Econometria espacial com R - Aula 04

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Regressão ponderada geograficamente

Pacote

```
library(spgwr)
```

```
## Loading required package: sp
```

```
## NOTE: This package does not constitute approval of GWR
## as a method of spatial analysis; see example(gwr)
```

Shapefile

```
# Pacotes
library(rgdal)
```

```
## rgdal: version: 1.2-8, (SVN revision 663)
##  Geospatial Data Abstraction Library extensions to R successfully loaded
##  Loaded GDAL runtime: GDAL 1.11.3, released 2015/09/16
##  Path to GDAL shared files: /usr/share/gdal/1.11
##  Loaded PROJ.4 runtime: Rel. 4.9.2, 08 September 2015, [PJ_VERSION: 492]
##  Path to PROJ.4 shared files: (autodetected)
##  Linking to sp version: 1.2-5
```

```
brmicro.shp <- readOGR("data", "br_micro", encoding = "ISO-8859-1")
```

```
## OGR data source with driver: ESRI Shapefile
## Source: "data", layer: "br_micro"
## with 558 features
## It has 5 fields
```

```
# Plotar o mapa
plot(brmicro.shp)
```

Dados

```
dados <- read.csv2("data/Dados_GWR.csv", header = TRUE)
str(dados)
```

```
## 'data.frame':    558 obs. of  17 variables:
##  $ ID     : int  110001 110002 110003 110004 110005 110006 110007 110008 120001 120002 ...
##  $ X_COORD: num  -64.5 -63.8 -62.6 -62.5 -62.8 ...
##  $ Y_COORD: num  -9.42 -11.68 -9.53 -10.54 -11.67 ...
##  $ P9303  : num  -0.0492 0.0584 0.2066 0.0747 0.157 ...
##  $ Q9303  : num  0.881 0.148 0.195 -0.627 0.366 ...
##  $ P93    : num  8.3 4.64 2.54 3.1 1.82 ...
##  $ G0     : num  0 0.44 0.694 0.626 0.781 ...
##  $ CT9303 : num  1.91 1.71 1.66 2.21 3.08 ...
##  $ CI9303 : num  1.147 2.03 -1.385 -0.294 1.647 ...
##  $ CC9303 : num  1.206 -0.165 1.662 1.975 2.734 ...
##  $ WP9303 : num  0.2632 0.0802 0.1186 0.0738 0.0905 ...
##  $ WQ9303 : num  0.853 0.146 1.075 0.42 -0.171 ...
##  $ WP93   : num  3.79 3.54 3.96 2.65 2.89 ...
##  $ WG0    : num  0.409 0.544 0.372 0.546 0.612 ...
##  $ WCT9303: num  1.62 2.49 1.15 2.08 2.23 ...
##  $ WCI9303: num  -0.817 0.809 0.718 1.654 0.824 ...
##  $ WCC9303: num  1.64 2.09 1.02 1.33 1.42 ...
```

Especificação

```
esp <-  Q9303 ~ P9303 + G0 + CI9303
```

Modelo OLS

```
mod1 <- lm(formula = esp, data = dados)
summary(mod1)
```

```
##
```

```
## Call:
## lm(formula = esp, data = dados)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.2571 -0.3653 -0.0417  0.2531 12.1204
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.255015   0.054681   4.664 3.9e-06 ***
## P9303        1.692115   0.124878  13.550  < 2e-16 ***
## G0           0.041733   0.033751   1.236   0.217
## CI9303      -0.002689   0.019658  -0.137   0.891
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9564 on 554 degrees of freedom
## Multiple R-squared:  0.2672, Adjusted R-squared:  0.2632
## F-statistic: 67.33 on 3 and 554 DF,  p-value: < 2.2e-16
```
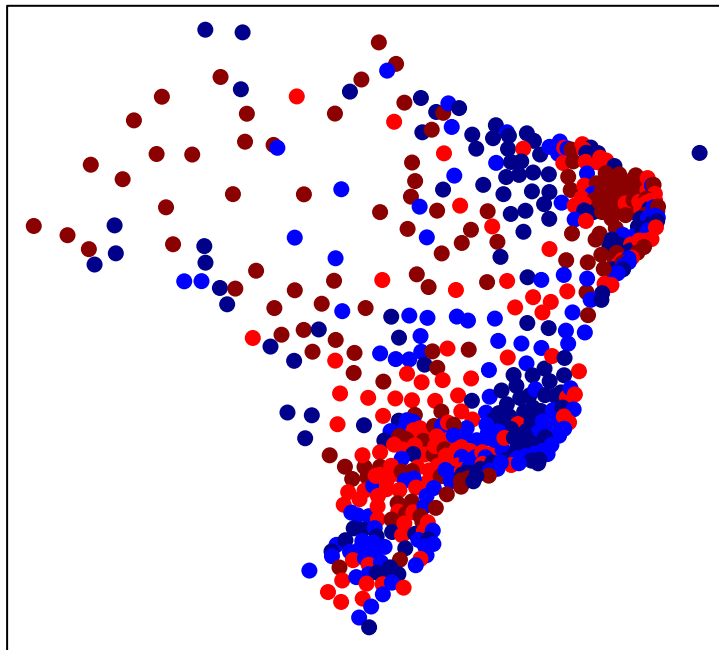
Verificando erros do modelo

```
plot(mod1, which=3)
```
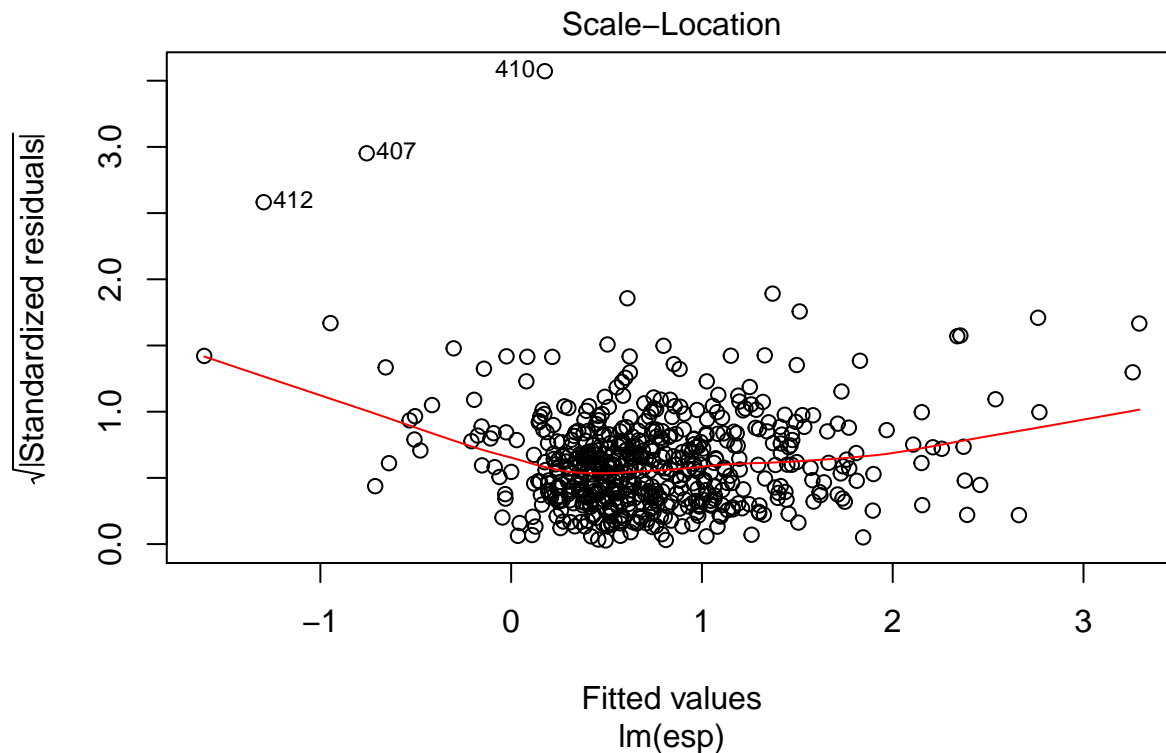
Verificando resíduos no espaço

```
resids<-residuals(mod1)
cores <- c("dark blue", "blue", "red", "dark red")
map.resids <- SpatialPointsDataFrame(data=data.frame(resids), coords=cbind(dados$X_COORD,dados$Y_COORD))
spplot(map.resids, cuts=quantile(resids), col.regions=cores, cex=1)
```


- [−8.257,−0.3653]
- (−0.3653,−0.04165]
- (−0.04165,0.2531]
- (0.2531,12.12]

Kernel bandwith

```
GWRbandwidth <- gwr.sel(esp, data=dados, coords = cbind(dados$X_COORD,dados$Y_COORD), adapt = TRUE)
```

```
## Adaptive q: 0.381966 CV score: 513.9403
## Adaptive q: 0.618034 CV score: 514.5733
## Adaptive q: 0.236068 CV score: 510.1655
## Adaptive q: 0.145898 CV score: 509.9981
## Adaptive q: 0.1818601 CV score: 509.6378
## Adaptive q: 0.1867464 CV score: 509.5685
## Adaptive q: 0.2055856 CV score: 509.9121
## Adaptive q: 0.1894925 CV score: 509.6879
## Adaptive q: 0.1852418 CV score: 509.6098
## Adaptive q: 0.1877954 CV score: 509.6292
## Adaptive q: 0.1864049 CV score: 509.5482
## Adaptive q: 0.1861779 CV score: 509.5577
## Adaptive q: 0.1864456 CV score: 509.5506
## Adaptive q: 0.1863466 CV score: 509.5485
## Adaptive q: 0.1864049 CV score: 509.5482
```

Modelo GWR

```
mod1.gwr = gwr(esp, data=dados, coords = cbind(dados$X_COORD,dados$Y_COORD), adapt=GWRbandwidth, hatmat:
mod1.gwr
```

```
## Call:
## gwr(formula = esp, data = dados, coords = cbind(dados$X_COORD,
##     dados$Y_COORD), adapt = GWRbandwidth, hatmatrix = TRUE, se.fit = TRUE)
## Kernel function: gwr.Gauss
## Adaptive quantile: 0.1864049 (about 104 of 558 data points)
## Summary of GWR coefficient estimates at data points:
##                  Min.    1st Qu.    Median   3rd Qu.      Max.   Global
## X.Intercept. -0.276464 -0.066091  0.143081  0.367378  0.612604   0.2550
## P9303         1.207676  1.483514  1.872278  2.474311  2.747145   1.6921
## G0           -0.081195 -0.034559  0.015841  0.118441  0.173140   0.0417
## CI9303       -0.046286 -0.028744  0.016651  0.074686  0.121517  -0.0027
## Number of data points: 558
## Effective number of parameters (residual: 2traceS - traceS'S): 17.35644
## Effective degrees of freedom (residual: 2traceS - traceS'S): 540.6436
## Sigma (residual: 2traceS - traceS'S): 0.9203189
## Effective number of parameters (model: traceS): 13.31951
## Effective degrees of freedom (model: traceS): 544.6805
## Sigma (model: traceS): 0.9169021
## Sigma (ML): 0.9058927
## AICc (GWR p. 61, eq 2.33; p. 96, eq. 4.21): 1502.684
## AIC (GWR p. 96, eq. 4.22): 1486.556
## Residual sum of squares: 457.918
## Quasi-global R2: 0.3378047
```