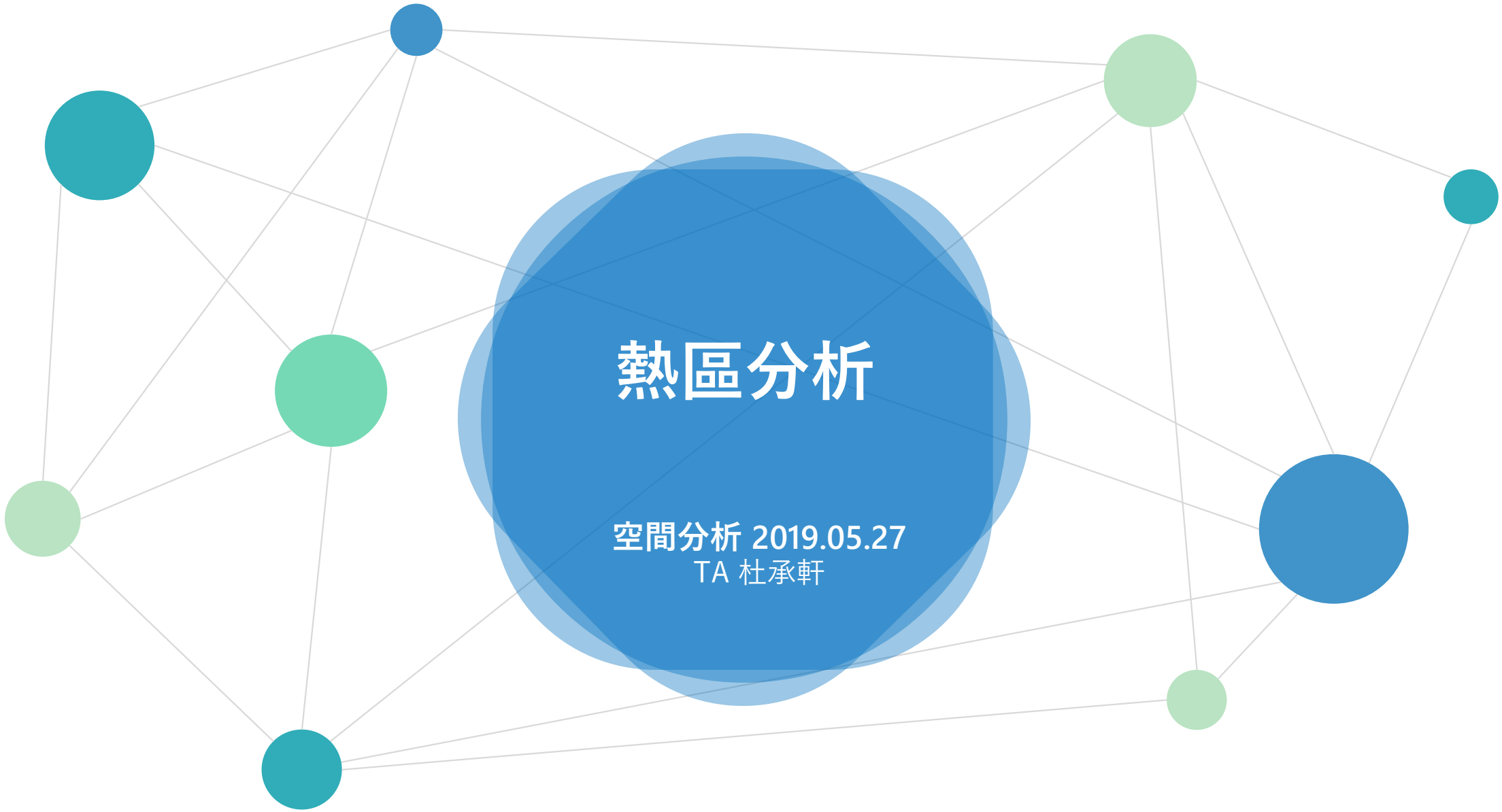


熱區分析

空間分析 2019.05.27

TA 杜承軒

HW9檢討

實習十一範例

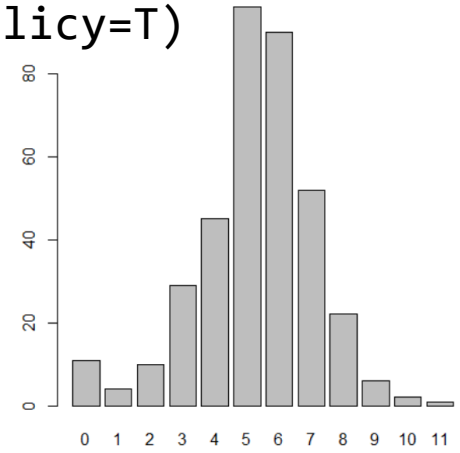
```
library(spdep);library(rgdal);library(GISTools)
setwd("D:/1072SA/Data")
TW=readOGR(dsn =".", layer = "Popn_TWN2", encoding="utf8")

#Q1
TW.nb=poly2nb(TW)
M=nb2mat(TW.nb, style="B",zero.policy=T)
rs=rowSums(M)
k=xtabs(~rs)
barplot(k)

#Q2
Max.ID=as.integer(names(rs[rs==max(rs)]))+1
TW@data[Max.ID,]$TOWN

#Q3
pop=rowSums(TW@data[,c(5,8,11)])
area=poly.areas(TW)/10^6

z=c()
for (i in 1:nrow(M)){
  nbs=TW.nb[[i]]
  if(any(nbs==0)) z[i]=NA
  else z[i]=sum(pop[nbs])/sum(area[nbs])
}

shade=auto.shading(na.omit(z), n = 5, cols = brewer.pal(5, "Reds"))
choropleth(TW,z,shading=shade)
choro.legend(340000,2650000,shade)
```

HW9檢討

1. 繪製各鄉鎮的鄰居數的直方圖

```
M=nb2mat(TW.nb, style="B",zero.policy=T)
rs=rowSums(M)
k=xtabs(~rs)
```

```
 0  1  2  3  4  5  6  7  8  9 10 11
11  4 10 29 45 96 90 52 22  6  2  1
```



第幾列

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
1	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0
3	2	0	0	0	0	0	0	0	0	0
4	3	0	0	0	0	0	0	0	0	0
5	4	0	0	0	0	0	0	1	0	0
6	5	0	0	0	0	0	1	0	0	0
7	6	0	0	0	0	1	0	1	0	0
8	7	0	0	0	1	0	1	0	0	0
9	8	0	0	0	0	0	0	0	0	0

2. 找出台灣本島最多鄰居的鄉鎮是哪一個

```
Max.ID=as.integer(names(rs[rs==max(rs)]))+1
TW@data[Max.ID,]$TOWN
```

```
> rs[rs==max(rs)]
230
 11
```

Ans: 士林區

HW9檢討

3. 繪製台灣各鄉鎮的1st-order鄰居人口密度的面量圖

$$\text{鄰居人口密度} = \frac{\text{鄰居鄉鎮人數的總和}}{\text{鄰居鄉鎮面積的總和}}$$

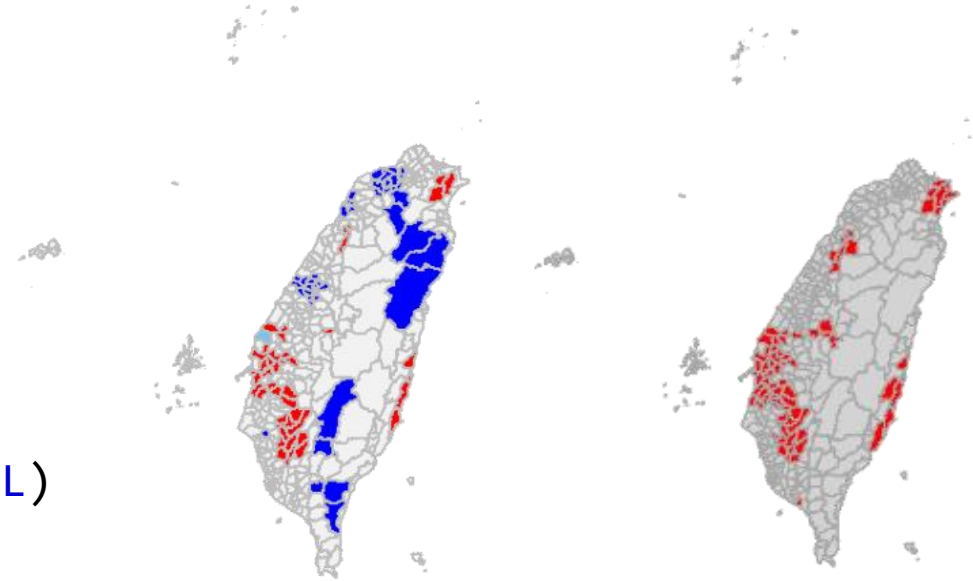
```
z=c()
for (i in 1:nrow(M)){
  nbs=TW.nb[[i]]
  if(any(nbs==0)) z[i]=NA   #沒鄰居
  else z[i]=sum(pop[nbs])/sum(area[nbs]) #有鄰居
}                  #加總鄰居人口     #加總鄰居面積
```

```
> TW.nb[[1]]
[1] 0
> TW.nb[[1]]==0
[1] TRUE
> any(TW.nb[[1]]==0)
[1] TRUE
```

```
> TW.nb[[8]]
[1] 5 7
> TW.nb[[8]]==0
[1] FALSE FALSE
> any(TW.nb[[8]]==0)
[1] FALSE
```

Lab 12

資料： Popn_TWN2.shp



繪製台灣鄉鎮高齡人口比例的主題地圖：

└定義：老年人口／全部人口

【鄰近定義：Contiguity (Queen)】

1. 原始數值
2. LISA map (p-value < 0.05, 區分 HH, HL, LH, LL)
3. Standardized Gi * values
   (p-value < 0.05, 區分 cluster, non-cluster)

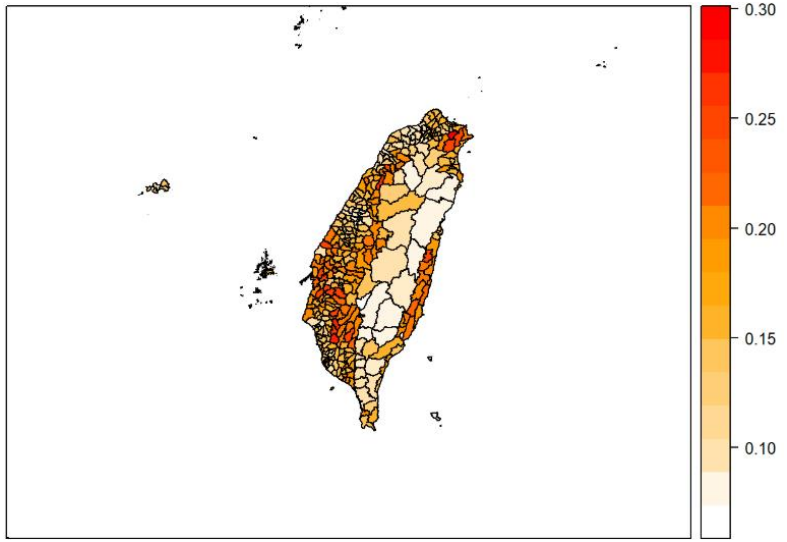
透過spplot繪製面量圖

※ 選顏色：「白→橘→紅」的漸層色

```
lm.palette=colorRampPalette(c( "white","orange","red"), space = "rgb")
```

```
spplot(TW, zcol="old", col.regions=lm.palette(20), main="標題")
```

圖層　畫圖數值　※ 分20格漸層色



實作

LISA

定義「鄰近」

```
TW.nb = poly2nb(TW)
```

建立鄰近表

```
TW.nb.w = nb2listw(TW.nb,
                   zero.policy=T)
```

區域空間自相關運算

```
LISA = localmoran(old, TW.nb.w,
       zero.policy = T,
       alternative = "two.sided")
```

```
> LISA
                Ii    E.Ii     Var.Ii         Z.Ii   Pr(z != 0)
220  0.8094220277 -0.025 0.17429168  1.998699187 4.564091e-02
221  0.6620073103 -0.025 0.22386090  1.452018784 1.464964e-01
222  1.3953564727 -0.025 0.17429168  3.402193655 6.684725e-04
223  0.5999538193 -0.025 0.14124553  1.662878712 9.633672e-02
224  1.5232521605 -0.025 0.14124553  4.119593286 3.795417e-05
225  1.3501517812 -0.025 0.17429168  3.293914418 9.880258e-04
226  2.3360250470 -0.025 0.14124553  6.282221450 3.337689e-10
227 -0.0299052525 -0.025 0.08616861 -0.016710399 9.866677e-01
228  0.0003684787 -0.025 0.11764114  0.073963051 9.410398e-01
229 -0.0043165576 -0.025 0.17429168  0.049543250 9.604864e-01
230 -0.0327045528 -0.025 0.06614064 -0.029958028 9.761005e-01
```

Local Moran's I
LISA[,1]

Z score
LISA[,4]

P value
LISA[,5]

Gi*

包含自己的鄰近定義

```
TW.nb = poly2nb(TW)
TW.nb.in = include.self(TW.nb)

TW.nb.w.in = nb2listw(TW.nb.in)

Gi = localG(old,TW.nb.w.in)
```

```
> Gi
 [1]  1.8911025  1.7181396  2.5357910  2.4823288
 [5]  3.7590712  2.4905072  4.3849408  1.7080833
 [9] -0.1426438  0.2470504  0.1209070 -1.7733190
[13]  2.4211648  2.8866465  2.4180649  2.9475747
[17]  0.9903472 -0.9465509  0.3367046 -0.9960144
[21] -1.4617826 -1.4423588 -1.6701713 -1.7999710
```

Z score of Gi*

LISA與繪圖

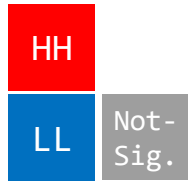
```
LISA = localmoran(old, TW.nb.w,zero.policy = T, alternative = "two.sided" )
```

※ 可以透過data.frame(LISA)來轉成表格格式

```
> LISA
```

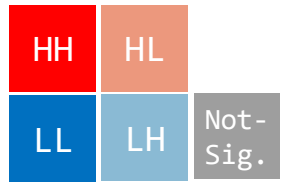
	Ii	E.Ii	Var.Ii	Z.Ii	Pr(z > 0)
220	0.8094220277	-0.025	0.17429168	1.998699187	2.282046e-02
221	0.6620073103	-0.025	0.22386090	1.452018784	7.324819e-02
222	1.3953564727	-0.025	0.17429168	3.402193655	3.342363e-04
223	0.5999538193	-0.025	0.14124553	1.662878712	4.816836e-02
224	1.5232521605	-0.025	0.14124553	4.119593286	1.897709e-05

alternative = "greater"
預設：是否和鄰居相似(正相關)



Pr(z != 0)
4.564091e-02
1.464964e-01
6.684725e-04
9.633672e-02
3.795417e-05

alternative = "two.sided"
我們要的：是否和鄰居有相關



區分顏色

```
LISA = localmoran(old, TW.nb.w, zero.policy=T, alternative ="two.sided")
diff = old - mean(old) # diff看自己和平均比起來算是H還是L
z = LISA[,4]
quad = c()
quad[diff>0 & z>0] = 1 # H-H
quad[diff<0 & z>0] = 2 # L-L
quad[diff>0 & z<0] = 3 # H-L
quad[diff<0 & z<0] = 4 # L-H
quad[LISA[, 5]>0.05]=5 # 不顯著, 設定雙尾所以用0.05比較就可以
```

著色

繪圖

```
colors=c("red", "blue", "lightpink", "skyblue2", rgb(.95, .95, .95))
plot(TW, border="grey", col=colors[quad], main = "LISA Map")
legend("bottomright",legend=c("HH","LL","HL","LH","NS"),fill=colors,bty="n",cex=0.7,y.intersp=1,x.intersp=1)
```

Gi*與繪圖

```
Gi = localG(old,TW.nb.w.in)
```

※ 會列出Gi*的Z分數

※ 可以透過as.vector(Gi)來轉成向量格式

```
> Gi
 [1]  1.8911025  1.7181396  2.5357910  2.4823288
 [5]  3.7590712  2.4905072  4.3849408  1.7080833
 [9] -0.1426438  0.2470504  0.1209070 -1.7733190
[13]  2.4211648  2.8866465  2.4180649  2.9475747
```

cluster

1.645

non-cluster

區分顏色

```
Gi = localG(old,TW.nb.w.in)
LG = as.vector(Gi)
quad = c()
quad[LG>=1.645] = 1 # cluster
quad[LG <1.645] = 2 # non-cluster
```

繪圖

```
colors=c("red", "lightgray")
plot(TW, border="grey", col=colors[quad], main = "Cluster Map")
legend("bottomright", c("Cluster","Non-cluster"), fill=colors,bty="n",cex=0.7,y.intersp=1,x.intersp=1)
```

補充

```
Gi = localG(old, TW.nb.w.in, return_internals =T)
```

※ 可以列出每個格子的Gi*，以及期望值、變異數

```
> attr(Gi,"internals")
```

	G	EG	VG
1	0.0443024793	0.02439024	1.108689e-04
2	0.0444890960	0.02439024	1.368440e-04
3	0.0510906836	0.02439024	1.108689e-04
4	0.0482406792	0.02439024	9.231537e-05
5	0.0605077328	0.02439024	9.231537e-05
6	0.0506138713	0.02439024	1.108689e-04