Caso 3 de Salvador

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2022-11-05

```
set.seed(1234)
options(scipen = 6, digits = 3)

library(sp)
library(rgdal)
```

```
## Please note that rgdal will be retired by the end of 2023,
## plan transition to sf/stars/terra functions using GDAL and PROJ
## at your earliest convenience.
##
## rgdal: version: 1.5-32, (SVN revision 1176)
## Geospatial Data Abstraction Library extensions to R successfully loaded
## Loaded GDAL runtime: GDAL 3.4.3, released 2022/04/22
## Path to GDAL shared files: C:/Users/vshal/AppData/Local/R/win-library/4.2/rgdal/gdal
## GDAL binary built with GEOS: TRUE
## Loaded PROJ runtime: Rel. 7.2.1, January 1st, 2021, [PJ_VERSION: 721]
## Path to PROJ shared files: C:/Users/vshal/AppData/Local/R/win-library/4.2/rgdal/proj
## PROJ CDN enabled: FALSE
## Linking to sp version:1.5-0
## To mute warnings of possible GDAL/OSR exportToProj4() degradation,
## use options("rgdal_show_exportToProj4_warnings"="none") before loading sp or rgdal.
```

```
library(raster)
library(spdep)
```

```
## Loading required package: spData
```

```
## To access larger datasets in this package, install the spDataLarge
## package with: `install.packages('spDataLarge',
## repos='https://nowosad.github.io/drat/', type='source')`
```

```
## Loading required package: sf
```

```
## Linking to GEOS 3.9.1, GDAL 3.4.3, PROJ 7.2.1; sf_use_s2() is TRUE
```

```
library(ncf)
```

Lectura de datos fuente

```
fin <- readOGR("INSUMOS/servicios_financieros.shp")
```

```
## OGR data source with driver: ESRI Shapefile
## Source: "G:\Mi unidad\UdeG_Docencia\CUCSH_Doctorado_TT3\2022B\Caso_3\INSUMOS\servicios_financieros.
shp", layer: "servicios_financieros"
## with 4300 features
## It has 48 fields
```

```
fin
```

```
## class       : SpatialPointsDataFrame
## features    : 4300
## extent      : 640797, 701750, 2250985, 2310040  (xmin, xmax, ymin, ymax)
## crs         : +proj=utm +zone=13 +datum=WGS84 +units=m +no_defs
## variables   : 48
## names       :      ID,                          CLEE,               NOM_ESTAB,
RAZ_SOCIAL, CODIGO_ACT,                          NOMBRE_ACT,         PER_OCU,  TIPO_VIAL,             NO
M_VIAL, TIPO_V_E_1, NOM_V_E_1, TIPO_V_E_2, NOM_V_E_2, TIPO_V_E_3, NOM_V_E_3, ...
## min values  :  315752, 0100152245200124100002238 9S8, ABC CAPITAL GUADALAJARA,
ABC CAPITAL SA,     521110,                      Banca central,  0 a 5 personas, AMPLIACION, _ADOLFO_LO
PEZ_MATEOS,    ANDADOR,         1,    ANDADOR,         1,    ANDADOR,         1, ...
## max values  : 9383166, 3019352245200152100002238 9S3,               ZONA EURO, ZONA EURO CENTRO CAMB
IARIO SA DE CV,     523990, Fondos y fideicomisos financieros, 6 a 10 personas,    RETORNO,
ZOQUIPAN,   VIADUCTO, Zarzamora,   VIADUCTO, ZARZAMORA,   VIADUCTO,  ZOQUIPAN, ...
```

```
str(fin@data)
```

```
## 'data.frame':    4300 obs. of  48 variables:
##  $ ID        : int  6902919 6904233 6894107 6893615 6893633 6893619 6893692 9234371 1651259 9233455
...
##  $ CLEE      : chr  "14101522110001371000000000U0" "14101522110001381000000000U9" "1412052211001041
1000000000U3" "14120522110010091000000000U3" ...
##  $ NOM_ESTAB : chr  "HSBC MEXICO" "HSBC MEXICO" "HSBC MEXICO" "HSBC MEXICO" ...
##  $ RAZ_SOCIAL: chr  "BANCO HSBC MEXICO" "BANCO HSBC MEXICO" "BANCO HSBC MEXICO" "BANCO HSBC MEXICO"
...
##  $ CODIGO_ACT: chr  "522110" "522110" "522110" "522110" ...
##  $ NOMBRE_ACT: chr  NA NA NA NA ...
##  $ PER_OCU   : chr  "0 a 5 personas" "0 a 5 personas" "0 a 5 personas" "0 a 5 personas" ...
##  $ TIPO_VIAL : chr  "AVENIDA" "AVENIDA" "CARRETERA" "CALLE" ...
##  $ NOM_VIAL  : chr  "RIO NILO" "RIO NILO" "BASE AEREA" "MANUEL AVILA CAMACHO" ...
##  $ TIPO_V_E_1: chr  NA NA NA NA ...
##  $ NOM_V_E_1 : chr  NA NA NA NA ...
##  $ TIPO_V_E_2: chr  NA NA NA NA ...
##  $ NOM_V_E_2 : chr  NA NA NA NA ...
##  $ TIPO_V_E_3: chr  NA NA NA NA ...
##  $ NOM_V_E_3 : chr  NA NA NA NA ...
##  $ NUMERO_EXT: chr  NA NA NA NA ...
##  $ LETRA_EXT : chr  NA NA NA NA ...
##  $ EDIFICIO  : chr  NA NA NA NA ...
##  $ EDIFICIO_E: chr  NA NA NA NA ...
##  $ NUMERO_INT: chr  "1620" "7540" "3016" "601" ...
##  $ LETRA_INT : chr  NA NA NA NA ...
##  $ TIPO_ASENT: chr  "COLONIA" "PUERTO" "AEROPUERTO" "COLONIA" ...
##  $ NOMB_ASENT: chr  "DE ORIENTE" "ORIENTE" "LA MORA" "SEATLE" ...
##  $ TIPOCENCOM: chr  NA NA NA NA ...
##  $ NOM_CENCOM: chr  NA NA NA NA ...
##  $ NUM_LOCAL : chr  NA NA NA NA ...
##  $ COD_POSTAL: chr  "45417" "45403" "45136" "45150" ...
##  $ CVE_ENT   : chr  "14" "14" "14" "14" ...
##  $ ENTIDAD   : chr  "JALISCO" "JALISCO" "JALISCO" "JALISCO" ...
##  $ CVE_MUN   : chr  "101" "101" "120" "120" ...
##  $ MUNICIPIO : chr  NA NA "Zapopan" "Zapopan" ...
##  $ CVE_LOC   : chr  "0001" "0001" "0001" "0001" ...
##  $ LOCALIDAD : chr  NA NA "Zapopan" "Zapopan" ...
##  $ AGEB      : chr  "2020" "2020" "6758" "2242" ...
##  $ MANZANA   : chr  "016" "016" "060" "037" ...
##  $ TELEFONO  : chr  NA NA NA NA ...
##  $ CORREOELEC: chr  NA NA NA NA ...
##  $ WWW       : chr  NA NA NA NA ...
##  $ TIPOUNIECO: chr  "Fijo" "Fijo" "Fijo" "Fijo" ...
##  $ FECHA_ALTA: chr  "2019-04" "2019-04" "2019-04" "2019-04" ...
##  $ COD_GEN   : chr  "52" "52" "52" "52" ...
##  $ CODIGO_AC5: chr  "522" "522" "522" "522" ...
##  $ EMPLEO    : num  5 5 5 5 5 5 5 30 5 300 ...
##  $ DUP_IDS   : num  NA NA NA NA NA NA NA NA 8 NA ...
##  $ SELECTED  : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ MORAN_LAG : num  -0.066 -0.0855 -0.1925 -0.0559 -0.2114 ...
##  $ LISA_I    : num  0.0139 0.0181 0.0407 0.0118 0.0447 ...
##  $ LISA_CL   : num  0 0 0 0 2 0 0 0 0 0 ...
```

```
AMG <- readOGR("INSUMOS/LIMITES AMG.shp")
```

```
## Warning in OGRSpatialRef(dsn, layer, morphFromESRI = morphFromESRI, dumpSRS
## = dumpSRS, : Discarded datum Mexico_ITRF2008 in Proj4 definition: +proj=lcc
## +lat_0=12 +lon_0=-102 +lat_1=17.5 +lat_2=29.5 +x_0=2500000 +y_0=0 +ellps=GRS80
## +towgs84=0,0,0,0,0,0,0 +units=m +no_defs
```

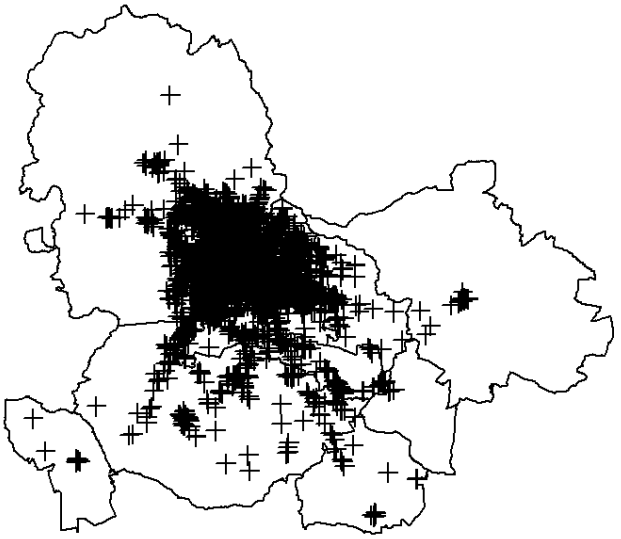
```
## OGR data source with driver: ESRI Shapefile
## Source: "G:\Mi unidad\UdeG_Docencia\CUCSH_Doctorado_TT3\2022B\Caso_3\INSUMOS\LIMITES AMG.shp", laye
r: "LIMITES AMG"
## with 10 features
## It has 261 fields
```

```
AMG
```

```
## class       : SpatialPolygonsDataFrame
## features    : 10
## extent      : 2324559, 2409730, 925112, 999569  (xmin, xmax, ymin, ymax)
## crs         : +proj=lcc +lat_0=12 +lon_0=-102 +lat_1=17.5 +lat_2=29.5 +x_0=2500000 +y_0=0 +ellps=GR
S80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs
## variables   : 261
## names       : CVEGEO, NOM_ENT,            NOMGEO,    POB1,  POB2, POB2_R,  POB4, POB4_R,   POB5, PO
B5_R,   POB6, POB6_R,  POB7, POB7_R,   POB8, ...
## min values  :  14002, Jalisco, Acatlán de Juárez,   25250,  1195,    3.4,  1360,    4.1,   2595,
8,   4057,    9.5,  1775,    4.1,   7487, ...
## max values  :  14124, Jalisco,       Zapotlanejo, 1476491, 61352,    5.8, 69907,    6.9, 130302,
13.4, 153487,   16.1, 66470,    9.3, 328031, ...
```

```
crs_utm <- CRS("+proj=utm +zone=13 +datum=WGS84 +units=m +no_defs")
AMG <- spTransform(AMG, crs_utm)

plot(AMG)
plot(fin, add = TRUE)
```



Definición de parámetros

```
## Puntos incluidos en la vecindad
k <- 50
```

Preparar los datos para analisis de autocorrelación espacial

```
fin_knn <- knearneigh(fin, k = k, longlat = NULL, use_kd_tree = TRUE)
```

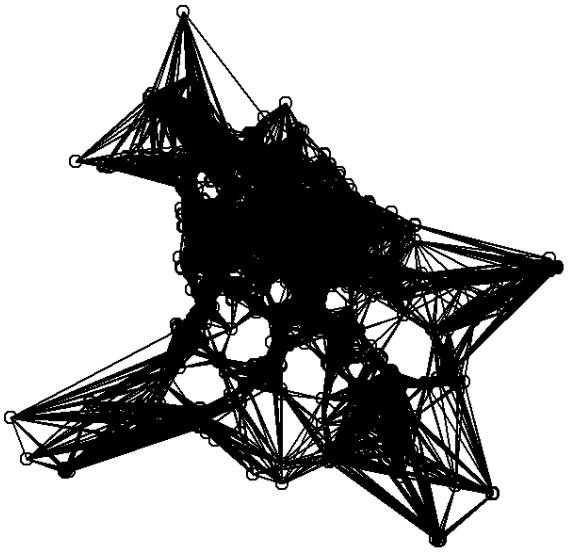
```
## Warning in knearneigh(fin, k = k, longlat = NULL, use_kd_tree = TRUE):
## knearneigh: identical points found
```

```
## Warning in knearneigh(fin, k = k, longlat = NULL, use_kd_tree = TRUE):
## knearneigh: kd_tree not available for identical points
```

```
fin_nb <- knn2nb(fin_knn)

#str(fin_knn)
#str(fin_nb)

fin_coord <- coordinates(fin)
plot(fin_nb, fin_coord)
```



```
#fin_lw <- nb2listw(fin_nb, style="W", zero.policy=TRUE)

fin_lw <- nb2listwdist(fin_nb, x = fin, style="W",type="idw", zero.policy=TRUE)


#str(fin_lw)
```

```
suma_G <- 0
suma_Gw <- 0
suma_Gw_inv <- 0
suma_X <- 0

n <- fin_knn$np

for (i in 1:n) {
#for (i in 1:100) {
  #print(paste0("punto: ",i))
  empl <- fin@data[i,"EMPLEO"]
  #print(paste0("empleados: ", as.numeric(empl)))
  suma_X <- suma_X + empl
  weights <- fin_lw$weights[[i]]
  #print(paste0("primer vecino: ",fin_knn$nn[i,1]))
  for (j in 1:k) {
    emplv <- fin@data[fin_knn$nn[i,j],"EMPLEO"]
    #print(paste0("vecino ",j,": ",fin_knn$nn[i,j]," empleados: ",emplv))
    comp_form <- abs(empl - emplv)
    #print(comp_form)
    comp_form_w <- weights[j] * comp_form
    comp_form_w_inv <- (1 - weights[j]) * comp_form

    suma_G <- suma_G + comp_form
    suma_Gw <- suma_Gw + comp_form_w
    suma_Gw_inv <- suma_Gw_inv + comp_form_w_inv
  }
}
```

Valores resultantes en el calculo de índice

```
suma_G
```

```
## [1] 1569320
```

```
X_prima <- suma_X / n

X_prima
```

```
## [1] 9
```

```
G <- suma_G / (1 * n^2 * X_prima)

G
```

```
## [1] 0.00943
```

```
Gw <- suma_Gw / (1 * n^2 * X_prima)

Gw
```

```
## [1] 0.000185
```

```
Gw_inv <- suma_Gw_inv / (1 * n^2 * X_prima)

Gw_inv
```

```
## [1] 0.00925
```

```
Gfinal <- Gw + Gw_inv

Gfinal
```

```
## [1] 0.00943
```