Exponential and Weibull Models

We consider the data of times to infection of kidney dialysis patients. In a study Wyse et al. (2011), (given in the book by **?**) designed to assess the time to first exitsite infection (in months) in patients with renal insufficiency, 43 patients utilized a surgically placed catheter (Group 1), and 76 patients utilized a percutaneous placement of their catheter (Group 2), a total of 119 patients.

The variables represented in the data set are `time` to infection in months/10 denoted by t, infection indicator or `event` (0=no, 1=yes) denoted by δ and catheter `placement` (1=surgically, 2=percutaneously) denoted by trt. We analyse the data set using exponential model and Weibull model.

The **exponential model** for this example can be specified as:

$$t_i \sim E(\lambda_i)$$

Where each survival time follows an exponential distribution with parameter λ_i and i is from 1 to 119. For this example we have only one covariate, catheter placement (trt) and therefore $\boldsymbol{\beta} = (\beta_0, \beta_1)'$, where β_0 denotes the intercept term and β_1 denotes the coefficient for the placement covariate (trt). Here, the latent field is

$$\lambda_i = \exp(\eta_i)$$

with

$$\eta_i = \beta_0 + trt_i\beta_1$$

where both β_0 and β_1 are assign the following priors distributions

$$\beta_0 \sim N(0, 0.001)$$

$$\beta_1 \sim N(0, 0.001)$$

There is no hyperparameter used in this model.

The **Weibull model** for this example can be specified as:

$$t_i \sim \text{Weibull}(\alpha, \lambda_i)$$

Here also , the latent field is

$$\lambda_i = \exp(\eta_i)$$

with

$$\eta_i = \beta_0 + trt_i\beta_1$$

where β_0 and β_1 are assign the following priors distributions

$$\beta_0 \sim N(0, 0.001)$$

$$\beta_1 \sim N(0, 0.001)$$

The model has one hyperparameter, α , we assign the following prior distribution

$$\alpha \sim \text{Gamma}(1, 0.001)$$

References

Wyse, J., Friel, N., and Rue, H. (2011). Approximate simulation-free bayesian inference for multiple changepoint models with dependence within segments (with discussion). *Bayesian Analysis*, 6(4):501–546.