

Função de Ligação Modificada

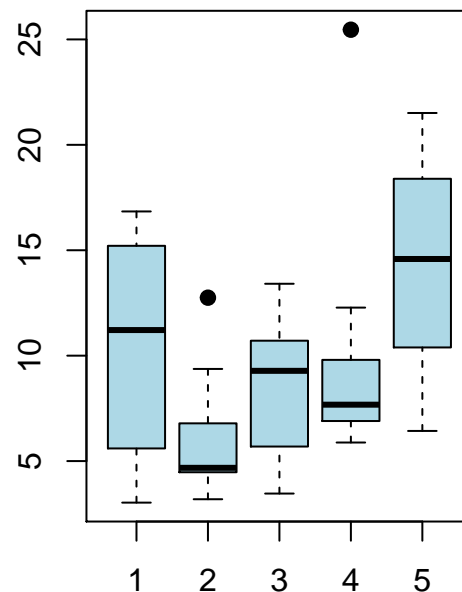
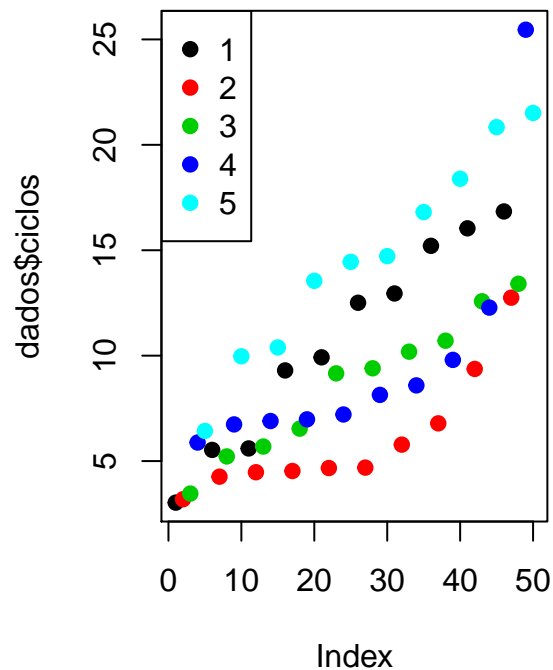
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```
require(dplyr)
dados<-tbl_df(read.table("turbina.dat",header=TRUE))
dados
```

```
## Source: local data frame [50 x 2]
##
##   tipo ciclos
##   (int) (dbl)
## 1     1   3.03
## 2     2   3.19
## 3     3   3.46
## 4     4   5.88
## 5     5   6.43
## 6     1   5.53
## 7     2   4.26
## 8     3   5.22
## 9     4   6.74
## 10    5   9.97
## .. ... ..
```

```
par(mfcol=c(1,2))
plot(dados$ciclos,col=dados$tipo, pch=19)
legend("topleft",c("1","2","3","4","5"),pch=19, col=1:5)
boxplot(ciclos~tipo, data=dados, col="lightblue",pch=19)
```



Modelo 1 (Função de Ligação Log do R)

$$Y_{ij} \sim \text{ind. Gama}(\mu_i, \phi)$$
$$i = 1, 2, \dots, 5 \text{ (Tipo de Turbina)}$$
$$j = 1, 2, \dots, 10 \text{ (Turbina - UE, replicação)}$$
$$\ln \mu_i = \alpha + \beta_i, \beta_1 = 0$$
$$\mathbb{E}(Y_{ij}) = \mu_i$$
$$\text{Var}(Y_{ij}) = \mu_i^2 \phi^{-1}$$

```
fit<-glm(ciclos~as.factor(tipo), data=dados,family = Gamma(link="log"))
summary(fit)
```

```
##
## Call:
## glm(formula = ciclos ~ as.factor(tipo), family = Gamma(link = "log"),
##      data = dados)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.04345  -0.33058  -0.07744   0.21689   1.13451
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.36959    0.14429  16.422 < 2e-16 ***
## as.factor(tipo)2 -0.56953    0.20406  -2.791  0.00768 **
## as.factor(tipo)3 -0.21365    0.20406  -1.047  0.30069
## as.factor(tipo)4 -0.08741    0.20406  -0.428  0.67043
## as.factor(tipo)5  0.31867    0.20406   1.562  0.12538
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Gamma family taken to be 0.2081995)
##
##      Null deviance: 12.9654  on 49  degrees of freedom
## Residual deviance:  8.8616  on 45  degrees of freedom
## AIC: 285.91
##
## Number of Fisher Scoring iterations: 4
```

Modelo 2 (Função de Ligação Log definida “explicitamente”)

$$Y_{ij} \sim \text{ind. Gama}(\mu_i, \phi)$$
$$i = 1, 2, \dots, 5 \text{ (Tipo de Turbina)}$$
$$j = 1, 2, \dots, 10 \text{ (Turbina - UE, replicação)}$$
$$\ln \mu_i = \alpha + \beta_i, \beta_1 = 0$$
$$\mathbb{E}(Y_{ij}) = \mu_i$$
$$\text{Var}(Y_{ij}) = \mu_i^2 \phi^{-1}$$

Definindo a função de ligação:

$$\begin{aligned}\ln \mu_i &= \eta_i \\ \mu_i &= e^{\eta_i} \\ \frac{\partial \mu_i}{\partial \eta_i} &= \frac{\partial e^{\eta_i}}{\partial \eta_i} = e^{\eta_i}\end{aligned}$$

```
my_log_link <- function(){
  ##Nome da Funcao de Ligacao
  link <- "my_link_log"
  ##Funcao de ligacao
  linkfun <- function(mu) log(mu)
  ##Inversa da Funcao de ligacao
  linkinv <- function(eta) exp(eta)
  ##derivada de \mu em relacao a \eta
  mu.eta <- function(eta) exp(eta)
  ##eh TRUE se \eta estah no dominio da funcao de ligacao inversa
  valideta <- function(eta) TRUE
  ##Parametros do R, soh copiar e colar
  structure(list(linkfun = linkfun, linkinv = linkinv,
                mu.eta = mu.eta, valideta = valideta, name = link),
            class = "link-glm")
}
```

```
fit<-glm(ciclos~as.factor(tipo), data=dados,family = Gamma(link=my_log_link()))
summary(fit)
```

```
##
## Call:
## glm(formula = ciclos ~ as.factor(tipo), family = Gamma(link = my_log_link()),
##      data = dados)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.04345  -0.33058  -0.07744   0.21689   1.13451
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
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## as.factor(tipo)5  0.31867    0.20406   1.562  0.12538
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
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## (Dispersion parameter for Gamma family taken to be 0.2081995)
##
##      Null deviance: 12.9654  on 49  degrees of freedom
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## AIC: 285.91
##
## Number of Fisher Scoring iterations: 4
```

Como esperado, os resultados foram idênticos.