

## Student- $t$ with strata

### Parametrization

This model is an extension to the Student- $t$ , where different strata have their own precisions but the degrees-of-freedom parameter is common.

The Student- $t$  likelihood is defined so that

$$\sqrt{w \tau_s}(y - \eta) \sim T_\nu$$

for continuous response  $y$  where

$\tau_s$  : is the precision parameter, depending on the stratum  $s$

$w$  : is a fixed weight  $w > 0$

$\eta$  : is the linear predictor

$T_\nu$  : is a standardized Student- $t$  with  $\nu$  degrees of freedom such that its variance is 1 for any value of  $\nu$ , common for all strata.

### Link-function

Identity

### Hyperparameters

This likelihood  $N_s + 1$  hyperparameters

$$\begin{aligned}\theta_1 &= \log(\nu - 2) \\ \theta_2 &= \log(\tau_1) \\ \theta_3 &= \log(\tau_2) \\ &\text{etc....} \\ \theta_{N_s+1} &= \log(\tau_{N_s})\end{aligned}$$

where  $N_s$  is the number of strata defined. The current implementation limits  $N_s$  to 10, but this is easy to fix if needed. The prior is defined on  $\theta = (\theta_1, \theta_2, \dots)$ .

### Specification

- family = **tstrata**
- Required argument:  $y$  and  $w$  (keyword **weights**, default to 1), and **inla()**-argument “**strata**” which is either a integer vector with elements  $1, 2, \dots, N_s$ , or factor for which the levels defines the strata.

### Hyperparameter specification and default values

**hyper**

**theta1**

**name** log degrees of freedom  
**short.name** dof

```

    initial 0
    fixed FALSE
    prior loggamma
    param 1 0.5
    to.theta function(x) log(x-2)
    from.theta function(x) 2+exp(x)
theta2
    name log precision1
    short.name prec1
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta3
    name log precision2
    short.name prec2
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta4
    name log precision3
    short.name prec3
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta5
    name log precision4
    short.name prec4
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta6
    name log precision5

```

```

    short.name prec5
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta7
    name log precision6
    short.name prec6
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta8
    name log precision7
    short.name prec7
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta9
    name log precision8
    short.name prec8
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta10
    name log precision9
    short.name prec9
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
theta11

```

```

    name log precision10
    short.name prec10
    initial 3
    fixed FALSE
    prior loggamma
    param 1 5e-05
    to.theta function(x) log(x)
    from.theta function(x) exp(x)

survival FALSE

discrete FALSE

link default identity

pdf tstrata

```

## Example

```

df = 10
n = 100L
nstrata = 5L
ntot = n * nstrata

z = rnorm(ntot)
y = numeric(ntot)
k = 0L
for(i in 1L:nstrata) {
  j = 1L:n
  stdev = i
  y[k + j] = 1 + z[k+j] + rt(n, df=df) / sqrt(df/(df-2)) * stdev
  k = k + n
}

strata = rep(1L:nstrata, each = n)
i = 1L:ntot
formula = y ~ 1 + z

r = inla(formula, data = data.frame(y, z, strata), family = "tstrata",
        strata = strata)

```

## Notes

None