, 0.001);

for (i in 1:p) beta[i] ~ normal(0, lambda[i] \* tau);

y ~ normal(x \* beta, sigma);}'

M = stan(model\_code=model, data=DS\_7\_1, iter=2000, chains=2)

print(M,digits=3)

**#**

**# LASSO and SELECTION**

**#**

cat("model { for (i in 1:n) {y[i] ~ dnorm(beta0+sum(beta.terms[i,1:p]),inv.sig2)

for (j in 1:p) {beta.terms[i,j] <- beta.r[j]\*x[i,j]}}

# priors

inv.sig2 ~ dgamma(1,0.001)

sig2 <- 1/inv.sig2

beta0 ~ dnorm(0,0.0000001)

for (j in 1:p) {beta[j] ~ dnorm(0,1/(sig2\*eta2[j]))

gam[j] ~ dbern(omega)

beta.r[j] <- gam[j]\*beta[j]

eta2[j] ~ dexp(lambda\*lambda/2)}

lambda ~ dunif(0.001,100)

omega ~ dbeta(1,1)}

", file="diabM4.jag")

**# Initial values and estimation**

ini1 <- list(inv.sig2=1,beta0=100,beta=rep(0,64),lambda=1)

ini2 <- list(inv.sig2=0.1,beta0=150,beta=rep(0,64),lambda=2)

INI <- list(ini1,ini2)

M4 <- jags.model(inits=INI,data=DS\_7\_1,n.chains=2, file="diabM4.jag")

gelman.diag(coda.samples(M4,c("beta","lambda","omega"),n.iter=5000))

S4 <- coda.samples(M4,c("beta","lambda","omega","gam"),n.iter=5000)

summary(S4)

**# Fit measures**

dic.samples(M4, n.iter=1000,type="pD")