# analise_fdanova

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5/24/2020

## FANOVA usando o pacote fdANOVA

```
library("tidyverse")
```

```
## -- Attaching packages ---------------------------- tidyverse 1.3.0 --
## v ggplot2 3.3.0     v purrr   0.3.4
## v tibble  3.0.1     v dplyr   0.8.5
## v tidyr   1.0.3     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0
## -- Conflicts ------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library("fdANOVA")
```

Lendo os dados dos municípios

```
mun <- readRDS("./dados_por_municipio.rds")
#View(mun)
dim(mun)
```

```
## [1] 293930    286
```

Selecionando numero de casos confirmados por municipio e IDHMs

```
mun_conf <- select(mun,Estado,Município,confirmed,Data,IDHM_Renda,
              IDHM_Longevidade,IDHM_Educação) %>%
  # deixando as datas nas colunas
  spread(key = Data, value = confirmed) %>%
  # removendo DF, pois pra usar fdANOVA os grupos precisam ter n>1
  filter(Estado!="DISTRITO FEDERAL") %>%
  # removendo municipios que tem NA em IDHM_Renda
  filter(!is.na(IDHM_Renda))
dim(mun_conf)
```

```
## [1] 3452   90
```

Removendo os NAs:

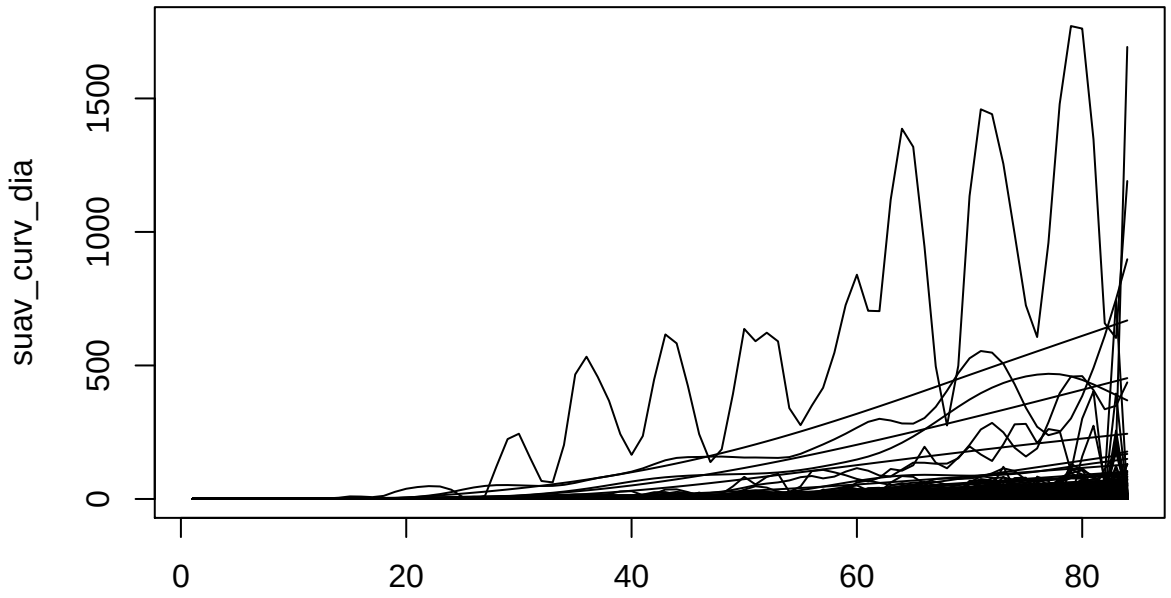
```
mun_conf <- na.omit(mun_conf)
```

Matriz em que nas colunas teremos as curvas suavizadas de casos diarios. Valores suavizados negativos são substituídos por zero.

```
suav_curv_dia <- matrix(nrow=84,ncol=dim(mun_conf)[1])
for(i in 1:dim(mun_conf)[1]){
  tmp <- as.matrix(t(mun_conf[i,6:90]))
  tmp2 <- smooth.spline(1:84,diff(tmp))
  suav_curv_dia[,i] <- tmp2$y
}
suav_curv_dia[suav_curv_dia<0] <- 0
```

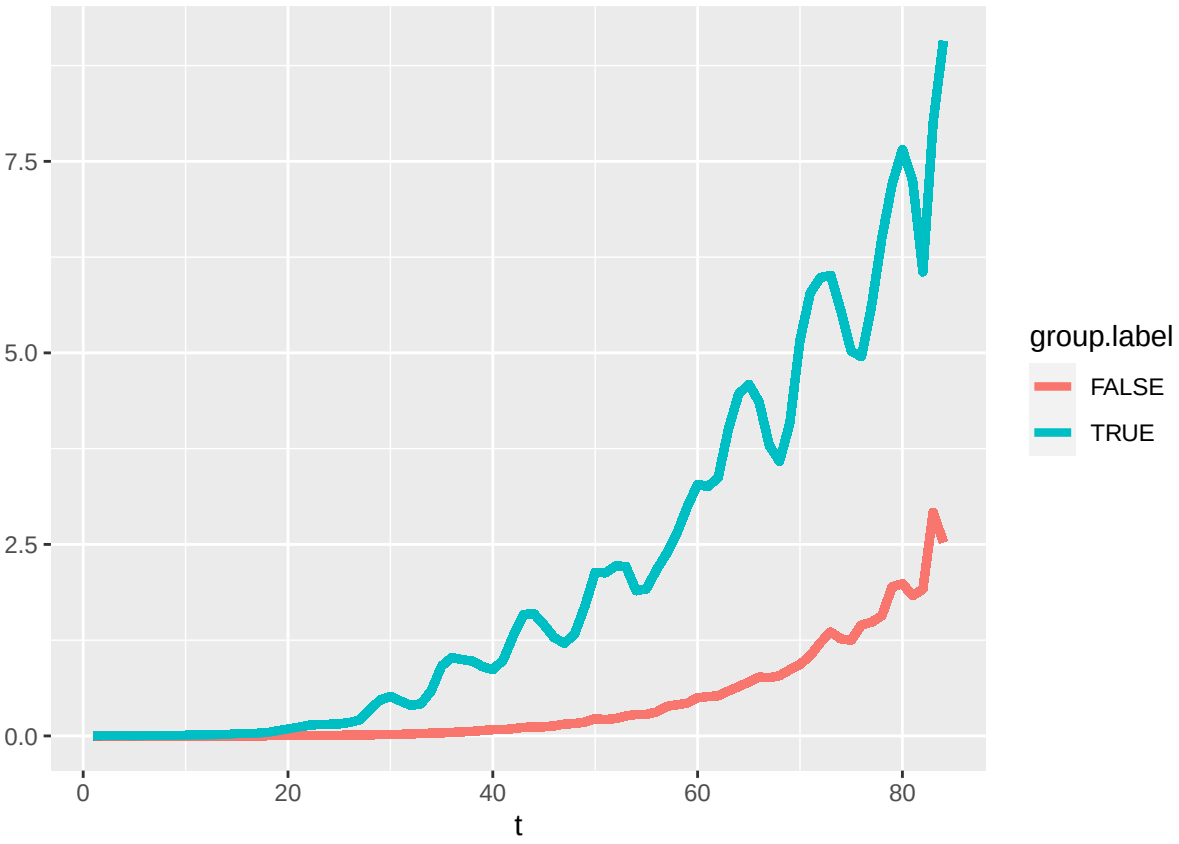
Gráfico dos casos diários

```
matplot(suav_curv_dia,type='l',lty=1,col=1)
```




Separamos os municípios de acordo com o valor de IDHM_Renda.

```
set.seed(2020)
# Avaliando o efeito de IHHM_Renda
aux_groups <- as.matrix(mun_conf$IDHM_Renda > 0.7)
plotFANOVA(x = suav_curv_dia, group.label = aux_groups,
           means = TRUE)
```



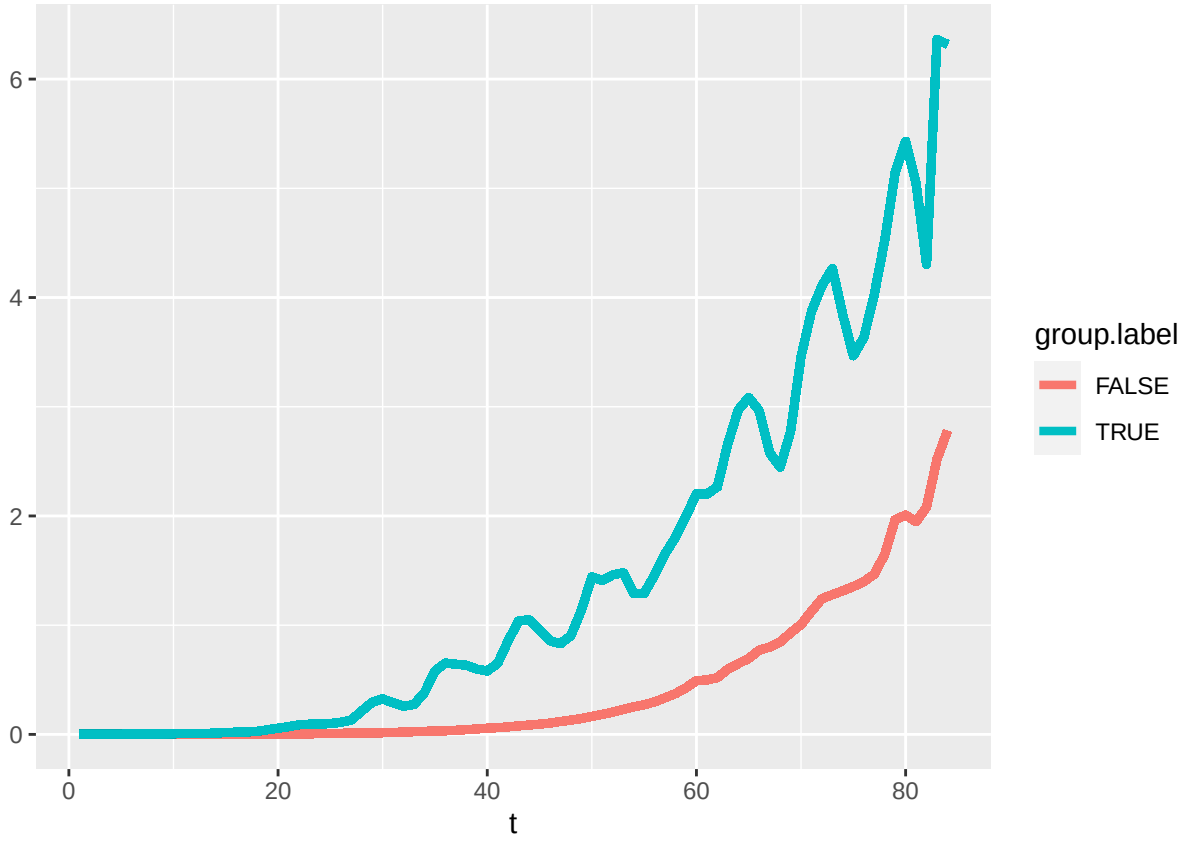

Teste FANOVA quando [IDHM_Renda>0.7] é usado como fator:

```
fanova <- fanova.tests(x = suav_curv_dia,
                       group.label = aux_groups, test = "FP",
                      parallel = TRUE, nslaves = 2)
summary(fanova)
```

```
##      Analysis of Variance for Functional Data
##
##  Data summary
##
## Number of observations = 3206
## Number of time points = 84
## Number of groups = 2
## Group labels: FALSE TRUE
## Group sizes: 2141 1065
## Range of data = [ 0 , 84 ]
##
##  Testing results and parameters of tests
##
## FP test - permutation test based on a basis function representation
## Test statistic = 17.72759  p-value = 0
## Number of permutations = 1000
## Basis: Fourier
## Criterion: BIC
## CommonK: mode
## K = 83 minK = 3 maxK = 83
##
```

Separando os municípios de acordo com o valor de IDHM_Longevidade.

```
aux_groups <- as.matrix(mun_conf$IDHM_Longevidade > 0.8)
plotFANOVA(x = suav_curv_dia, group.label = aux_groups,
           means = TRUE)
```




Teste FANOVA quando [IDHM_Longevidade>0.8] é usado como fator:

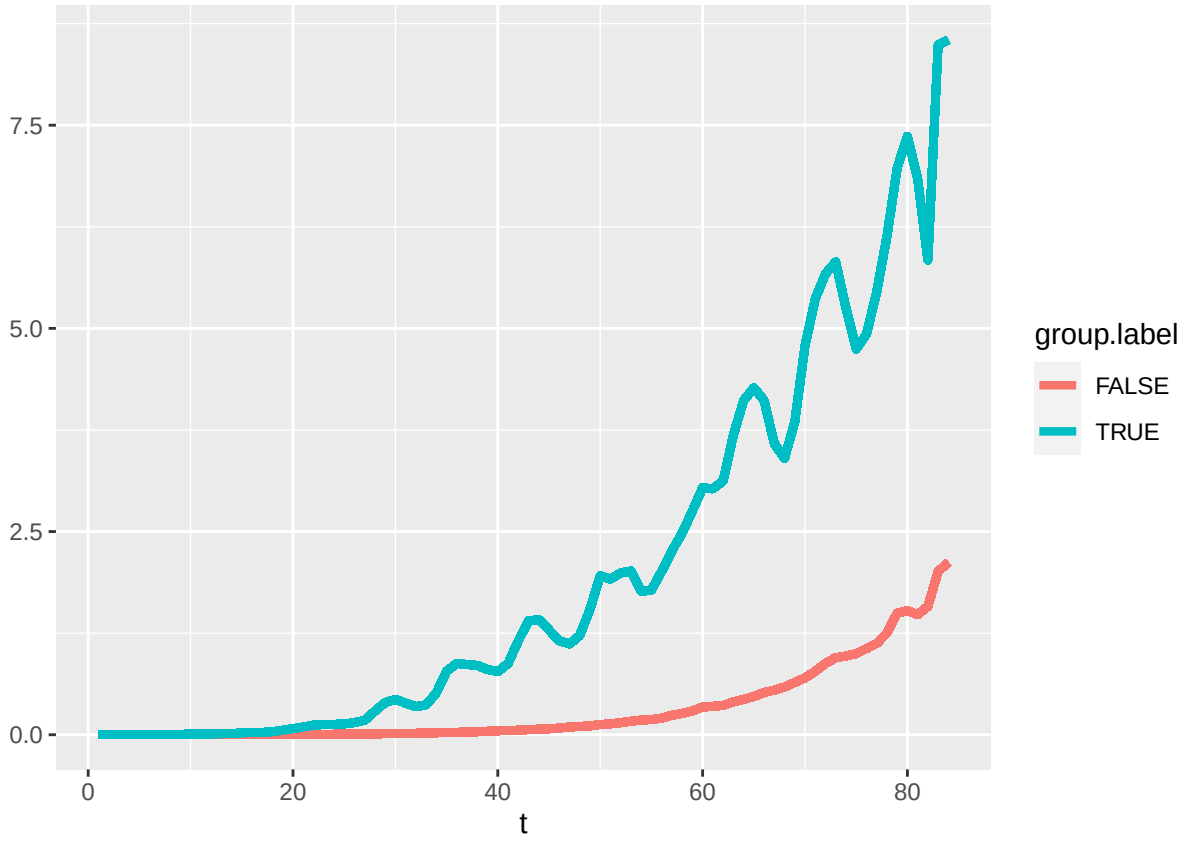
```
fanova <- fanova.tests(x = suav_curv_dia,
                       group.label = aux_groups, test = "FP",
                       parallel = TRUE, nslaves = 2)
summary(fanova)
```

```
##      Analysis of Variance for Functional Data
##
##  Data summary
##
## Number of observations = 3206
## Number of time points = 84
## Number of groups = 2
## Group labels: FALSE TRUE
## Group sizes: 1463 1743
## Range of data = [ 0 , 84 ]
##
##  Testing results and parameters of tests
##
## FP test - permutation test based on a basis function representation
## Test statistic = 7.266773  p-value = 0
## Number of permutations = 1000
```

```
## Basis: Fourier
## Criterion: BIC
## CommonK: mode
## K = 83 minK = 3 maxK = 83
##
```

Separando os municípios de acordo com o valor de IDHM_Educação.

```
aux_groups <- as.matrix(mun_conf$IDHM_Educação > 0.6)
plotFANOVA(x = suav_curv_dia, group.label = aux_groups,
           means = TRUE)
```




Teste FANOVA quando [IDHM_Educação>0.6] é usado como fator:

```
fanova <- fanova.tests(x = suav_curv_dia,
                       group.label = aux_groups, test = "FP",
                       parallel = TRUE, nslaves = 2)
summary(fanova)
```

```
##      Analysis of Variance for Functional Data
##
##  Data summary
##
## Number of observations = 3206
## Number of time points = 84
## Number of groups = 2
## Group labels: FALSE TRUE
## Group sizes: 1919 1287
## Range of data = [ 0 , 84 ]
```

```
##
##  Testing results and parameters of tests
##
## FP test - permutation test based on a basis function representation
## Test statistic = 19.68647  p-value = 0
## Number of permutations = 1000
## Basis: Fourier
## Criterion: BIC
## CommonK: mode
## K = 83 minK = 3 maxK = 83
##
```