# More info at: https://crd230.github.io/lab5.html

# Install packages --------------------------------------------------------

install.packages("tidyverse")

install.packages("sp")

install.packages("spdep")

# Import libraries --------------------------------------------------------

library(tidyverse)

library(sf)

library(tmap)

library(spdep)

# Set working directory ---------------------------------------------------

#setwd("C:\\Users\\tatia\\Desktop\\INPE\\\_An?liseEspacial\\R\\Efietos1e2ordem")

# Creating spatial objects ------------------------------------------------

# Creating a spatial object sf

s <- st\_read("/dados/shapes/rj\_bairros2.shp")

bairros\_sf <- st\_as\_sf(s, coords = c("lon", "lat"), crs = 4326)

s <- st\_read("/dados/shapes/rj\_bairros\_centroides2.shp")

pontos\_sf <- st\_as\_sf(s, coords = c("lon", "lat"), crs = 4326)

# Filtering areas with population > 0 (NASCTOT>0)

bairros\_sf <- bairros\_sf[which(bairros\_sf$NASCTOT > 0),]

pontos\_sf <- pontos\_sf[which(pontos\_sf$NASCTOT > 0),]

#Convert the sf object to an sp, using "Spatial" to designate sp

bairros\_sp <- as(bairros\_sf, "Spatial")

class(bairros\_sp)

View(bairros\_sp)

data.frame(bairros\_sf)

pontos\_sp <- as(pontos\_sf, "Spatial")

class(pontos\_sp)

# Exploratory mapping -----------------------------------------------------

#ploting the map to see if it clusters.

#"TAXANEO" ranges from 0 to 1000.

 tm\_shape(bairros\_sf, unit = "km") +

 tm\_polygons(col = "TAXANEO", style = "quantile",palette = "Reds",

 border.alpha = 0, title = "") +

 tm\_scale\_bar(breaks = c(0, 10, 20), size = 1) +

 tm\_compass(type = "4star", position = c("left", "bottom")) +

 tm\_layout(main.title = "Taxa de obitos neonatal no Rio de Janeiro 1995",

 main.title.size = 0.95, frame = FALSE)

# Neighbour matrix --------------------------------------------------

#Neighbor connectivity: Contiguity (Queen or Rook)###

#poly2nb function calls for a sp object

bairros\_queen<-poly2nb(bairros\_sp, queen=T)

summary(bairros\_queen)

# list neighboors for [[i]] polygon

bairros\_queen[[1]]

# Check the 'name' of the polygon

bairros\_sp$BAIRROMA[1]

# Check neighbours name's

bairros\_sp$BAIRROMA[c(2,24,66,88)] #this or this below.

bairros\_sp$BAIRROMA[bairros\_queen[[1]]]

# Neighbor connectivity: k-nearest neighbors###

bairros\_knear <- knearneigh(pontos\_sp, k = 3) # k= number of neighbours

bairros\_knear

knn2nb(bairros\_knear) # converts a knn object returned by knearneigh into a neighbours list of class nb with a list of integer vectors containing neighbour region number ids.

# Neighbor connectivity: Distance###

bairros\_dnear <- dnearneigh(pontos\_sp, 1, 5000)

bairros\_dnear

# CorreÃ§Ã£o de taxas -------------------------------------------------------

# Scatter plot (Mostrar Efeito Funil)

plot(bairros\_sf$TAXANEO ~ bairros\_sf$NASCTOT, xlab="NASCTOT", ylab="TAXANEO")

# Boxplot

#boxplot(bairros\_sf$TAXANEO ~ bairros\_sf$NASCTOT, bairros\_sf)

# Global Empirical Bayes

gbayes <- EBest(bairros\_sf$OBITNEO, bairros\_sf$NASCTOT, family="poisson")

bairros\_sf$taxaneo\_gbayes <- gbayes$estmm\*1000

bairros\_sf$taxaneo\_gbayes

plot(bairros\_sf$taxaneo\_gbayes ~ bairros\_sf$NASCTOT, xlab="NASCTOT", ylab="TAXANEO")

tm\_shape(bairros\_sf, unit = "km") +

 tm\_polygons(col = "taxaneo\_gbayes", style = "quantile",palette = "Reds",

 border.alpha = 0, title = "") +

 tm\_scale\_bar(breaks = c(0, 10, 20), size = 1) +

 tm\_compass(type = "4star", position = c("left", "bottom")) +

 tm\_layout(main.title = "Taxa de obitos neonatal no Rio de Janeiro 1995",

 main.title.size = 0.95, frame = FALSE)

# Local Empirical Bayes

lbayes <- EBlocal(bairros\_sf$OBITNEO, bairros\_sf$NASCTOT, bairros\_queen, zero.policy = NULL, spChk = NULL, geoda=FALSE)

bairros\_sf$taxaneo\_lbayes <- lbayes$est\*1000

plot(bairros\_sf$taxaneo\_lbayes ~ bairros\_sf$NASCTOT, xlab="NASCTOT", ylab="TAXANEO")

tm\_shape(bairros\_sf, unit = "km") +

 tm\_polygons(col = "taxaneo\_lbayes", style = "quantile",palette = "Reds",

 border.alpha = 0, title = "") +

 tm\_scale\_bar(breaks = c(0, 10, 20), size = 1) +

 tm\_compass(type = "4star", position = c("left", "bottom")) +

 tm\_layout(main.title = "Taxa de obitos neonatal no Rio de Janeiro 1995",

 main.title.size = 0.95, frame = FALSE)

# Spatial weights matrix --------------------------------------------------

#Assing weights for the 'queen' neighbour matrix

bairros\_wqueen<-nb2listw(bairros\_queen, style="W", zero.policy = TRUE) #add zero.policy = TRUE

bairros\_wqueen$weights[[1]]

bairros\_wdnear <- nb2listw(bairros\_dnear, style = "W", zero.policy = TRUE)

bairros\_wdnear$weights[[1]]

# Visualize the neighbor connections between areas using the weight matrix

plot(bairros\_sp, border = "grey60")

plot(bairros\_wqueen, coords = coordinates(bairros\_sp), add=T, col=2)

plot(bairros\_sp, border = "grey60")

plot(bairros\_wdnear, coords = coordinates(bairros\_sp), add=T, col=2)

values <- bairros\_sf$taxaneo\_gbayes

std\_values <- values - mean(values)

# Moran Scatterplot -------------------------------------------------------

set.ZeroPolicyOption(TRUE)

moran.plot(std\_values, listw=bairros\_wqueen,

 xlab="Taxa padronizada de obitos neonatal ",

 ylab="Lag padronizado de obitos neonatal",

 xlim=c(-10, 40), ylim=c(-10,40),

 main=c("Moran Scatterplot para taxa de obitos neonatal", "no Rio de Janeiro") ) #I=.0.425?

# checar o que ? essa taxa padronizada e I=0.425...

# Global spatial autocorrelation ------------------------------------------

#A global index of spatial autocorrelation provides a summary over the entire study area of the level of spatial similarity observed among neighboring observations.

#Moran I

moran.test(values, bairros\_wqueen)

moran.test(values, bairros\_wdnear)

#Compute a p-value from a Monte Carlo simulation

moran.mc(values,bairros\_wdnear, nsim = 999)

# Moran I ranges from -1 to 1

#Geary C

geary.test(values, bairros\_wqueen)

geary.test(values, bairros\_wdnear)

#Compute a p-value from a Monte Carlo simulation

geary.mc(values, bairros\_wdnear, nsim=999)

# Geary's c ranges from 0 to 2, with 0 indicating perfect positive correlation

# G (Getis e Ord)

globalG.test(values, bairros\_wqueen, zero.policy=NULL, alternative="greater",

 spChk=NULL, adjust.n=TRUE, B1correct=TRUE, adjust.x=TRUE, Arc\_all\_x=FALSE)

globalG.test(values, bairros\_wdnear, zero.policy=NULL, alternative="greater",

 spChk=NULL, adjust.n=TRUE, B1correct=TRUE, adjust.x=TRUE, Arc\_all\_x=FALSE)

# Local spatial autocorrelation -------------------------------------------

# Local Indicators of Spatial Association (LISAs)

####Getis-Ord###

##Gi

localg <-localG(values, bairros\_wqueen, zero.policy = TRUE)

#localg <-localG(values, bairros\_wdnear, zero.policy = TRUE)

localg

# Interpretation of the Z-score:large positive value suggests a cluster of high rates (hot spot) and a large negative value indicates a cluster of low rates (cold spot).

# To plot, coerce the object localg to be numeric.

bairros\_sf <- mutate(bairros\_sf, localg = as.numeric(localg))

# Breaks: designate the cutoff points at the different significance levels (1% (or 99%), 5% (or 95%), and 10% (or 99%))

breaks <- c(-2.58, -1.96, -1.65, 1.65, 1.96, 2.58, max(bairros\_sf$localg[!is.nan(bairros\_sf$localg)]))

#Map the clusters using breaks = breaks\_a:

tm\_shape(bairros\_sf, unit = "km") +

 tm\_polygons(col = "localg", title = "Gi value", palette = "-RdBu",

 breaks = breaks) +

 tm\_scale\_bar(breaks = c(0, 10, 20), size = 1) +

 tm\_compass(type = "4star", position = c("left", "bottom")) +

 tm\_layout(frame = F, main.title = "Sacramento eviction clusters",

 legend.outside = T)

### Local Moran ###

locali<-localmoran(values, bairros\_wqueen)

bairros\_sf <- mutate(bairros\_sf, localmi = locali[,1], localz = locali[,4])

bairros\_sf <- mutate(bairros\_sf, mcluster = cut(localz, breaks = c(min(bairros\_sf$localz[!is.nan(bairros\_sf$localz)]), -1.96, 1.96, max(bairros\_sf$localz[!is.nan(bairros\_sf$localz)])), include.lowest = TRUE, labels = c("Negative Correlation", "Not Significant", "Positive Correlation")))

bairros.taxaneo <- tm\_shape(bairros\_sf, unit = "km") +

 tm\_polygons(col = "mcluster", title = "", palette = "-RdBu",

 breaks = breaks) +

 tm\_scale\_bar(breaks = c(0, 10, 20), size = 1) +

 tm\_compass(type = "4star", position = c("left", "bottom")) +

 tm\_layout(frame = F, main.title = "Cluster da taxa de ?bitos neonatal ",

 legend.outside = T)

bairros.taxaneo + tm\_view(basemaps="OpenStreetMap")