Calculating WAIC

$p(\underset{\sim}{y}_{it} | \theta^{(s)})$ = Bivariate Normal pdf with mean function $\underset{\sim}{x}_{it}\underset{\sim}{\beta}^{(s)} - \underset{\sim}{u}_{it}\underset{\sim}{\phi}_t^{(s)}$ and covariance matrix $V^{(s)}$ evaluated at $\underset{\sim}{y}_{it} = \begin{pmatrix} y_{1it} \\ y_{2it} \end{pmatrix}$

$i = 1, \ldots, N$

N = All individuals in the dataset.

$t = 1, \ldots, T$

T = total # of timepoints

S = # of MCMC iterations after burn-in.

$$lppd = \sum_{i=1}^{N} \sum_{t=1}^{T} \log\left(\frac{1}{S}\sum_{s=1}^{S} p(y_{it} | \theta^{(s)})\right)$$

$$pWAIC_2 = \sum_{i=1}^{N} \sum_{t=1}^{T} \text{Variance}\left(\log\left(p(\underset{\sim}{y}_{it} | \theta^{(s)}\right), s=1, \ldots, S\right)$$

where

$$\log\left(p(\underset{\sim}{y}_{it} | \theta^{(s)}\right)$$

$$= -\ln\left(2\pi |V^{(s)}|^{\frac{1}{2}}\right) - \frac{1}{2}\left\{\left(\underset{\sim}{y}_{it} - \underset{\sim}{x}_i\underset{\sim}{\beta}^{(s)} - \underset{\sim}{u}_{it}\underset{\sim}{\phi}_t^{(s)}\right)' \times \left(V^{(s)}\right)^{-1}\left(\underset{\sim}{y}_{it} - \underset{\sim}{x}_i\underset{\sim}{\beta}^{(s)} - \underset{\sim}{u}_{it}\underset{\sim}{\phi}_t^{(s)}\right)\right\}$$

$$WAIC = -2\left(lppd - pWAIC_2\right)$$