R: Spatial weights

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Spatial weights

```
library(sf)
```

```
## Linking to GEOS 3.7.2, GDAL 3.0.1, PROJ 6.2.0
```

```
lux <- st_read("../data/lux_tmerc.gpkg")
```

```
## Reading layer `lux_tmerc' from data source `/home/rsb/presentations/ectqg19-workshop/data/lux_tmerc.g
## Simple feature collection with 102 features and 16 fields
## geometry type:  MULTIPOLYGON
## dimension:      XY
## bbox:           xmin: 48930.89 ymin: 57015.29 xmax: 106113.8 ymax: 138759.2
## epsg (SRID):    NA
## proj4string:    +proj=tmerc +lat_0=49.8333333333333 +lon_0=6.16666666666667 +k=1 +x_0=80000 +y_0=100
```

Contiguity neighbours and nb neighbour objects and methods

```
library(spdep)
```

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

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

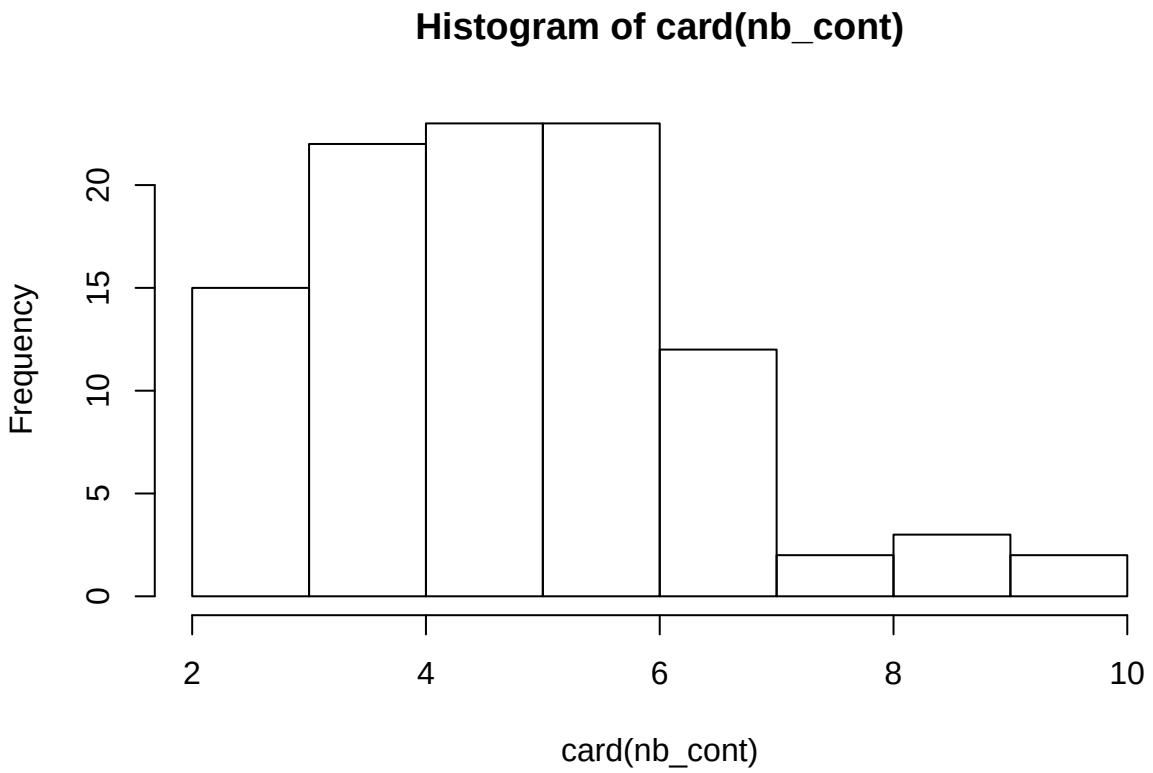
```
nb_cont <- poly2nb(lux, row.names=as.character(lux$LAU2))
nb_cont
```

```
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 528
## Percentage nonzero weights: 5.074971
## Average number of links: 5.176471
```

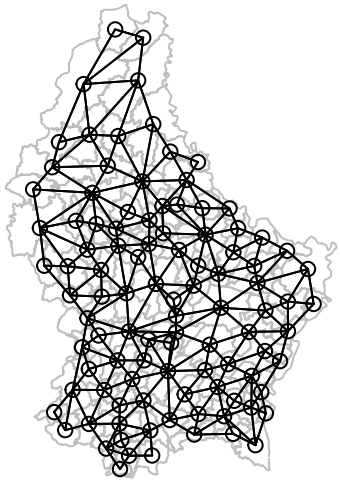
```
summary(nb_cont)
```

```
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 528
## Percentage nonzero weights: 5.074971
## Average number of links: 5.176471
## Link number distribution:
##
##  2  3  4  5  6  7  8  9 10
##  5 10 22 23 23 12  2  3  2
## 5 least connected regions:
## 24 33 35 66 92 with 2 links
## 2 most connected regions:
## 70 94 with 10 links
```

```
hist(card(nb_cont))
```




```
plot(st_geometry(lux), border="grey")
crds <- st_centroid(st_geometry(lux))
plot(nb_cont, crds, add=TRUE)
```



Point geometries should be planar, not spherical (example with k nearest neighbours)

```
knn5 <- knn2nb(knearneigh(crds, k=5))
knn5
```

```
## Neighbour list object:
## Number of regions: 102
```

```
## Number of nonzero links: 510
## Percentage nonzero weights: 4.901961
## Average number of links: 5
## Non-symmetric neighbours list
```

```
knn5s <- knn2nb(knearneigh(crds, k=5), sym=TRUE)
knn5s
```

```
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 608
## Percentage nonzero weights: 5.843906
## Average number of links: 5.960784
```

Do not use geographical coordinates for KNN unless you use Great Circle distances, here the need for GC distances is detected from the CRS of the object, so the neighbours are the same as with projected points

```
knn5_ll <- knn2nb(knearneigh(st_transform(crds, 4326), k=5))
knn5_ll
```

```
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 510
## Percentage nonzero weights: 4.901961
## Average number of links: 5
## Non-symmetric neighbours list
```

```
all.equal(knn5, knn5_ll, check.attributes=FALSE)
```

```
## [1] TRUE
```

```
knn5_ll_eucl <- knn2nb(knearneigh(st_coordinates(st_transform(crds, 4326)), k=5))
knn5_ll_eucl
```

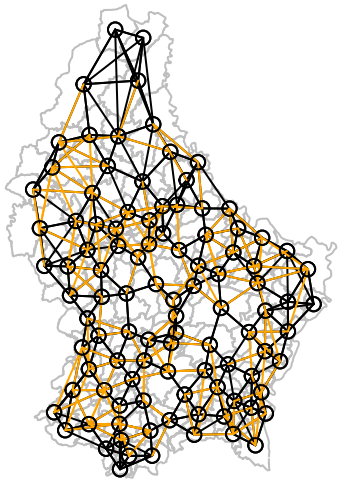
```
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 510
## Percentage nonzero weights: 4.901961
## Average number of links: 5
## Non-symmetric neighbours list
```

```
isTRUE(all.equal(knn5, knn5_ll_eucl, check.attributes=FALSE))
```

```
## [1] FALSE
```

The orange neighbours are added or cut by using the wrong distance metric

```
plot(st_geometry(lux), border="grey")
plot(knn5, crds, add=TRUE)
plot(diffnb(knn5, knn5_ll_eucl), crds, add=TRUE, col="orange")
```



Weights

The `nb2listw()` function is used to construct an `listw` spatial weights object from an `nb` neighbour object, possibly working around no-neighbour observations, adding edge weights and choosing the style

```
args(nb2listw)
```

```
## function (neighbours, glist = NULL, style = "W", zero.policy = NULL)
## NULL
```

```
lw_B <- nb2listw(nb_cont, style="B")
lw_B
```

```
## Characteristics of weights list object:
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 528
## Percentage nonzero weights: 5.074971
## Average number of links: 5.176471
##
## Weights style: B
## Weights constants summary:
##     n    nn  S0   S1    S2
## B 102 10404 528 1056 12096
```

```
lw_W <- nb2listw(nb_cont) # default style="W"
lw_W
```

```
## Characteristics of weights list object:
## Neighbour list object:
## Number of regions: 102
## Number of nonzero links: 528
## Percentage nonzero weights: 5.074971
## Average number of links: 5.176471
##
## Weights style: W
## Weights constants summary:
##     n    nn  S0       S1       S2
## W 102 10404 102 42.09561 421.4185
```