

# 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.

---

<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  
**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  
**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.