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Location analytics and decision support: Reflections on recent advancements, a research framework, and the path ahead

1. Introduction

The expansion in analytics and big data over the past decade has included a rapid growth in locational analytics, spatial analysis, and geographic information systems and science. Although research in Decision Support Systems (DSS) has typically tackled spatial decision problems through connections to geographic information systems (GISs), recent research has focused on the benefits from combining the two bodies of knowledge and research streams in addressing important challenges in delivering quality decisions in settings with locational/spatial components. Consequently, research in spatial decision support now seeks to take advantage of the advances in analytics, big data and cloud based decision support. This work incorporates spatio-temporal big data, mobile location-based services, 3-D, location in the sharing economy, space-time, and location-based social media.

The goal of this special issue is to present explorations and knowledge enhancement on the cutting edges of decision making involving location and place. The work presented includes new problem areas, data sources, methodologies, and applications in today's more complex and data-rich decision-making environments. To provide a context for the ideas and findings in the special issue articles, this editorial reviews and extracts broad themes and categorizations from a selection of over two dozen past articles published in DSS that combine location analytics (LA), non-location analytics (NLA), and decision support (DS). We then propose a generic framework for LA/NLA/DS research, briefly summarize the eight articles in the special issue, and then outline the directions the field of location analytics and decision support is moving towards. Finally we discuss what gaps in the LA/NLA/DS research landscape need to be addressed by future research.

2. Location analytics and decision support: synopsis of extant research

Location analytics (LA) refers to the contemporary concept of using specialized spatial analysis techniques to understand spatial arrangements, patterns, groupings and relationships in geographically referenced phenomena. Methods include overlays, buffers, hot spot analysis, spatial cluster analysis, spatial autocorrelation, proximity polygons, spatial econometrics and other techniques. Non-location analytics (NLA) refers to analytics methods that do not include spatial dimensions, such as non-spatial statistics, forecasting, optimization, sensitivity analysis, multi-criteria evaluation, simulation, and data mining. The research reviewed in this section has both location analytics and non-location analytics, which, together, provide decision support (DS). The term spatial Decision Support Systems (SDSS) refers to a decision support system that includes spatial components.

In examining past research in LA/NLA/DS, this journal provides a rich corpus of investigation, which is the focus of the literature examined here. We chose this path not only due to limited space for the editorial, but also because of this journal's leadership in publishing in this area. For instance, in a study [10] of spatial papers published in leading IS journals during 1988–2012, *Decision Support Systems* was identified as the leader with 54% of published articles, followed by *Communications of the ACM* with 17%.

The papers in Table 1 appeared between 2002 and 2017 in *Decision Support Systems*, and were selected for discussion based on having substantial location analytics and decision support content. The body of research can be understood by considering: (a) the problem being addressed and research questions, (b) methodologies, (c) location analytics content, (d) non-location analytics and decision support content, (e) types of relationships between location analytics and decision support, and (f) empirical analysis and validation. Since there is not enough space to examine each of the over two dozen papers on these six components, the prior LA/NLA/DS landscape is discussed with examples to illustrate pertinent points.

2.1. The problem areas and research questions

Roughly half of the studies concern solving problems in transportation/routing, location siting, and urban issues (see Table 1). Other problems include: 1) gaining understanding of the cognitive aspects of LA/NLA/DS, 2) conceiving conceptual theory and frameworks for LA/NLA/DS, 3) designing a geospatial information utility for LA/NLA/DS, 4) designing spatial decision support for disruption of links in critical national infrastructure, 5) developing structural theory and testing of locational privacy issues with application to marketing decisions, 6) predicting small business failures using social media locational data, and 7) developing an integrated predictive model of human mobility and movement intention based on a person's GPS trajectories [7,8,25,32,35,41]. The research questions underpinning these studies mostly concern how to construct LA/NLA/DS models, what are the implications of the results of empirical applications, and what is learned from experimental outcomes.

2.2. Methodologies

A variety of methodologies have been utilized in past research. In the papers that focus on constructing SDSS, methods include optimization

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