

Report on the Sixth International Workshop on Location and the Web (LocWeb 2016)

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Abstract

For describing and understanding the real world, location is an important factor. Consequently, it also appears in many Web applications and mining approaches as a cross-cutting issue. LocWeb 2016 continues a workshop series addressing issues at the intersection of location-based services and Web architecture and was held at WWW 2016. It combines geospatial search, information management, and Web architecture, with a main focus on *location-aware information access*. The workshop drew contributions from various fields, ranging from mobility analytics over new ways to understand cities to Web standards. LocWeb2016 had an interdisciplinary combination of contributions, with two keynotes and three long papers. We will briefly discuss the workshop theme and the contributions.

1 Introduction

Location has quickly moved into the mainstream of the (mobile) Web. It also continues to be a strong driver of applications and research activities. After the initial boost and consolidation of approaches based on the simple use of geospatial coordinates, we now see an increasing demand for more sophisticated location-based services, involving more powerful mechanisms in terms of information retrieval, mining, analytics and semantics. New application areas for Web architecture, such as the Internet of Things (IoT) and the Web of Things (WoT), also mean that there will be increasingly rich and large sets of resources for which location is highly relevant.

Following the successful LocWeb workshops in 2008, 2009, 2010, 2014, and 2015, LocWeb 2016 continues the workshop series, addressing issues at the intersection of location-based services and Web architecture. Its focus lies in Web-scale systems and services facilitating *location-aware information access*. The location topic is understood as a cross-cutting issue equally concerning Web information retrieval, semantics and standards, and Web-scale systems and services.

LocWeb 2016 is the sixth event in the workshop series and took place on April 11th, 2016 in Montréal, Canada, co-located with WWW2016, the 25th International World Wide Web Conference, which was held in the Palais des Congrès (*geo:45°30'N;73°34'W*).

LocWeb is an integrated venue where the location aspect is discussed in depth within an interdisciplinary community. It is also highly interactive and collaborative, with ample room for discussion and demos that explore and advance the geospatial topic in its various relevant areas. The workshop helps advancing the integration of the geospatial dimension into the Web, and promotes challenging research questions.

Details, including most of the presentations made at the workshop and information about previous editions, can be found on the workshop homepage¹ and on the workshop series homepage². The LocWeb report for 2015 has been previously published in SIGIR Forum [2] as well as those for previous years.

2 Workshop Theme and Topics

LocWeb solicited submissions under the main theme of Web-scale Location-Aware Information Access. Subtopics included (i) geospatial semantics, systems, and standards; (ii) large-scale geospatial and geo-social ecosystems; (iii) mobility; (iv) location in the Internet/Web of Things; and (v) mining and searching geospatial data on the Web. The workshop encouraged submissions describing Web-mediated or Web-scale approaches that build on reliable foundations, and that thoroughly understand and embrace the geospatial dimension.

The workshop's topics of interest were: Location-Aware Information Access, Location-Aware Web-Scale Systems and Services, Location in the Internet/Web of Things, Large-scale Geospatial Ecosystems, Standards for Location and Mobility Data, Location in Unstructured and Semi-Structured Information Sources, Location Semantics, Modeling Location and Location Interaction, Geo-Social Media and Systems, Location-Based Social Networks, Geospatial Web Search and Mining, Visual Analytics of Geospatial Data on the Web, Location-Based Recommendation, Geo-Crowdsourcing, Mobile Search and Recommendation.

3 Workshop Contributions

We had an interdisciplinary combination of contributions at LocWeb 2016, with one research keynote, one standards keynote and three full papers.

3.1 Keynotes

The first keynote was given by Luca Aiello, who talked about *The Sensorial Map of the City* [4]. The keynote discussed the broad human sensorial range that can be used for urban studies, furthering a theme from last years' keynote. Apart from the classical sense of sight, Luca discussed sound and smell as important aspects of a cityscape. While difficult to capture in real life, he showed an approach that uses data containing implicit perceptions of sound and smell from social media to draw new kinds of urban maps, thus adding a new factor to location characteristics mined from Web sources.

A second keynote titled *GeoJSON Update* was given by Erik Wilde, which was an update about the ongoing standardization effort for the GeoJSON format. GeoJSON moved from being a community standard to establishing an IETF working group, which was working on

¹<http://dhere.de/locweb2016/>

²<http://dhere.de/locweb/>

the specification text until mid 2016. In the meantime GeoJSON has been published by the IETF as RFC 7946 [6].

3.2 Paper Presentations

The workshop accepted 3 full papers. Due to a very diligent PC, we had over 5 reviews per paper on average which led to an overall acceptance rate of 60%. We had international author groups from Europe and Asia, but this time there were no cross-country authorships. Full papers had 20 minutes of presentation and 10 minutes of time for discussion. The proceedings [3] are available in the ACM Digital Library³ and also from the conference page⁴, as part of the WWW 2016 Companion. Slides for all papers are available from the workshop homepage.

The first paper was by Hakan Bagci and Pinar Karagoz about *Context-Aware Friend Recommendation for Location Based Social Networks using Random Walk* [5]. It discussed a personalized recommendation approach for Location-based Social Networks (LBSNs). Sub-graph analysis is used to link locations, users, and relationships and a ranking approach based on random walks delivers friend recommendations based on a user's context. Their approach considers social, personal, and spatial context to consider popularity, expertise, and multiple degrees of friendship. The evaluation shows that the recommender can outperform good baselines and is stable over various datasets.

Lisette Espín Noboa presented a joint paper with Florian Lemmerich, Philipp Singer and Markus Strohmaier titled *Discovering and Characterizing Mobility Patterns in Urban Spaces: A Study of Manhattan Taxi Data* [8]. The work focuses on discovering and explaining spatio-temporal mobility patterns by combining both non-negative tensor factorization (NTF) for clustering and HypTrails, a Bayesian approach for hypotheses generation based on previous work of their group. They use openly available data in the form of the well-known Manhattan taxi data set together with census and foursquare data. The combined approach allows to test different mobility hypotheses generated from three categories and derive explanations for the specific type of mobility patterns existing within taxi rides. The work shows a good theoretical grounding and very thorough evaluation, arguing for more granular mobility analysis to better understand spatio-temporal patterns.

Peter Rushforth presented a paper on *Maps for HTML: A New Media Type and Prototype Client for Web Mapping* [11]. The main argument in this paper is that in the same way as browsers have started to incorporate other previously add-on based functionality such as video and audio, the same might happen for Web maps. Browser-based maps are ubiquitous in today's Web, and yet browsers themselves are still fundamentally unaware of location and mapping as a concept (apart from the very limited Geolocation API [9], with a new but still rather limited version being proposed [10]). The solution presented uses HTML5 custom elements [7] as their current implementation foundation, but could also be natively implemented by browsers. Rushforth participates in the *Maps For HTML Community Group (CG)*⁵ which aims at creating a draft that would become part of the general HTML5 landscape.

³<http://dl.acm.org/citation.cfm?id=2872518&picked=prox>

⁴<http://www2016.net/proceedings/forms/companion.htm#9>

⁵<https://www.w3.org/community/maps4html/>

4 Discussion Session

This discussion session was started by the organizers with an introduction of location-related characteristics of the hosting city. This was to highlight the highly local and specific uses of location and of place and how this can lead to location being highly context- and city-dependent.

One interesting peculiarity about Montreal from the LocWeb viewpoint is that it contains the so-called Underground City (La Ville Souterraine or RÉSO in French). This is a tunnel network that connects buildings and subway stations within a large part of downtown Montreal. It could be more accurately called an indoor city as it is not fully separated underground, but uses a tunnel system to connect both underground places and also open malls and public buildings with atrium structures starting in the basement. An impression is given in Fig. 1 with maps of the structure available on the Web⁶.

Montreal shares this with some other Canadian cities – for example Toronto PATH – and also some other places around the world that have extensive underground structures that not only concern one building, but form an underground network. This “city below” does not necessarily follow the same network structure similar of the road network of the city above because it is mostly pedestrian in nature and so often incorporates paths through buildings, as can also be seen in the Montreal example in Fig. 1. Structures can also be overground, such as the Calgary +15 covered skywalk or the Central Elevated Walkway in Hong Kong, that create a pedestrian bridge network connecting buildings for easier access by pedestrian on top of traffic. Tunnels, bridges, or skywalks appear in many cities, and in these examples, the structures are in large parts open and accessible. There is another class that are not open to the general public, such as bridges between office buildings or utility and transport tunnels between hospital or university buildings. Then there is also the aspect of out-of-bounds, fenced off, or abandoned structures, giving rise to the subculture of urban explorers⁷ or the guild of trespassers⁸. Such structures may not even be mapped at all. One motivation for structures such as RESO can be to get out of the cold or get out of the heat; but also to connecting vast public transport networks such as underground metro stations. There was a previous discussion at LocWeb2014 about how Tokyo subway stations are dubbed dungeons, both in reference to RPGs (role playing games) and the difficulty in navigating them or using mobile local search in them, for example due to the lack of GPS signals, prominent landmarks, or good maps.

Such urban overlapping structures [1] and the complexities of 3D structures in an often still 2D mapping mindset provide a number of interesting challenges to the LocWeb topic. There are challenges for navigation that needs all pathways and connections mapped and needs to develop stronger towards a combination of outdoor and indoor mapping and also for local search in the extraction and presentation of results that are not at default level. On a usual map, POIs may be overlapped by, e.g., a street and need to be represented accordingly; on the other hand, identifying and extracting location references to a specific place within a large indoor or underground structure is significantly more difficult than extracting an address, with geocoding being an additional issue.

Another topic of discussion that was raised concerned the granularity of location infor-

⁶http://ville.montreal.qc.ca/pls/portal/docs/page/arrond_vma_fr/media/documents/vm_carte_reso.pdf

⁷<http://weburbanist.com/category/global/urban-exploration/>

⁸http://wiki.lspace.org/mediawiki/Trespassers'_Society

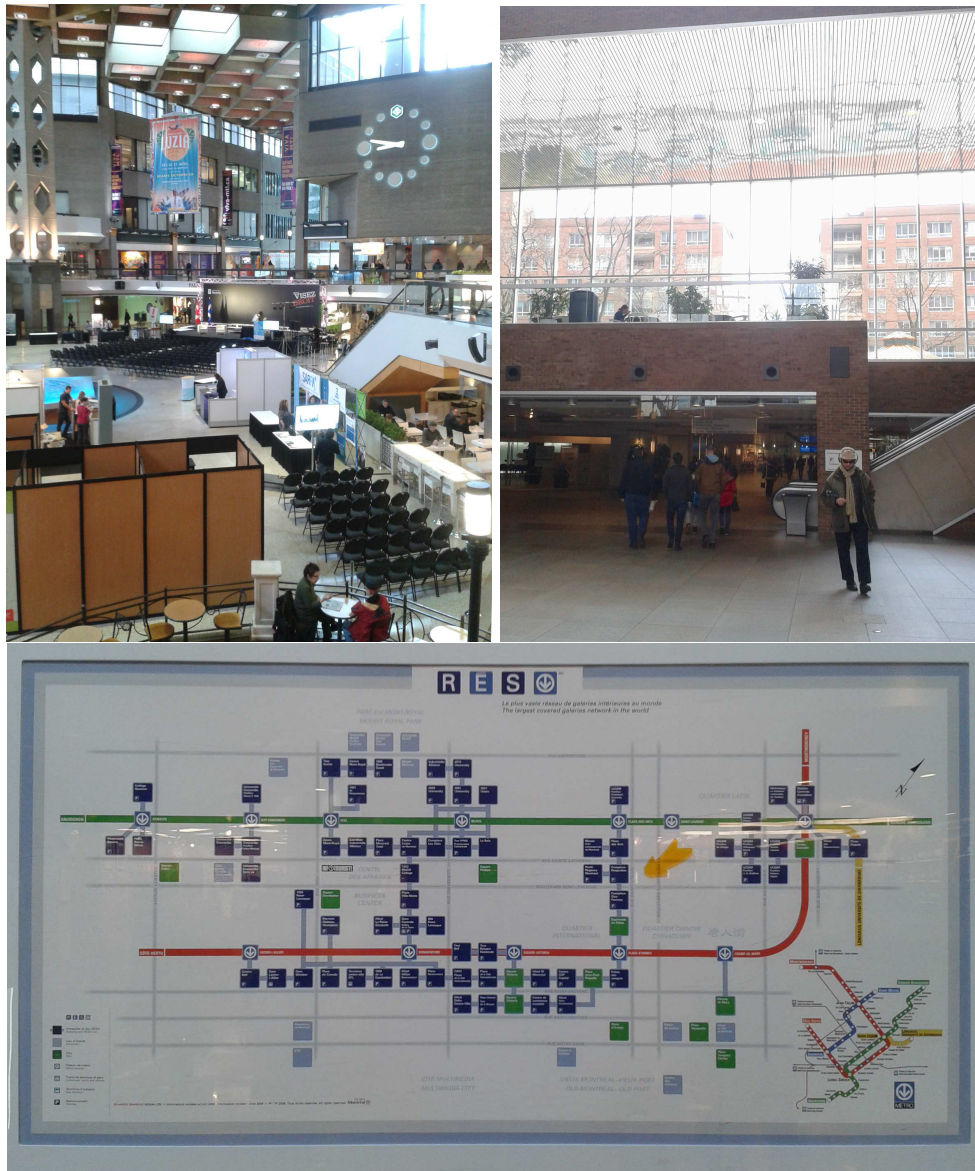


Figure 1: Underground City views: Atrium of Complexe Desjardins; view from Complexe Desjardins towards Complexe Guy-Favreau with the tunnel crossing under Boulevard René-Lévesque; map of RESO

mation, issues in making sense of patterns as well as bias in datasets that can be hard to detect. Another point in line with the workshop topics was the use of Web standards for presentation and also extraction of location information.

5 Conclusion and Future Directions

LocWeb2016 had a broad variety of contributions, reflecting the cross-cutting issue of location on the Web, reaching from standards over varied analysis approaches to rich applications. WWW2016 was a good conference to hold this workshop. We could reach many interested and interesting participants from industry and academia and the conference itself also hosted some additional papers discussing increasingly complex location models as an important part of the approach. The workshop showed again that location is still a complex and rich topic to be further analyzed and developed and we are looking forward to more exciting contributions in this field.

Acknowledgements

We would like to thank the authors of submitted papers for their efforts, and all attendees of LocWeb 2016 for making this an interesting and interactive workshop. We specially thank Luca Aiello for his keynote. A very special thanks goes to our co-organizer Bruno Martins from University of Lisbon, Portugal. We are especially grateful to the members of the program committee for their hard work in reviewing the contributions and providing substantial feedback on a tight deadline:

Andreas Henrich, Universität Bamberg, Germany; Arjen de Vries, CWI, Netherlands; Bruno Martins, University of Lisbon, Portugal; Carsten Keßler, CUNY, USA; Chandan Kumar, University Koblenz-Landau, Germany; Christoph Trattner, Graz University of Technology, Austria; Christopher Jones, Cardiff University, UK; Claudia Hauff, Delft University, Netherlands; Clodoveu Davis, Universidade Federal de Minas Gerais, Brazil; Dirk Ahlers, NTNU, Norway; Erik Wilde, Siemens, USA; Francisco López-Pellicer, Universidad Zaragoza, Spain; Massimiliano Ruocco, Telenor Research, Norway; Max Egenhofer, University of Maine, USA; Rainer Simon, AIT Austrian Institute for Technology; Ross Purves, Universität Zürich, Switzerland; Steven Schockaert, Cardiff University, UK; Torsten Suel, New York University, USA; Vanessa Murdock, Bing, USA; Yana Volkovich, Centro Tecnológico de Catalunya, Spain.

Finally, we would like to thank the organizers of WWW2016 for hosting the workshop, as well as ACM and Sheridan for their support.

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