

LocalRec 2019 Workshop Report

# The Third ACM SIGSPATIAL Workshop on Location-based Recommendations, Geosocial Networks and Geoadvertising

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Panagiotis Bouros  
Johannes Gutenberg University Mainz  
Germany  
bouros@uni-mainz.de

Tamraparni Dasu  
AT&T Labs–Research  
USA  
tamr@research.att.com

Yaron Kanza  
AT&T Labs–Research  
USA  
kanza@research.att.com

Matthias Renz  
Christian-Albrechts-Universität zu Kiel  
Germany  
mr@informatik.uni-kiel.de

Dimitris Sacharidis  
Technische Universität Wien  
Austria  
dimitris@ec.tuwien.ac.at

The amount of publicly available geo-referenced data has seen a dramatic explosion over the past few years. Many user activities generate data that are annotated with location and contextual information. Furthermore, it has become easier to collect and combine rich and diverse location information. In the context of geoadvertising, the use of geosocial data for targeted marketing is receiving significant attention from a wide spectrum of companies and organizations. With the advent of smartphones and online social networks, a multi-billion dollar industry that utilizes geosocial data for advertising and marketing has emerged. Geotagged social-media posts, GPS traces, data from cellular antennas and WiFi access points are used widely to directly access people for advertising, recommendations, marketing, and group purchases. Exploiting this torrent of geo-referenced data provides a tremendous potential to materially improve existing recommendation services and offer novel ones, with numerous applications in many domains, including social networks, marketing, and tourism.

Realizing the full potential of geo-referenced data requires new technologies to collect, store, analyze and use the data. It also raises issues in the area of responsibility, accountability, transparency, fairness, adequacy (e.g., avoiding ads in improper places) and preventing misconduct. This in turn means addressing many core challenges and combining ideas and techniques from various research communities, such as recommender systems, data management, geographic information systems, social network analytics, and text mining. By bringing together researchers and practitioners from these communities, the LocalRec workshop provides a unique forum for in-depth discussion about challenges, opportunities, novel techniques and applications related to location-based recommendation, geosocial networks and geoadvertising.

LocalRec 2019 was a full-day workshop (<http://www.ec.tuwien.ac.at/localrec2019/>). The program committee received and evaluated 17 submissions (12 full papers and 5 short papers), out of which 6 papers were accepted as full (acceptance rate of 50%) and 6 papers were accepted as short (overall acceptance rate of 71%). Among the main conference attendees, 22 registered for LocalRec. In most of the sessions there were about 15–20 participants, with about 25 attendees at peak time; see also Figure 1.



Figure 1: Photo from the LocalRec 2019 sessions.

There were two keynotes in the workshop. Siva Ravada from Oracle gave a keynote about *Spatial Analytics for Storing and Analyzing Geosocial data for Geoadvertising*. He provided an overview of challenges and solutions for supporting geoadvertising and other location-related business decisions. For example, when selecting a store location, it is important to estimate the number of potential customers who might use the services of that store. This requires providing information about other stores in the area, transportation to the store location, population size in the area, etc. Another example is presenting distribution of market share of competing companies in different geospatial regions. Solving these problems using ordinary database management systems does not scale, because many expensive geospatial computations are involved. Hence, indexes and query processing methods were developed for these tasks. For recommendations, there is a need to maintain location-based relationships between customers. The talk elaborated on the applicability of Property Graphs for this task, and their use in recommender systems. The talk also surveyed concepts like Augmented Location (location within the context of the user data), Beacon Technology (location targeting, customer mapping, visit tracking, geofencing), Hyper-Local Marketing and Mobile App Localization.

Syagnik Banerjee, from the University of Michigan-Flint, gave a keynote on *Geo-marketing and Situated Consumers: Opportunities and Challenges* [1]. This talk presented potential uses of location and spatial analytics in geoadvertising and geomarketing. The first part of the talk focused on the different ways in which geolocation can be used in marketing, distinguishing between conversion, retention, and discovery objectives. For example, it described uses of augmented reality in supermarkets to provide information to customers while collecting information about the items that customers looked at. It illustrated the effect of location on decisions regarding price, e.g., offering customers a low price on a Web site of a store before they get into the physical store, and avoiding offering the low price after the actual visit at the store. The second part of the talk focused on measuring the effectiveness of a marketing campaign and how it is perceived by customers with respect to their privacy concerns. Both keynote talks gained a lot of attention and led to fruitful discussions.

The research papers were organized into four sessions. The first session focused on *Spatial Analytics* and included two research papers. In The authors of [5] presented an approach for classifying Points of Interest (POIs) into accurate category recommendations using minimum amount of available POI metadata (name, coordinates). This is in contrast to existing techniques that require a wealth of metadata (e.g. reviews, ratings, working hours, price ranges). A methodology for generating sketch maps, i.e., simplified maps that improve readability by visualising only necessary or requested facilities, is discussed in [8]. The paper shows how to automatically select the necessary roads for sketching a map, for given facilities.

The second session focused on *Location Recommendations*, and included four papers. The authors of [9]

presented automatic creation of trip itineraries, while exploiting multiple social media sources. The source-to-target trips are derived using an ant colony optimization algorithm where the total score of a trip depends on its length, the social media popularity of the contained POIs, and the relevance of the POIs with respect to the city’s history. In [3], inferring the rating for an unseen hiking trail is studied. The proposed approach examines similar historical trails and appropriately weighs their ratings, to predict the desired rating. Given a sparse geo-textual dataset, the goal of [11] is to predict emotions associated with certain topics at a target location. In the absence of specific location-topic combinations data, the paper applies interpolation based on combination of SVD and Kriging. The last paper of the session presented a study of various aspects of fairness in location recommender systems [13]. Fairness could relate to receivers of recommendations or to recommended locations. The desired notion of fairness is quantified based on outputs of recommenders over a period of time.

The third session included three talks related to *Privacy*. In [10], the authors considered the impact of privacy-by-design requirements on the accuracy of POI recommendations on mobile devices, based on the assumption that the recommender system can only use locally stored user information, i.e., the user trajectory. The focus is on detecting the stay area based on generated recommendations. The authors of [4] discussed the trade-off between utility and privacy in mobility datasets and the evaluation of geo-indistinguishability techniques for two distinct applications over the Geolife dataset. In [6], the authors discussed the problem of location privacy for physical infrastructure maps. Various types of obfuscation techniques, which differ in how they perturb the locations of the infrastructure nodes and/or their connections, were proposed.

The last session included three talks in the areas of *Geoadvertising and Location-Based Services*. In [7], the authors studied ways to measure the effect of location-based advertising based on uplift modeling. They identified significant geo-features for location-based targeting and predicted user segments with high net effect of advertisement. The second paper [12] described the association of semantic labels to entities in an indoor map, based on crowd-sourced images and motion traces. The third paper [14] introduced a novel augmented reality (AR) application for location-based social networks that (1) integrates mobile augmented reality with user generated content, (2) allows users to publish their own content through an augmented reality form on a 3D model aligned to the real-world scenario (with real-world coordinates) displayed by the device, and (3) allows users to interact with user-generated content published by others.

The research papers and the keynote talks emphasized the many facets of location recommendations and geoadvertising. They illustrated the potential of recommendation systems to help users find the geospatial information they need, whether it is points of interest, routes or recommended venues. They described methods for advertisers and marketing people to reach out to potential customers with high precision based on location information, and they also emphasized the need for awareness of privacy and fairness issues.

We thank the authors for publishing and presenting their papers in LocalRec 2019, and the program committee for their professional evaluation and help in the peer-review process. We hope that the proceedings [2] will inspire new research ideas and will help promoting the area of location-recommendations and geoadvertising.

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