library(R2OpenBUGS)

library(coda)

library(MCMCvis)

library(loo)

D <- list(n=39, P=6,y= structure(.Data =c(1,0,1,0,0,1,1,1,1,0,1,1,1,0,0,0,1,0,0,1,0,0,0,0,1,1,1,0,0,1,0,0,1,0,1,1,1,1,1,1,0,0,1,1,1,1,1,1,0,1,0,0,1,1,0,1,1,0,1,1,0,1,0,0,0,0,0,1,0,1,0,1,0,1,0,0,0,1,1,0,1,0,0,1,1,0,1,0,0,0,0,1,0,0,0,0,0,

1,1,0,1,1,0,0,1,1,0,1,1,1,1,0,1,1,0,0,1,0,0,0,1,1,0,0,0,1,0,1,0,0,0,0,0,1,1,1,0,0,1,1,1,1,1,1,1,0,

0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,1,1,1,1,1,1,0,1,0,0,1,1,0,1,1,0,0,0,0,1,0,0,0,0,0,0,0,1,1,0,0,0,0,0,

1,1,0,0,0,0,0,0,1,1,0,0,0,0,0,0,1,0,0,1,1,1,0,0,1,1,1,1,1,1,1,1,1,1,0,0,0,1,1),.Dim = c(6,39)))

**#**

**# Augmented Data Probit**

**#**

model1 <- function() {for (j in 1:P) {conc.item[j] <- sum(conc[,j])/n

for (i in 1:n) { mu[i,j] <- lambda[j]\*F[i] - alpha[j]

pi[i,j] <- phi(mu[i,j])

ystar[i,j] ~ dnorm(mu[i,j],1) %\_% I(A[i,j], B[i,j])

A[i,j] <- -10\*equals(y[j,i],0);B[i,j] <- 10\*equals(y[j,i],1)

# new latent data

ystar.new[i,j] ~ dnorm(mu[i,j],1)

# new binary data

ynew[j,i] <- step(ystar.new[i,j])

# predictive concordance

conc[i,j] <- equals(y[j,i],ynew[j,i])

LL[j,i] <- y[j,i]\*log(pi[i,j])+(1-y[j,i])\*log(1-pi[i,j])}}

#priors for item parameters

for (j in 1:P) { lambda[j] ~ dnorm(1,2) %\_% I(0,)

alpha[j] ~ dnorm(0,0.5)}

# factor score

for (i in 1:n){ F[i] ~ dnorm(0,1) }}

**# Initial Values and Estimation**

inits1 = list(alpha=c(0,0,0,0,0,0),lambda=c(0.5,0.5,0.5,0.5,0.5,0.5))

inits2 = list(alpha=c(0,0,0,0,0,0),lambda=c(1,1,1,1,1,1))

inits=list(inits1,inits2)

pars = c("lambda","conc.item","LL")

n.iters=10000; n.burnin =2000; n.chains=2

R1 = bugs(D,inits,pars,n.iters,model1,n.chains, n.burnin,debug=T,codaPkg = F,bugs.seed=10)

R1$summary

loo1 =loo(matrix(as.array(R1$sims.list$LL),16000,6\*39))

**#**

**# Augmented Data Skew Probit**

**#**

model2 <- function() {for (j in 1:P) {conc.item[j] <- sum(conc[,j])/n

for (i in 1:n) { mu[i,j] <- lambda[j]\*F[i] - alpha[j]-delta[j]\*V[i,j]

pi[i,j] <- phi(mu[i,j])

ystar[i,j] ~ dnorm(mu[i,j],prec.ystar[j]) %\_% I(A[i,j], B[i,j])

A[i,j] <- -10\*equals(y[j,i],0);B[i,j] <- 10\*equals(y[j,i],1)

# new latent data

ystar.new[i,j] ~ dnorm(mu[i,j],prec.ystar[j])

# new binary data

ynew[j,i] <- step(ystar.new[i,j])

# predictive concordance

conc[i,j] <- equals(y[j,i],ynew[j,i])

V[i,j] ~ dnorm(0,1) %\_% I(0,)

LL[j,i] <- y[j,i]\*log(pi[i,j])+(1-y[j,i])\*log(1-pi[i,j])}}

#priors for item parameters

for (j in 1:P) { lambda[j] ~ dnorm(1,2) %\_% I(0,)

alpha[j] ~ dnorm(0,0.5)

# skewness parameters

delta[j] ~ dunif(-1,1)

prec.ystar[j]<- 1/(1-pow(delta[j],2))

kappa[j] <- delta[j]\*sqrt(prec.ystar[j])}

# factor score

for (i in 1:n){ F[i] ~ dnorm(0,1) }}

**# Initial Values and Estimation**

inits1 = list(alpha=c(0,0,0,0,0,0),lambda=c(0.5,0.5,0.5,0.5,0.5,0.5),delta=c(0,0,0,0,0,0))

inits2 = list(alpha=c(0,0,0,0,0,0),lambda=c(1,1,1,1,1,1),delta=c(0,0,0,0,0,0))

inits=list(inits1,inits2)

pars = c("lambda","delta","conc.item","LL")

n.iters=10000; n.burnin =2000; n.chains=2

R2 = bugs(D,inits,pars,n.iters,model2,n.chains, n.burnin,debug=T,codaPkg = F,bugs.seed=10)

R2$summary

loo2 =loo(matrix(as.array(R2$sims.list$LL),16000,6\*39))