

Gompertz

Parametrisation

The Gompertz distribution has log survival function

$$\log S(y) = -\frac{\mu}{\alpha} (\exp(\alpha y) - 1)$$

for response $y \geq 0$, $\mu > 0$ and $\alpha > 0$. The cumulative distribution function and the density then follows as

$$F(y) = 1 - \exp \left[-\frac{\mu}{\alpha} (\exp(\alpha y) - 1) \right]$$

and

$$f(y) = \mu \exp \left[\alpha y - \frac{\mu}{\alpha} (\exp(\alpha y) - 1) \right].$$

Link-function

The parameter μ is linked to the linear predictor η as:

$$\mu = \exp(\eta)$$

Hyperparameters

The shape parameter α is represented as

$$\alpha = \exp(S\theta)$$

and the prior is defined on θ . The constant S currently set to 0.1 to avoid numerical instabilities in the optimization, since small changes of α can make a huge difference.

Specification

- family = `gompertz` for regression models and family = `gompertz.surv` for survival models.
- Required arguments: y (to be given in a format by using `inla.surv()` for survival models)

Hyperparameter spesification and default values

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hyper

theta

hyperid 105101

name shape

short.name alpha

initial -20

fixed FALSE

prior normal

param -20 0.01

to.theta function(x, sc = 0.1) log(x) / sc

from.theta function(x, sc = 0.1) exp(sc * x)

status experimental

survival FALSE

discrete FALSE

link default log neglog

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Example

In the following example we estimate the parameters in a simulated case

```
library(flexsurv)
```

```
library(INLA)
```

```
n <- 1000
```

```
alpha <- 1.0
```

```
intercept <- 1.1
```

```
beta <- 1.2
```

```
x <- rnorm(n, sd = 0.2)
```

```
eta <- intercept + beta*x
```

```
mu <- exp(eta)
```

```
event <- rep(1,n)
```

```
y <- rgompertz(n, rate = mu, shape = alpha)
```

```
r <- inla(y ~ 1 + x,
```

```
      family = "gompertz", data=data.frame(y, x))
```

```
r.surv <- inla(inla.surv(y, event) ~ 1 + x,
```

```
      family = "gompertzsurv", data=data.frame(y, event, x))
```

```
## should be 'small'  
print(r$mlik - r.surv$mlik)
```

Notes