

Collective and Individual Mental Maps of the City in Social Awareness Streams

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ABSTRACT

Geo-tagged social media data provide a way to uncover users' perception of the city, namely, their mental map. In this article we examine the elements that assemble an online mental map and discuss the differences between the depiction of an individual and collective mental maps using these data.

INTRODUCTION

In recent years, we are witnessing an emerging class of communication and information platforms some call social awareness streams (SAS) [10] such as Facebook, Twitter, Instagram, Foursquare and Flickr that enables users to post geo-tagged content items. Most often, these items are associated with location coordinates in the form of latitude and longitude, or with the precise location of a venue. Consequently, studying the vast amounts of these geo-tagged SAS data in a local context offers unique opportunities for understanding communities and people's attitudes, attention, and interest in them.

Utilizing methods from Artificial Intelligence, Information Retrieval and Natural Language, researches can now uncover a mental map of the city [9] based on geo-tagged SAS information. Although looking at depictions of mental maps through digital technologies has been studied before [7, 12], In this article we examine Lynch's [8] five elements that make up an individual's mental map of a city (districts, landmarks, paths, nodes, and edges) through the lens of SAS data and consider their application to geographic information systems (GIS). These include boundary definition and detection (districts and edges); computation of attractions (landmarks); derivation and recommendation of paths; and evaluation of points of intense activities, interests and temporal trends (nodes). Finally, we conclude by discussing the differences between the *collective* and *individual* mental maps and the implications of these differences to the design process of data retrieval and presentation in GIS.

DISTRICTS AND EDGES

The first mental map element we can retrieve from geo-tagged SAS data is the computation of districts and boundaries. For example, Flickr had learned from the coordinates of photos and neighborhood metadata that were corrected by users to create outlines for various (known) regions and neighborhoods [1]. More recently, Cranshaw et

al. studied Foursquare check-ins data to map the different areas of a city based on collective behavior patterns [3]. However, in SAS, exceedingly more geo-tagged information is made available about mundane, everyday activities, that will allow the modeling of temporal districts and regions, as well as help model these regions as they are seen by different communities (e.g. visitors vs. locals, young versus old). Note that this opportunity to distinguish between geographic meanings ascribed by different communities is true for all the elements listed in this article.

LANDMARKS AND ATTRACTIONS

SAS offers an opportunity to detect landmarks, reason about their attributes, and even their relative importance. These landmarks may range from widely recognized, prominent landmarks such as mountains, towers, or bridges, to local features such as plazas, statues, and even cafes. In early work using social media, Ahern et al. [1] created a World Explorer that used tags on Flickr geo-tagged photos to explore geo-specific tags on the world map, in any region and at any zoom level. Again, due to the type of content initially available (a fairly large proportion of tourist photos [4]), these detected landmarks are somewhat driven by tourist activity. For example, Foursquare offers opportunities to better understand various attributes of landmarks and their social use. Using information from SAS, GIS systems can create better models of landmarks like their area of "influence" and visibility, and their importance to various populations as well as create a visual summary improving the user interaction [6].

PATHS

Lynch's paths are "channels" along which people customarily, or occasionally, move [7]. Indeed, beyond landmarks, SAS information embeds data about how people move inside different geographic areas. Two subsequent posts from the same user in different locations, can be combined into a segment; multiple segments from many people can help us reason about common paths between landmarks or places. For example, social media in the form of geo-tagged photographs was used to gain insight about the paths of tourists through cities, and to recommend itineraries for tourism based on other people's paths [2].

NODES

Jane Jacobs argued that it is the activities in cities and neighborhoods that make them attractive to people, both residents and visitors [5]. SAS data provides an opportunity

to discover, and model, human activities in specific venues. What activities do people perform in different locations, and what are the temporal regularities (or irregularities) of these activities? [4] SAS information can expose activities and interests of local communities, allowing us to understand the dynamics and patterns of urban and geographic activity. Moreover, these patterns can be associated with other key terms or sentences (using traditional NLP and IR methods) that explain them, or draw out differences between particular activities and times.

COLLECTIVE VS. INDIVIDUAL MENTAL MAP

By examining the five above-mentioned elements along the social ties data that is available on SAS, we can uncover two types of mental maps of the city: a *collective* and an *individual* one. Each represents different views of the city and can be used in changing scenarios by various end-users.

Collective mental maps provide a bird's-eye view of the city. This mapping often emphasizes the aggregation of data in the form of a tool to identify group patterns on large scale. Collective mental maps are beneficial to local organizations such as newsrooms, local government employees and urban researchers as they offer access to local insights that would otherwise be difficult to impossible to retrieve. Moreover, with the growing access to real time SAS data through various application programming interfaces (APIs), collective mental maps can now provide both live and historical representations of activity in the city. Consequently, these mappings can cater the needs of local journalists that seek information about breaking news as well as urban planners that trace activity patterns over time.

Although this type of mapping is currently biased towards certain communities, the growing use of this technology can offer opportunities to represent important aspects of the city such as its diverse cultural groups, the changing character of various areas throughout the day and the effect of tourists activity on the city.

Individual mental maps, on the other end, generate a personalized depiction of the city based on the user's specific geographic activity and social ties. Although one might argue that mental maps, representing a distorted view of reality, can not be captured by longitude and latitude coordinate, SAS information does provide access to this type of skewed perception as users choose the venues they would like to share with their friends. This type of mapping offers a glance into the urban experiences of the individual user. Through this, GIS systems can recognize the unique elements (paths, districts, nodes etc.) that apply for each user and thus provide relevant information in the form of recommendations for places, people and activities. Moreover, individual mental maps provide users a way to evaluate and document their activity over time.

Understanding and correctly modeling and designing these two types of mental maps based on their end-users'

requirements while taking into consideration each of their biases offers high potential in improving GIS systems. The association between people's activity, the places they frequent and their social ties can advance the precision of GIS tasks such as detecting geographic references, tracing transportation and flows of people as well as ranking, presentation, and recommendation of local content.

SUMMARY AND CHALLENGES

This article outlines the way in which geo-tagged data from Social Awareness Streams can help reveal the mental map of a city. As technology companies already practice sophisticated individual social information retrieval as part of their search engine, social GIS systems can utilize the mental map concept to enhance their reach to both local groups and individuals.

To summarize, by studying the various online elements that construct mental maps and understanding the difference in purposes and use between collective and individual maps, we have the potential to provide individuals and organization better GIS systems that will offer specific tools and customized results to the study and exploration of the urban habitat.

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