GPCW: Gaussian Process for Estimating Crtical Windows of Susceptibility

Statistical Model

$$y_i|\boldsymbol{\beta},\boldsymbol{\theta} \overset{\text{iid}}{\sim} \text{Bernoulli}\left(p_i\left(\boldsymbol{\beta},\boldsymbol{\theta}\right)\right),\ i=1,...,n;$$

$$\log\left(\frac{p_i\left(\boldsymbol{\beta},\boldsymbol{\theta}\right)}{1-p_i\left(\boldsymbol{\beta},\boldsymbol{\theta}\right)}\right)=\mathbf{x}_i^{\mathrm{T}}\boldsymbol{\beta}+\sum_{j=1}^{m_i}\mathrm{z}_{ij}\theta\left(j\right);$$

$$\boldsymbol{\theta}=\left(\theta\left(1\right),...,\theta\left(m\right)\right)^{\mathrm{T}}|\sigma_\theta^2,\phi\sim\text{MVN}\left(\mathbf{0}_m,\sigma_\theta^2\Sigma\left(\phi\right)\right)$$

- p: Length of $\mathbf{x}_i$ vector (same for all i)
- $m=\max\left\{m_i:i=1,...,n\right\}$

Prior Information

$\beta_j \overset{\text{iid}}{\sim} \text{N}\left(0,\sigma_\beta^2\right),\ j=1,...,p$

- Default setting: $\sigma_\beta^2=10,000$

$\sigma_\theta^2\sim\text{Inverse Gamma}\left(\alpha,\beta\right)$

- Default setting: $\alpha=3$, $\beta=2$

$\phi\sim\text{Uniform}\left(a_\phi,b_\phi\right)$

- Default setting: $a_\phi=d$, $b_\phi=d$

Default Initial Values

$\beta_j=0$ for all j

$\theta_j=0$ for all j

$\sigma_\theta^2=0.50$

$\phi=0.50$