

# Generalised Extreme Value (GEV) distribution

## Parametrisation

The GEV distribution is defined through the cummulative distribution function

$$F(y; \eta, \tau, \xi) = \exp \left( - \left[ 1 + \xi \sqrt{\tau s} (y - \eta) \right]^{-1/\xi} \right)$$

for

$$1 + \xi \sqrt{\tau s} (y - \eta) > 0$$

and for a continuously response  $y$  where

$\eta$ : is the linear predictor

$\tau$ : is the “precision”

$s$ : is a fixed scaling,  $s > 0$ .

## Link-function

The linear predictor is given in the parameterisation of the GEV distribution.

## Hyperparameters

The GEV-models has two hyperparameters. The “precision” is represented as

$$\theta_1 = \log \tau$$

and the prior is defined on  $\theta_1$ . The shape parameter  $\xi$  is represented as

$$\theta_2 = \xi$$

and the prior is defined on  $\theta_2$ .<sup>1</sup>

## Specification

- `family="gev"`
- Required arguments:  $y$  and  $s$  (keyword `scale`)
- The scaling  $\xi_s$  is given by the argument `gev.scale.xi` and is default set to 0.1.

The weights has default value 1.

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<sup>1</sup>Internally, the parameter  $\theta_2$  is scaled with a fixed scaling  $\xi_s$  (default 0.1), to improve the numerics as the natural “scale” of  $\xi$  is small. For this reason the  $\theta_2(= \xi)$  reported in `result$mode$theta` will appear as  $\theta_2/\xi_s$ . For the same reason, if you define the mode using `control.mode = list(theta = ..., ...)` then the element representing  $\theta_2$  should be given as  $\theta_2/\xi_s$ .

## Hyperparameter specification and default values

doc The Generalized Extreme Value likelihood

hyper

theta1

hyperid 76001  
name log precision  
short.name prec  
output.name precision for GEV observations  
output.name.intern log precision for GEV observations  
initial 4  
fixed FALSE  
prior loggamma  
param 1 5e-05  
to.theta function(x) log(x)  
from.theta function(x) exp(x)

theta2

hyperid 76002  
name tail parameter  
short.name tail  
output.name tail parameter for GEV observations  
output.name.intern tail parameter for GEV observations  
initial 0  
fixed FALSE  
prior gaussian  
param 0 25  
to.theta function(x) x  
from.theta function(x) x

survival FALSE

discrete FALSE

link default identity

status disabled: Use likelihood model 'bgev' instead; see inla.doc('bgev')

pdf gev

## Example

In the following example, we estimate the parameters of the GEV distribution on some simulated data.

```
rgev = function(n=1, xi = 0, mu = 0.0, sd = 1.0) {  
  u = runif(n)  
  if (xi == 0) {  
    x = -log(-log(u))  
  } else {
```

```

        x = ((-log(u))^(-xi) - 1.0)/xi
    }
    return (x*sd + mu)
}

n = 300
z = rnorm(n)
sd.y = 0.5
xi = 0.2
y = 1+z + rgev(n, xi=xi, sd = sd.y)

r = inla(y ~ 1 + z, data = data.frame(y, z), family = "gev",
        control.family = list(gev.scale.xi = 0.01))
summary(r)

```

## Notes

None.