Review of the DAC Statistic

Alexandru I. Petrisor, MSPH[1]

J. Wanzer Drane, PE, PhD[1], **Kirby L. Jackson**, AB[1];

and **Liviu Dragomirescu**, PhD[2]

1 - School of Public Health, University of South Carolina, Columbia, SC, USA

2 - Department of Systems Ecology, University of Bucharest, Romania

Using Spatial and Temporal Statistics

- Detect disease space and time clusters
- Increase the efficiency of health department's activity
- Study the spatial pattern or distribution of a population
- Generate individual-based models in Ecology
- Socio-economic problems, biology, or geography

The DAC Statistic

- Introduced for through a study by Drane, Creanga, Aldrich, and Hudson – 1995

- Computation based on the empirical cumulative distribution function

$$F_n(x_1, x_2) = \frac{m(x_1, x_2)}{n}$$

$m(x_1, x_2)$ is the number of points of the sample of size n such that $x_1i = x_1$ and $x_2j = x_2$

The DAC Statistic (Continued)

- The DAC statistic is:

$$DAC(x_1, x_2) = F_m(x_1, x_2) - F_n(x_1, x_2)$$

- The maximum absolute value of the DAC statistic represents the Kolmogorov-Smirnov statistic for two samples

Simulations

- It can be proved mathematically that the DAC statistic does not depend upon the location of origin

- The purpose of the simulations is to investigate the sensitivity of the DAC statistic to the orientation of axes

Simulation: Data

- Demonstration project sponsored by the Robert Woods Johnson Foundation

- 6434 geo-coded live births in Spartanburg County, SC for the period 1989-1992

- 591 low birth weight babies (less than or equal to 2500 grams) were the cases

- Variables: a counter, the actual latitude and longitude, and the infant's birth weight

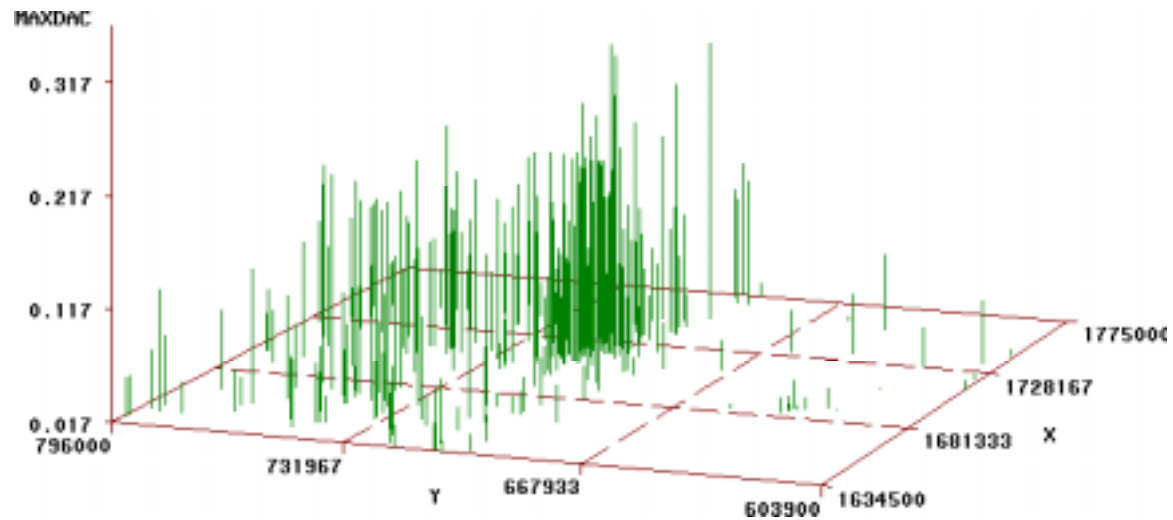- 1,000 samples of size 400

Results

Figure 1. Location of the Maximum DAC
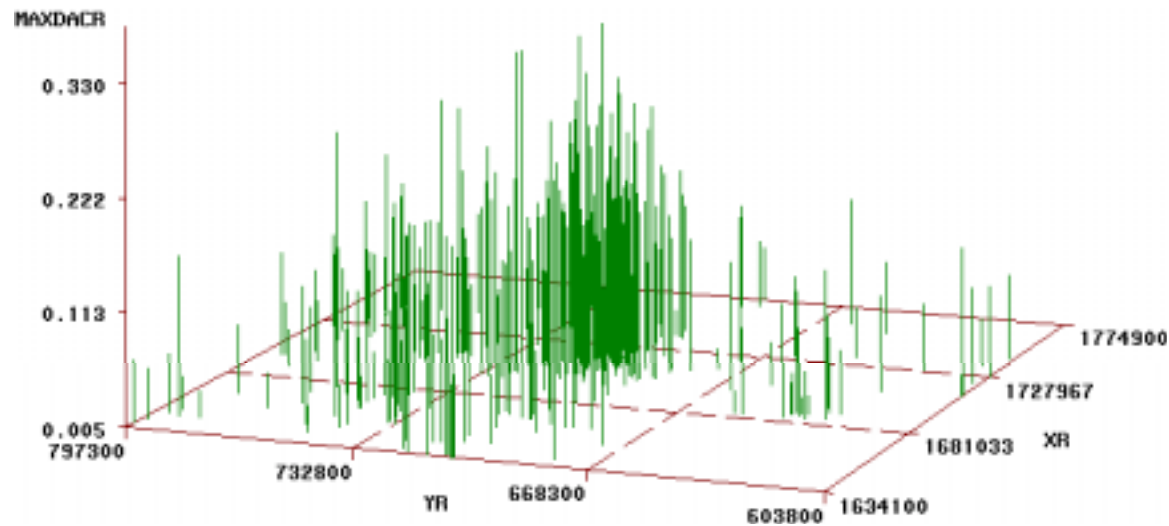Statistic for 400 Random Samples
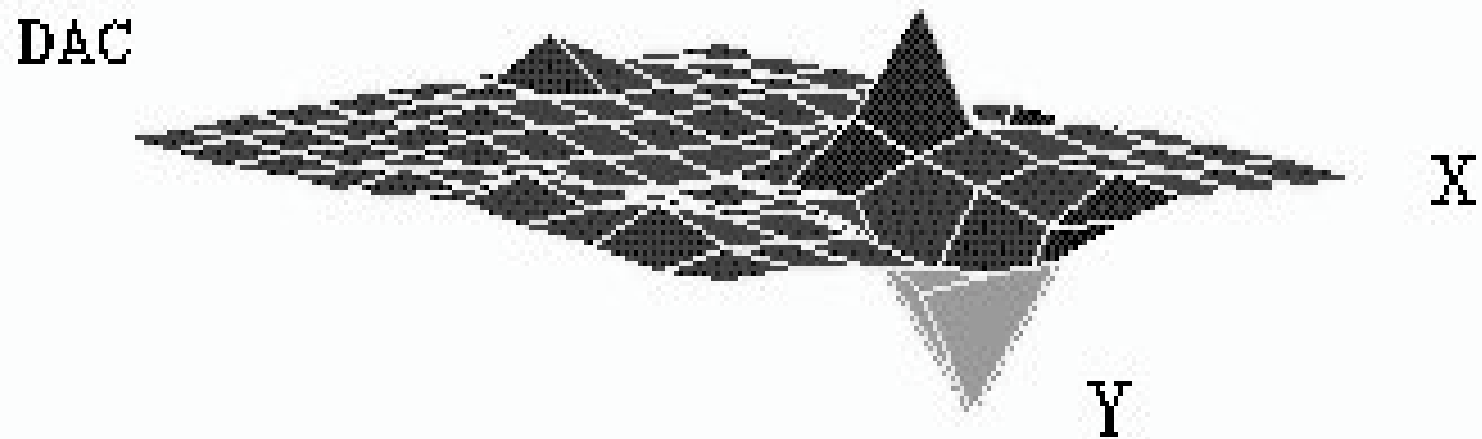
Results (Continued)

Figure 2. Location of the Maximum DAC Statistic for 400 Random Samples Rotated with Random Angles
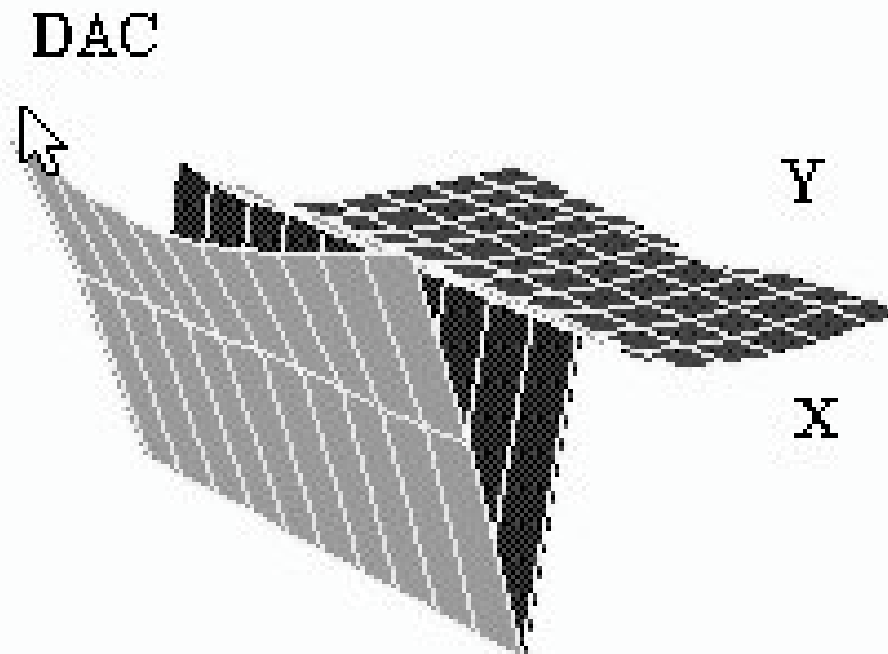
Results (Continued)

Plot of DAC Statistic for the Original Sample

Results (Continued)

Plot of DAC for the Rotated Sample

Discussion

- The DAC Statistic does not depend on the origin of the axes

- Dependence on the orientation of axes has an analytical expression that may not be easily detected

- In this example, the maximum DAC statistic appears to be a reliable instrument in detecting spatial clusters independently of the orientation of axes

Conclusions

- In real life example, the maximum DAC statistic does not have necessarily an analytical expression, therefore it is almost impossible to find its geometrical locus

- May be a reliable instrument in detecting spatial or temporal clusters

- Necessity for more and deeper research