

CWVS: Critical Window Variable Selection

Statistical Model

$$Y_i | \beta, \alpha \stackrel{\text{iid}}{\sim} \text{Bernoulli} \{p_i(\beta, \alpha)\}, \quad i = 1, \dots, n;$$

$$\log \left\{ \frac{p_i(\beta, \alpha)}{1 - p_i(\beta, \alpha)} \right\} = \mathbf{x}_i^T \beta + \sum_{j=1}^{m_i} z_{ij} \alpha(j);$$

$$\alpha(j) = \theta(j) \gamma(j), \quad j = 1, \dots, m;$$

$$\gamma(j) | \pi(j) \stackrel{\text{iid}}{\sim} \text{Bernoulli} \{\pi(j)\}, \quad \Phi^{-1} \{\pi(j)\} = \eta(j), \quad j = 1, \dots, m;$$

$$\begin{bmatrix} \theta(j) \\ \eta(j) \end{bmatrix} = A \begin{bmatrix} \delta_1(j) \\ \delta_2(j) \end{bmatrix}, \quad A = \begin{bmatrix} A_{11} & 0 \\ A_{21} & A_{22} \end{bmatrix};$$

$$\boldsymbol{\delta}_k = \{\delta_k(1), \dots, \delta_k(m)\}^T | \phi_k \stackrel{\text{iid}}{\sim} \text{MVN} \{\mathbf{0}_m, \Sigma(\phi_k)\}, \quad k = 1, 2.$$

- $m = \max \{m_i : i = 1, \dots, n\};$
- $\mathbf{0}_m$: Length m vector with each entry equal to zero.

Prior Information

$$\beta_j \stackrel{\text{iid}}{\sim} N(0, \sigma_\beta^2), \quad j = 1, \dots, p.$$

- p : Length of \mathbf{x}_{ij} vector (same for all i, j);
- Default setting: $\sigma_\beta^2 = 10,000$.

$$\ln(A_{11}), \ln(A_{22}), A_{21} \stackrel{\text{iid}}{\sim} N(0, \sigma_A^2).$$

- Default setting: $\sigma_A^2 = 1.00$.

$$\phi_k \stackrel{\text{iid}}{\sim} \text{Gamma}(\alpha_{\phi_k}, \beta_{\phi_k}), \quad k = 1, 2.$$

- Default setting: $\alpha_{\phi_k} = 1.00, \beta_{\phi_k} = 1.00, k = 1, 2$.

Default Initial Values

- $\beta_j = 0$ for all j ;
- $\gamma(j) = 1$ for all j ;
- $\delta_k(j) = 0$ for all j, k ;
- $\phi_k = -\ln(0.05) / (m - 1)$ for all k ;
- $A_{kk} = 1$ for all k ;
- $A_{21} = 0$.

Alternate Likelihood: Gaussian

$Y_i | \boldsymbol{\beta}, \boldsymbol{\alpha}, \sigma_\epsilon^2 \stackrel{\text{ind}}{\sim} \text{Normal} \left(\mathbf{x}_i^T \boldsymbol{\beta} + \sum_{j=1}^{m_i} z_{ij} \alpha(j), \sigma_\epsilon^2 \right), \quad i = 1, \dots, n.$

- $\sigma_\epsilon^2 \sim \text{Inverse Gamma} (a_{\sigma_\epsilon^2}, b_{\sigma_\epsilon^2})$;
- Default setting: $a_{\sigma_\epsilon^2} = 0.01, b_{\sigma_\epsilon^2} = 0.01$;
- Default initial value: $\sigma_\epsilon^2 = 1.00$.

Alternate Likelihood: Negative Binomial

$Y_i | \boldsymbol{\beta}, \boldsymbol{\alpha}, r \stackrel{\text{ind}}{\sim} \text{Negative Binomial} \{r, \lambda_i(\boldsymbol{\beta}, \boldsymbol{\theta})\}, \quad i = 1, \dots, n;$

$\ln \left\{ \frac{\lambda_i(\boldsymbol{\beta}, \boldsymbol{\alpha})}{1 - \lambda_i(\boldsymbol{\beta}, \boldsymbol{\alpha})} \right\} = \mathbf{O}_i + \mathbf{x}_i^T \boldsymbol{\beta} + \sum_{j=1}^{m_i} z_{ij} \alpha(j).$

- $r \sim \text{Discrete Uniform} [a_r, b_r]$;
- Default setting: $a_r = 1, b_r = 100$;
- Default initial value: $r = b_r$.

Likelihood Indicator

- likelihood_indicator = 0: Bernoulli;
- likelihood_indicator = 1: Gaussian;
- likelihood_indicator = 2: Negative binomial.