The Design and Implementation of CAST: An Open Source Software to Detect Spatial Patterns and Trends in Space-Time Data

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In this paper, we introduce the open source software CAST: Crime Analytics for Space and Time. CAST detects spatial patterns and trends in space-time data (e.g. crime data) based on a suite of space-time analytic measures provided by PySAL (Python Spatial Analysis Library) developed at Arizona State University's GeoDa Center for Geospatial Analysis and Computation. It is designed to represent different dimensions and contexts of space-time data with fully interactive and dynamic geospatial and geotemporal statistical graphics, such as dynamic maps (e.g. heat maps over time), graphs (e.g. boxplot, histogram), and calendar maps. Using statistical significance tests, CAST includes several dynamic cluster maps (e.g. LISA maps, local G statistics maps) and dynamic trend graphs to detect where concentrations of activities are higher or lower than expected over time. The implementation of these functionalities in CAST is based on a fast algorithm that aggregates large space-time data and data subsets in real-time. Using a loose coupling architecture, CAST, which is developed mainly in Python, combined with C/C++ code, can be easily extended with new functionality in both the front-end (e.g. visualization) and the back-end (e.g. space-time analytic methods). This paper also illustrates select CAST functionalities using crime data for the city of San Francisco, California.

Keywords: space-time, spatial analysis, spatial pattern