Introduction to the HICSS-54 Minitrack on Location Intelligence

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1. Introduction to Minitrack

The expansion in location intelligence over the past decade and a half has occurred based on a blend of concepts and techniques from analytics, geographic information science, remote sensing, big data, visualization, computer science spatial business, and location privacy and security. Although location intelligence literatures are well developed in GIScience and computer science, research has been scarcer in the other system sciences and in management. Recently, location is emerging as important for the system sciences, stimulated by the growth worldwide in locationally-aware mobile devices and by widespread computational power sufficient to supporting advanced geo-technical processing. The rapid growth in prevalence of locational apps brings along with it ethical and security challenges. This inaugural HICCS track and research minitrack serves to introduce more fully this important science to the HICSS conference.

The goal of the minitrack is to open a larger channel for location intelligence research. The hope in the inaugural year is that the science of location intelligence can prosper at HICSS and find its place as a growing member of the system sciences.

The papers in this first year of the track may be divided into four areas: replicability of location analytics, location intelligence in transport, location privacy, and emerging geo-spatial technologies. These areas are representative of many other topics in location intelligence research, such as location analytics and decision support, role of location in social media, location intelligence value chains, spatial digital transformation, digital twins, and others. The introduction profiles the present papers grouped into these four areas.

2. Replicability of location intelligence and analytics

Recognizing that replication is one of the main principles of the scientific method, the paper "Replicability Challenges in Location Analytics" by A. Murray makes the important argument that location analytics research that is increasingly enabled by easy-to-use point-and-click software must pay attention to definition of location analytical methods underpinned by GIS and their implementation details in different softwares. This paper addresses an important the issue of replicability challenges in location analytics, particularly in the area of spatial optimization modeling. Such modeling approaches often provide prescriptive solutions to practical problems in social and environmental arenas. The same could be argued to be true in many business settings in which practical real-life problems can be formulated as location-allocation, vehicle routing, and related spatial optimization problems or their extensions. The author argues that current industry-leading GIS software packages deploy heuristics to solve spatial optimization problems that do not always produce consistent results; hence the replicability challenge. Therefore, the paper encourages researchers and prospective users of such software to understand definitions and assumptions of background heuristics and their inherent constraints to improve the reliability of decisions made using location intelligence and analytics.

3. Location intelligence in transport

The paper on "Spatial Location and Air Transport Connections: The Case of Minnesota's Medical Device Industry Cluster, by L. Munnich, T. Fried, J. Cho, and T. Horan, analyzes the spatial development of the medical device industry and its air transport implications. This industrial arrangement is examined with respect to industry cluster location and flow of products, building on Michael Porter's model of industry clusters. Based on Minnesota state data, nine complementary economic sector clusters are linked to the vibrant, core medical device cluster. A spatial analytical model of air transport, with a hub at Minneapolis-St. Paul Airport is analyzed over four years, and informs air transport's role as a backbone in to maximize Minnesota's medical device economy, with global linkages.

"Geographic Data Informs Funding and Management of Metro Bike Share System," by P.J. Schmidt, J. Feng, and R. Freeze uses location analytical methods to perform spatial analysis of a bikeshare program in the city of Topeka, Kansas. As sharing economy platforms proliferate, ridesharing, bikesharing, and similar forms of

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collaborative consumption are often shaped by where consumers live, work, and how they commute. This paper analyzes the likely purpose of bike rides to understand user motivation (transportation versus recreation), if bike use extends other mass transit offerings, and how bikesharing can provide transportation options to low-income areas without reliable access to public transportation options. It shows that geoenrichment of public open data and location analytical methods can provide valuable insights regarding ridesharing. Such spatial insights can be leveraged to shape public policy in areas such as transportation and city planning. Overall, the paper demonstrates the business value of mapping and spatial analysis to understand spatial patterns of people movement.

The paper "Reducing Transport Miles Through the Use of Mobile Hubs: A Case Study in Local Food Supply Chains," by I.T. Sanders, and B. Montreuil addresses another interesting problem of locating mobile hubs to for the consolidation and distributions of goods in local supply chains. Contextualized in the farm-to-table (F2T) model of fresh farm products being delivered to restaurants located in service areas, the paper's topic is particularly suitable in the current pandemic. The authors demonstrate the use of GIS and spatial analytical methods for a case of supplying food orders to approximately 125,000 destinations over a year, and argue that given the spatial proximity of destinations (restaurants), one hub location suffices. However, interestingly that one hub location is not fixed but is mobile. The case example finds that efficiencies result in reduced number of stops made by drivers as well as overall distance traveled due to the location of mobile hubs in the F2T setting.

4. Location privacy

"Privacy in Transport? Exploring Perceptions of Location Privacy through User Segmentation," by I. Becker, R. Posner, T. Islam, P. Ekblom, H. Borrion, M. McGuire, and S. Li, centers on individuals' transport experiences as they relate to internet privacy concerns, risk taking, privacy victimization, use of location apps, and choices in forms of ground transport in the UK. Survey analysis was conducted based on selected items from a combination of well-known constructs. Respondents were divided into novel groups termed cyber risk takers, physical risk takers, transport innovators, and risk abstainers. The survey findings for the groups were reinforced through a dozen focus groups. Commonalities and differences in the focus groups was examined. The implication is future transport systems and platforms based on spatial data need to consider personalizing the provision of information related to location sharing.

The paper contributed on "Challenges Posed by Locational Data Privacy: A Literature Review," examines literature on locational data privacy with the starting point of dividing the studies into locational data privacy as control or as value. The literature studies included the MIS basket of eight journals from 2008 to 2019, was narrowed based on relevance, from an initial 246 articles to 27. With the main focus on this small set of 27, the articles were examined on costs and benefit, effects of psychological controls and trust, impact of personality traits and demographic factors on location privacy concerns, and role of emotion on location privacy concerns. Future avenues of location privacy research are discussed in terms of positivist, interpretivist, and critical philosophical approaches. Research gaps remain in this research area at the confluences of "information technology, people, cultures, psychology, organizations, and information."

5. Emerging geo-spatial technologies

The paper, "Enterprise Solutions Criteria in the Age of GeoBlockchain: Land Ownership and Supply Chain," by C. Papantoniou and B. Hilton, presents a combination of blockchain and geospatial technologies to yield the novel concept of GeoBlockchain. Based on design science methodology, a GeoBlockchain system was designed, and user participation perspectives were examined through Q methodology. The combination was realized by integrating the Hyperledger Fabric blockchain with the ArcGIS Enterprise software. This combined software system was tested in managing participants engaged in the examples of land ownership and supply chains. Through Q methodology, seven criteria are tested, with participants assigned particular roles and rules and generalized by the use of the dashboards for the two example applications. The private blockchains and geospatial technologies can potentially be used in the future for any use case of GeoBlockchain.

"Kartta Labs: Collaborative Time Travel, by S. Tavakkol, F. Han, B. Mayer, M. Phillips, C. Shahabi, Y.-Y. Chiang, and R. Kiveris, emphasizes collaborative space-time travel in a reverse direction in time. Historical maps are vectorized through open sourcing and historical buildings are reconstructed as 3-D models with focus to identify their front facades. Through systems design principles, the maps and 3-D building models are integrated over time, based on a scalable, modular software system. Parts of the system are based on crowdsourcing and artificial intelligence. The Maps module supports uploading of historical maps and rectifying them by locating control points. At the end, the Kartta map renderer provides users capability to navigate in time and space. The paper delves into detailed design techniques and innovations that enable the space and reverse-time system to function well. The Kartta system is tested in reconstructing Manhattan street facades going back in time from 1960 to 1900. The system can be used

for urban research and education, while other use cases are anticipated in cancer epidemiology, biodiversity and sociology, among others, and in gaming and entertainment applications as well.

The paper, "Exploiting the Temporal Dimension of Remotely Sensed Imagery with Deep Learning Models, by A. Garcia Pereira, L. Porwol, A. Ojo, and E. Curry, highlights the role of spatial imagery which are of immense importance in many domains including agriculture. Spatial imagery contains a wealth of location-based information and insights. Predictive analytics based approaches are being increasingly used to extract and mine such information. This paper examines and compares different deep learning approaches to classify agricultural land use and practices by using the temporal and spectral dimensions of Earth Observation (EO) data. Among the deep learning models deployed are Random Forest and Convolutional Neural Networks (CNNs). The study is conducted over agricultural land spanning 4,500 square kilometers in Sacramento County California, with 32 datasets, each having different numbers of polygons and pixels. The authors found that CNN models significantly outperformed Random Forest models in terms of classification accuracy. This not only has implications for developing sustainable practices in agriculture but also provide novel ways of accurate risk appraisal and mitigation in industries such as insurance and real estate.

5. Conclusion

In concordance with the interdisciplinary field of systems science, location analytics, underpinned by the principles of geography and geographic information science is also interdisciplinary. Many of today's social, economic, environmental problems have implicit or explicit spatial underpinnings, yet, in business, MIS, computer science, operations research, and other disciplines – the spatial aspects of complex, contemporary problems are often neglected or considered sporadically. The contributors to this inaugural research mini-track have showcased a number of research strands in which location intelligence and analytics can play a key role. We hope that these papers provide encouragement to more authors and provide guidance to systems science scholars in incorporating spatial thinking and GIS into their research and scholarship.