About the presenter

Alan Silva is a Statistician, has a Master and a PhD in Transportation and he is an Associate Professor of Statistics at University of Brasilia, Brazil. Working with SAS since 2002 and developing solutions using SAS/IML and SAS/AF.
Working with PROC SPP, PROC GMAP and PROC GINSIDE to Produce Nice Maps

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Spatial Point Pattern

- The new PROC SPP (Spatial Point Pattern) deal with spatial data, which are a collection of locations of single events of a spatial process (SAS, 2014);

- It is possible to use PROC SSP to create a surface of the intensity of the point pattern process;

- The problem is that PROC SPP generates data only for a squared area, even the data are bordered by an irregular area.
Spatial Point Pattern

Estimated Intensity of AVG_Z
with Gaussian Kernel and Bandwidth = 500
Spatial Point Pattern

The first analysis in order to characterizing the intensity of the data points in an area can be done by a kernel estimator of the intensity function. The general form of this kind of estimator is given by (Cressie, 1991):

\[ \hat{\lambda}_h(s) = \frac{1}{\rho_h(s)} \left\{ \sum_{i=1}^{n} k_h(s - s_i) \right\} \]

\[ \hat{\lambda}_h(s) = \frac{1}{\rho_h(s)} \left\{ \sum_{i=1}^{n} h^{-2} k_h \left( \frac{s - s_i}{h} \right) \right\} \] (PROC SPP)

\[ K(d) = \frac{-d^2}{4 \pi} \]

\[ d = \sqrt{(x_i - x_j)^2 + (y_i + y_j)^2} \]
let us use an irregular shape from the Canchim farm (EMBRAPA) in São Carlos, São Paulo, Brazil. There are 85 data referring to the clay content.

The shape file (*.shp) can be imported by PROC MAPIMPORT.
First, one can use PROC SQL to select the borders of the area named MINX, MINY, MAXX, MAXY.

```sql
proc sql noprint;
  select min(x) into:minx from sao_carlos;
  select min(y) into:miny from sao_carlos;
  select max(x) into:maxx from sao_carlos;
  select max(y) into:maxy from sao_carlos;
quit;
%put minx=&minx maxx=&maxx miny=&miny maxy=&maxy;
```
Illustration

- After that, one can use that information about the borders of the area in the AREA= option of the PROCESS statement of PROC SPP. The b= option referred to the kernel bandwidth parameter of the kernel first-order intensity estimates and GRID= specifies a reference grid for computing the kernel estimate.

```sas
proc spp data=sao_carlos_pt plots(equate)=(trends observations);
  process AVG_Z = (x, y /area=(&minx,&miny,&maxx,&maxy)
    Event=AVG_Z) / 
    kernel(type=gaussian b=500 out=kernel grid(90,90));
run;
```

#SASGF
To plot the results, one can use the ANNOTATE Facility from the dataset generated by KERNEL sub-option OUT= and PROC GMAP with ANNO= option in the CHORO statement.

```sas
data anno;set kernel(rename=(GXC=x GYC=y));
  length function style $10. color $8.;
  retain line 1 xsys ysys '2' hsys '3' color 'red';
  function='label';text='U';position='5';style='marker';
  size=1;
run;
proc gmap data=a map=sao_carlos all;
  id segment;
  choro v / anno=anno nolegend;
run;quit;
```

Just remember to rename the variables GXC and GYC to X and Y, respectively.
Illustration

- Using SIZE=0.5 (small squares) we can see how the coordinates are distributed on the area (left) and using SIZE=1 (large squares) we can see these coordinates in the “continuous way” on the area (right).
Finally, to plot the continuous surface one can use the program described in the paper to color each coordinate (square created by the ANNOTATE Facility) and to create a continuous bar. This task can be done with \%colorscale macro (SAS, 2003) with some adaptations. This macro is on Appendix I.

\%colorscale(FFFFFF,,,FF0000,&nc,clist,no);\%patt;

\%bar(FF3333,FFFFFF,&min,&max,vertical,y_i=44,x_i=80);
Illustration

```sas
proc gmap data=a map=sao_carlos all anno=anno_points;
  id segment;
  choro v / anno=anno nolegend;
run;
quit;
```
Illustration

- Use PROC GINSIDE to show the intensity estimates only for the coordinates which are inside the polygon.

```plaintext
proc ginside data=anno map=Sao_carlos
out=anno2 insideonly;
  id segment;
run;

data anno2;set _a_ anno2;
proc gmap data=a map=sao_carlos all anno=anno2
  id segment;
  choro v / anno=anno2 nolegend;
run;quit;
```
Illustration

Much Better!!
Acknowledgments: FAPDF, Brazil

Thank you!!

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