INLA $\Longrightarrow$ Bayesian inference

$\downarrow$

computational method

- Gibbs sampling

$\downarrow$

JAGS

$\boxed{\text{VS}}$

INLA

$$\boxed{\pi(x|y,\theta)} \propto \pi(y|x,\theta)\,\pi(x|\theta)\,\underbrace{\pi(\theta)}$$

approximates

Models	Computational methods
- Binomial regression	- INLA
- Tokyo (Spline "rw2")	- INLA
- Survival	- INLA

???? LGM

- Logistic
- Time series
- GLM
- Multiple endpoint
- Poisson
- GLMM
- Survival

LGM

$\downarrow$

INLA ✓

• Spatial

Weibull

$t \sim \text{Weibull}(\alpha, \boxed{\lambda})$, $\lambda = \exp(\eta)$

$\boxed{\eta} = \underbrace{\beta' X}_{\text{fixed effects}} + \underbrace{\boxed{u}}_{\text{random effects}}$

X covariates

Latent

?

$\underbrace{\pi(\boxed{y_i} \mid \boxed{x_i}, \theta)}_{\text{Likelihood}}$

f(V, model="besag")

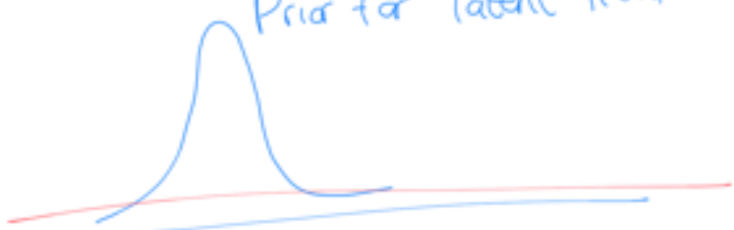
graph=

$y_i = f(\eta_i)$

$y_2 \overset{?}{=} f(\eta_3)$

$\boxed{\pi(\boxed{x_i}, \theta) \sim \boxed{N}(\mu, Q^{-1})}$

Prior for latent field



β_1

$\pi(\theta) = \text{ANYTHING*}$

PC Prior

Statistical Science 2016

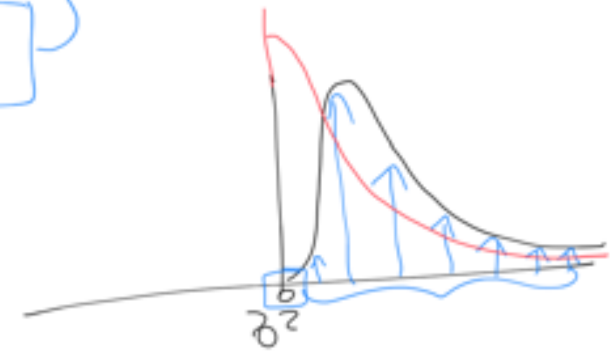
Penalizing complexity

$\alpha = 1$

$u_i \sim N(\boxed{\ }, \tau^2)$ $\pi(\tau^2)$

$y_i \sim N(\boxed{\mu}, \sigma^2), \ln \sigma^2)$

$\boxed{y_i = c}$



$$f(\underline{t}) = \boxed{\prod_{i=1}^{n_d}} f(t_i) \boxed{\prod_{i=1}^{n_s}} (1 - F(t_i))$$

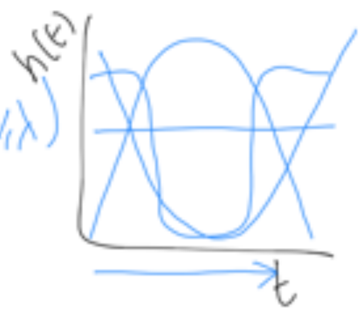
$$\boxed{f(t_i) = f_d(t_i)^{c_i} (1 - F_d(t_i))^{1-c_i}}$$

$$\therefore f(\underline{t}) = \prod_{i=1}^{n} \boxed{f(t_i)}$$

$$f(t_i) = \boxed{f_d(t_i)} \qquad c = 1$$

$$f(t_i) = 1 - \underbrace{F_d(t_i)} \qquad c = 0$$

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



$$S(\boxed{t}) = P(T \geq \boxed{t}) \quad \text{KM}$$

$$h(t) = \quad T = t \mid T \geq t$$

$$f(t) \sim \text{Weibull}(\alpha, \lambda)$$

$T \mid \ldots \sim \text{Weibull}(\ldots)$

$$\lambda = \exp(\eta)$$

$$\eta = \cancel{\beta_0} + \overbrace{\boxed{\boxed{\beta_{1,1}} x_1 + \boxed{\beta_{1,2}} x_2}}{} + \beta_2 \, \text{age} + \boxed{}$$

$$= \begin{bmatrix} \\ \end{bmatrix} \begin{array}{l} \text{level 1} \\ \text{level 2} \end{array}$$

Decided on exponential

$h(t) = \boxed{\lambda} = \exp(\eta)$

$\boxed{S(t) = e^{-\lambda t}}$ $\boxed{\text{plot those}}$

Cox $\quad h(t) = \underbrace{h_0(t)}_{} \boxed{\exp(\eta)}$

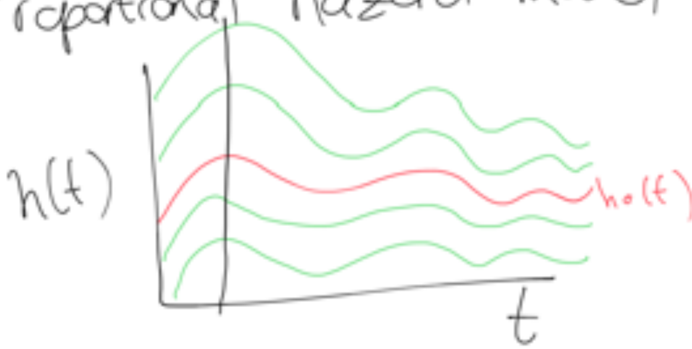
non-parametric ✓

parametric $\quad \cancel{\eta(t)}$

where $\eta = 0$

baseline hazard function

Proportional hazard model



Besag survival model:

$$\eta = \overset{0.045}{\cancel{\beta_1}}\, age + \begin{array}{c|l} \begin{bmatrix} \cdot \\ \cdot \end{bmatrix} & \begin{array}{l} gender=0 \\ gender=1 \end{array} \end{array} + 0.03tpi + \boxed{f(u \ldots)}$$

$$\eta_2 = 0.045(age_2) + \underbrace{\qquad} + 0.03tpi_2 + \boxed{distr\ 1}$$

$$\boxed{\eta_1, \ldots, \eta_{1043}}$$

$$\lambda = h(t) = \exp(\eta)$$

$$= \exp(\beta x_1 + \beta_2 x_2 + \beta_3 x_3 + u)$$

$$= \boxed{\exp(\beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3)}\ \boxed{\exp(u)}$$