Report on the Eighth International Workshop on Location and the Web (LocWeb 2018)

Workshop held at WWW2018

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Abstract

LocWeb 2018 continued the LocWeb workshop series at the intersection of location-based services and Web architecture and was held at The Web Conference, WWW 2018. It focused on Web-scale services and systems facilitating location-aware information access as well as on Spatial Social Behavior Analytics on the Web as part of social computing. The LocWeb 2018 workshop had contributions ranging from location data analysis over tourism and virtual reality up to societal engagement. This report briefly presents the theme, contributions, and discussions of the workshop.

1 Introduction

Location has quickly moved into the mainstream of the (mobile) Web and it continues to be a strong driver of applications and research activities. The general appeal and usefulness of geo-located data (e.g., for information access with freely available mapping services) are only some of the reasons for its fast rise. After the initial boost and consolidation of approaches based on the simple use of geospatial coordinates, we now see an increasing demand for (i) more sophisticated systems, (ii) stronger retrieval, mining, and analytics solutions, and (iii) more powerful semantics.

Following the LocWeb workshops held in 2008, 2009, 2010, 2014, 2015, 2016, and 2017, LocWeb 2018 continues the workshop series, addressing issues at the intersection of location-based services and Web architecture. It focuses on Web-scale services and systems facilitating *location-aware information access* as well as on *Spatial Social Behavior Analytics* on the Web as part of social computing.

The location topic is seen as a cross-cutting issue equally concerning information access, semantics and standards, social analysis and mining, and Web-scale systems and services.

The workshop is an integrated venue where location and spatio-social aspects can be discussed in depth with an interested community. New application areas for Web architecture, such as the Internet of Things (IoT) and the Web of Things (WoT), will lead to increasingly rich and large sets of applications for which location is highly relevant as the connection to the physical world. Location further has high importance in Web-based designs, and continues to provide challenging research questions.

LocWeb 2018 is the eighth event in the workshop series and took place on April 24th, 2018 in Lyon, France, co-located with WWW2018[1], The Web Conference, previously the International World Wide Web Conference, which was held in the Lyon Convention Centre, Centre de Congrès de Lyon,[2] in the Cité Internationale (International City) quarter in the 6th arrondissement.

This year, the workshop was merged with the organizers of another workshop, the Workshop on Social Computing (IWSC) – Spatial Social Behavior Analytics on the Web,[3] which was previously held at WWW2017.

Details, including most of the presentations made at the workshop and information about previous editions, can be found on the workshop homepage[4] and on the workshop series homepage[5]. The LocWeb report for 2017 has been published in SIGIR Forum [1] as well as those for previous years.

2 Workshop Theme and Topics

LocWeb had the main theme of Web-scale Location-Aware Information Access and spatial social computing. Subtopics include (i) geospatial semantics, systems, and standards; (ii) large-scale geospatial and geo-social ecosystems; (iii) mobility; (iv) location in the Web of Things; and (v) mining and searching geospatial data on the Web. The workshop encourages work describing Web-mediated or Web-scale approaches that build on reliable foundations, and that thoroughly understand and embrace the geospatial dimension through interdisciplinary perspectives.

The workshop's topics of interest were: Spatial Social Behavior, Location-Aware Information Access, Location-Aware Web-Scale Systems and Services, Location in the Internet/Web of Things, Large-scale Geospatial Ecosystems, Location prediction in social media and the Web, Influence modeling and processing in static and dynamic spatio-social graphs, Standards for Location and Mobility Data, Geospatial aspects of Smart Cities, Modeling Location and Location Interaction, Geo-Social Media and Systems, Location-Based Social Networks, Geospatial Web Search and Mining, Location-Based Recommendation, Geo-Crowdsourcing, Mobile Search and Recommendation.

3 Workshop Contributions

The workshop had an interdisciplinary combination of contributions, with one research keynote and five papers. The proceedings [2] are available in the ACM Digital Library

[1] `https://www2018.thewebconf.org/`
[2] geo:45°47'08"N;4°51'23"E
[3] `http://iwsc2017.csse.uwa.edu.au/`
[4] `http://dhere.de/locweb2018/`
[5] `http://dhere.de/locweb/`

and also from the conference page[6] as part of the WWW 2017 Companion. Browsing from there gives free access to the PDFs in the ACM DL. Slides are available from the workshop homepage.

3.1 Keynotes

Tassos Noulas from New York University gave the keynote with the title *New Opportunities for Research in the "Lost World" of Location-based Services*. He explored 'hidden' avenues for geospatial analysis outside the mainstream of location-based technologies and services towards more traditional environments that have not yet been in the focus as much as the usual players or Google Places, Foursquare, Uber etc. Out of this view, he developed concepts and research paths to open up these 'hidden' areas or, conversely, make the mainstream services useful and available to them, through a number of works his group has performed.

As examples, he presented insights into spatio-temporal epidemiological trace analysis, based on data collected in national health systems, showed how not only ambulances can be better routes, but how the reasons for their deployment can be better understood and even predicted through the use of open government datasets merged with social activity through Foursquare [6] and the use of a gravity model for classification of call types to ambulance services. This gives a deeper understanding of both socio-demographic influence factors as well as geospatial and temporal circumstances for ambulance calls. An important result was that daytime population is a better predictor than residential population numbers for call prediction. Ambulance data thus gives hints for probabilistic estimates towards activity traces of people, and shows correlation to socio-economic indicators. He discussed the use of data sources, such as government data on residential and daytime population, with sources such as foursquare being useful for the times in between, even if the data is biased. Such new analyses are only possible now that services are more digitized and data is becoming available. This helps support and formalize previous heuristics on real data.

Another example was OpenStreetcab, a mobile app to compare prices for New York yellow taxicabs and Uber cars in New York and London. Uber data can be directly accessed through its API, the yellow cab dataset on endpoints can be extended through map routing for available trips. Apart from the direct utility to users, they could also test some hypotheses on the spatio-temporal and financial variations. They could for example show that higher urban density such as in city centers gives an advantage to taxi drivers that do not (only) rely on navigation systems [7]. Further, Uber is not always cheaper, and can be especially more expensive for short trips. Also, the dataset has much more short trips, and a median distance of ≈2 km.

To be able to to the same comparison in the UK with Black Cabs, they built a system for taxidrivers as a real life experiment, giving drivers additional insights.

The keynote demonstrated well that there is a wide range of still unexplored data, application domains, and research questions for exploration.

3.2 Paper Presentations

The workshop accepted 4 full and one short paper. Our PC members provided over 3 reviews per paper on average. With 8 papers submitted, we had an acceptance rate of 62.5%. We

[6] `https://www2018.thewebconf.org/proceedings/#locweb`

had international author groups from Europe, South America, and Australia, with some cross-country and cross-continent authorships of papers.

The first presentation was on *Venice through the Lens of Instagram: A Visual Narrative of Tourism in Venice* by Luca Rossi, Eric Boscaro, Andrea Torsello [8]. The paper used Venice as one of the most popular tourist destinations and analyzed 2 years of Instagram pictures taken there. They built a six-category classifier based on computer vision and analyzed the weight and spatial distribution of the categories over time. They could then not only identify general tourist hotspots, but also link them to events, such as the Carnival and the Biennale as folklore and art festivals, and subsequently develop tourist trajectories through these events that confirm the utility of Instagram data for this task.

For the next paper, Antonio La Salandra presented joint work with Piero Fraternali and Darian Frajberg on *A Location-Based Virtual Reality Application for Mountain Peak Detection* [5]. PeakLens build a VR application on multiple data sources to identify mountain peaks from arbitrary viewpoints. It combines NASA elevation data and OSM data for peaks. There are a few interesting error cases for peaks in OSM, such as errors in position, or elevation, some wrong names, and naturally lots of peaks missing. Filling these gaps for integrated peak identification in the VR panorama demonstrates challenging applications of geospatial processing.

WeGovNow: A Map Based Platform to Engage the Local Civic Society was presented as a short paper by Elena Grassi as joint work with Guido Boella, Louise Francis, Axel Kistner, Andreas Nitsche, Alexey Noskov, Luigi Sanasi, Adriano Savoca, Claudio Schifanella, Ioannis Tsampoulatidis [3]. The system is designed for co-management and co-design of public spaces through citizen science of mapping and planning. It includes liquidfeedback and communitymaps and integrates different contributing systems and mappings. On the geospatial aspects, one challenge is to match different zoom levels for issues and entities. For example, OSM may not always have the right named service areas to map citizen concerns (empty spaces, squares, yards, etc.). Highlighting and selecting contained entities and determining the containing area for an entity are related issues that had to be built into the system, which was achieved through their OnToMap as a semantic mapping layer.

Eduardo Graells-Garrido presented *The WWW (and an H) of Mobile Application Usage in the City: The What, Where, When, and How*, coauthored with Diego Caro, Omar Miranda, Rossano Schifanella, Oscar F. Peredo [4]. An observation was that urban life also depends on what you can carry. Their question was how urban fabric and the activities in it affect the usage of mobile applications. For this, they used an anonymized dataset of data logs from a large Chilean operator to perform spatiotemporal analysis of app use in Santiago de Chile. They combined this with a travel survey and OSM data to identify nearby structures for user traces. On the traffic analysis, they mapped 5000 IPs to specific websites and services to identify over 1100 specific services. They use regression against urban factors, including indoor and metro stations, highways, buses, income distribution, green areas, etc. This can be used to find spatial and temporal patterns, and also mine for tourist or photo hotspots. They find that many apps show global autocorrelation in the afternoon due to concentration in work/study areas, and that commuting is a highly relevant factor towards informational behaviour, along with more detailed insights for specific categories.

Finally, with *Travel Itinerary Recommendations with Must-see Points-of-Interest*, Kwan Hui Lim presented a joint paper with Kendall Taylor and Jeffrey Chan [9]. They formulate tourism itinerary planning and recommendation as an operations research problem as a variant of the orienteering problem with an approach based on Integer Linear Programming.

Figure 1: Lyon city views: Traboule passageways and staircases in Vieux Lyon; overview and details of walkways and passages around the hills in Croix-Rousse.

In particular, they aim to find a sequence of POIs to visit that maximises utility, while including a predefined set of must-see POIs. The YFCC100M Flickr dataset is used to identify such spots and to evaluate the system.

4 Discussion Session

The discussion was started by the organizers presenting some specific local characteristics of Lyon. Since location and its use can be highly specific to local conditions of place, location often is highly context- and city-dependent, and can show interesting details that challenge default notions and help in understanding the city.

On a small scale, the first question was about how well attendants could find the workshop room. The congress center was rather large and complex, with the workshop room on the 3rd floor in another block, reached through the underground lobby and main passageways of the center and then a series of stairs and escalators. This reminds of the subway underground "dungeons" noted in previous workshops.

A very specific urban characteristic in Lyon are the traboules,[7] a type of passageway mostly found in the quarters of Vieux Lyon and Croix-Rousse. Parts of Lyon are built on hillsides along the river where most streets run roughly parallel to the river, with only few and far between streets connecting these. The traboules afford a means of easier and faster navigation between buildings higher up the hill and the river by combining passages and stairways in the built environment. These were originally 'private' passageways for silk workers, inside or between buildings, including underground passages, secret passageways, staircases, courtyards, and public passages. In Croix-Rousse many are openly accessible, while in Vieux Lyon most are inside of buildings and part of the buildings, with entrances through doors, but many open to the public.

[7] https://thisislyon.fr/things-to-do/historical-monuments/the-traboules/, http://www.lyontraboules.net/, https://en.wikipedia.org/wiki/Traboule

The discussion then continued around issues of spatial orientation around the hills and how it may be supported in search and navigation systems for such overlapping structures or elevation-aware navigation. Another local example on online services and their differences was that for public transport bus stops in Lyon, Google Maps did come up empty, but they could be found on Bing Maps.

Further discussion points were data availability and data quality. While understanding the quality issues of entities is challenging, a harder issue is the understanding of lacking entities within a dataset. Grounding of mobility traces to actual visited entities remains an open issue, depending on local entity density, and is also linked to classification of entities.

Another thread was the move towards more and more fine-granular locations, which gives rise to new issues around the separation of individual small entities within a block or even a single building. With this, old issues such as noise from multiple sources (GPS, dead reckoning, location API vs entity locations from mapping services) become relevant again at this finer granularity.

Participants discussed lacking access to large-scale mobility data, in part due to large industry players not sharing, but also due to privacy and anonymisation issues.

When building your own (polygon) data for a specific location and domain, it is challenging to try to find the optimal handover from own data generation versus use of existing data. Noisy data makes this choice more difficult, as well as limitations in updating source data directly instead of keeping own correction data. One example was a possible dependency on OSM and their requirements and guidelines, when combining OSM with own domain-specific mapping. This is linked to getting people engaged in specific community mapping, and the merging and linking of different data sources.

Looping back, the workshop closed with discussions of the impact of local characteristics on location and how while difficult to capture and fomalize, local knowledge helps to better interpret results and systems. Many of the insights and important issues regarding open issues came up in a similar way in previous workshops, showing the evolution and new challenges with ongoing research advances, with deeper integration, higher granularity, and improved quality being major themes.

5 Conclusion and Future Directions

LocWeb 2018 showed the breadth of location in the Web context, showing cross-cutting work around social media and geospatial analysis, health, augmented reality, tourist recommendation, crowdsourcing, citizen engagement and governance, combined with technical advancements. We could reach a variety of participants from academia and industry, with the main conference also showcasing many relevant papers on location topics from gazetteer data to geospatial analytics. The discussions at the workshop showed the constant evolution of location in the Web, and new research questions and applications growing quickly out of any advancements made, keeping location constantly involved at the forefront of Web technology and analysis. We expect the work presented at the workshop to be the basis for further growth in this field.

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