Eight years of crime evolution in the city of Monterrey under a network approach

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Abstract

Crime is without doubt one of Mexico's most important social problems, with data showing that crime-related violence has been in constant rise at least for the last decade. While essentially the whole country suffers the consequences of this scourge, some places have become focal points of gang-related violence. Human, social and economic losses in these regions are unfathomable, one of the most emblematic of these places being the city of Monterrey, a central scenario in the narco-war. Being the third largest metropolitan area in Mexico and a business hub, Monterrey has counted hundreds to thousands of casualties and seen even more people migrate to safer places.

Here, we propose a network-theory approach to understand the mechanisms by which the violence has evolved and moved through the city. For this purpose, we count with a database that contains the coordinates, date, and the number of casualties for each crime committed between January 2011 and February 2018 in the Monterrey metropolitan area. First, we create networks where nodes correspond to area-delimited blocks in the city, and links are constructed using one of three different approaches:

1. According to node proximity to a focal crime-area,

2. by using single-feature correlation, and

3. by linking similar-environment nodes (by type of land, e.g. residential, industrial or commercial; and by number of shared urban objects like high-way, street, parks, etc.).

Next, we construct cells of violence (using Voronoi diagrams) to try to determine the effect of the local landscape (security-force stations, business districts, residential areas) on crime. Finally, we use these networks to identify:

- The most dangerous zones per unit of time (weekly, monthly, yearly, and overall) and,

- the most influential nodes in the network, which could indicate disputed territories or gang-related boundaries, and help implementing policies to retain the spread of violence.

- The distinct urban environmental categories crime in the city develops upon and its relation with the type of crime (gang-related or otherwise).