

# **2016 17th IEEE International Conference on Mobile Data Management (MDM 2016)**

**Porto, Portugal  
13-16 June 2016**

**Volume 1  
Pages 1-375**



IEEE Catalog Number: CFP16299-POD  
ISBN: 978-1-5090-0884-1

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\*This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16299-POD
ISBN (Print-On-Demand):	978-1-5090-0884-1
ISBN (Online):	978-1-5090-0883-4
ISSN:	1551-6245

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# **2016 17th IEEE International Conference on Mobile Data Management**

## **MDM 2016**

### **Table of Contents Volume - 1**

<b>Message from the General Co-Chairs.....</b>	<b>xi</b>
<b>Message from the Program Co-Chairs.....</b>	<b>xiii</b>
<b>Message from the Keynote Co-Chairs.....</b>	<b>xiv</b>
<b>Message from the Panel Co-Chairs.....</b>	<b>xv</b>
<b>Message from the Industrial Track Co-Chairs.....</b>	<b>xvi</b>
<b>Message from the Demonstration Track</b>	
<b>Co-Chairs.....</b>	<b>xvii</b>
<b>Conference Officers.....</b>	<b>xviii</b>
<b>Program Committee.....</b>	<b>xx</b>
<b>External Reviewers.....</b>	<b>xxii</b>
<b>Sponsors.....</b>	<b>xxiii</b>

---

### **Keynote Abstracts**

<b>Developing and Deploying Mobile Sensing Applications in the Wild .....</b>	<b>1</b>
<i>Cecilia Mascolo</i>	
<b>How to Turn Data into a Smart Colution: Smart Cities Use Case .....</b>	<b>2</b>
<i>Susana Sargento</i>	
<b>LiveLabs: Building Real-World Testbeds for Mobile Sensing, Analytics, and Intervention Experiments .....</b>	<b>3</b>
<i>Rajesh Krishna Balan</i>	

## **Panel Abstract**

Advanced Query Answering Techniques over Big Mobile Data .....	4
Alfredo Cuzzocrea	

## **Research Papers**

### **Research Session 1: Information Management on Road Networks**

Group Finder: An Item-Driven Group Formation Framework .....	8
<i>Igo Brilhante, Jose Antonio Macedo, Franco Maria Nardini, Raffaele Perego, and Chiara Renso</i>	
A Framework to Model Human Behavior at Large Scale during Natural Disasters .....	18
<i>Jay Ghurye, Gautier Krings, and Vanessa Frias-Martinez</i>	
MobiHerd: Towards Enabling Cost-Effective and Scalable Mobile Group Buying .....	28
<i>Gurulingesh Raravi, Anirban Mondal, Rajasubramaniam Thangaraj, and Atul Singh</i>	
Characterizing User Mobility from the View of 4G Cellular Network .....	34
<i>Weijian Sun, Dandan Miao, Xiaowei Qin, and Guo Wei</i>	

### **Research Session 2: Query Processing and Information Search/Retrieval**

Building the Case for Dynamic Location Query Processing .....	40
<i>Jesse Weaver, Qi Han, and Archana Misra</i>	
Web Access Patterns Enhancing Data Access Performance of Cooperative Caching in IMANETs .....	50
<i>Xiaopeng Fan, Jiannong Cao, Haixiao Mao, Weigang Wu, Yubin Zhao, and Chengzhong Xu</i>	
Top-K with Diversity-M Data Retrieval in WSNs .....	60
<i>Kiran Kumar Puram and Sanjay K. Madria</i>	
Finding Geospatial Resources Using Uncertain Data .....	66
<i>Qing Guo and Ouri Wolfson</i>	

### **Research Session 3: Smart City and Urban Applications**

MPG: Not So Random Exploration of a City .....	72
<i>Xiaoyu Ge, Panos K. Chrysanthis, and Konstantinos Pelechrinis</i>	

Estimating Urban Traffic Congestions with Multi-sourced Data .....	82
<i>Senzhang Wang, Lifang He, Leon Stenneth, Philip S. Yu, Zhoujun Li, and Zhiqiu Huang</i>	

ParkGauge: Gauging the Occupancy of Parking Garages with Crowdensed Parking Characteristics .....	92
<i>Jim Cherian, Jun Luo, Hongliang Guo, Shen-Shyang Ho, and Richard Wisbrun</i>	

## **Research Session 4: Mining and Prediction for Streams and Moving Objects**

Online Risk Prediction for Indoor Moving Objects .....	102
<i>Tanvir Ahmed, Torben Bach Pedersen, Toon Calders, and Hua Lu</i>	
Online Clustering of Trajectory Data Stream .....	112
<i>Ticiana L. Coelho da Silva, Karine Zeitouni, and José A.F. de Macêdo</i>	
Distributed Convoy Pattern Mining .....	122
<i>Faisal Orakzai, Toon Calders, and Torben Bach Pedersen</i>	

## **Research Session 5: Social Media and Social Networks**

Scalable Processing of Location-Based Social Networking Queries .....	132
<i>Muhammad Aamir Saleem, Xike Xie, and Torben Bach Pedersen</i>	
Collaborative Co-clustering across Multiple Social Media .....	142
<i>Fengjiao Wang, Shuyang Lin, and Philip S. Yu</i>	
A Bayesian-Based Approach for Activity and Mobility Inference in Location-Based Social Networks .....	152
<i>Wen-Yuan Zhu, Yu-Wen Wang, Chin-Jie Chen, Wen-Chih Peng, and Po-Ruey Lei</i>	
Real-Time and Cost-Effective Limitation of Misinformation Propagation .....	158
<i>Iouliana Litou, Vana Kalogeraki, Ioannis Katakis, and Dimitrios Gunopoulos</i>	

## **Research Session 6: Ride Sharing, Road Networks and Routes**

A Model of Multimodal Ridesharing and Its Analysis .....	164
<i>Jane Lin, Sandeep Sasidharan, Shuo Ma, and Ouri Wolfson</i>	
Bicycle-Sharing System Analysis and Trip Prediction .....	174
<i>Jiawei Zhang, Xiao Pan, Moyin Li, and Philip S. Yu</i>	
Taxi, Please! A Nearest Neighbor Query in Time-Dependent Road Networks .....	180
<i>Mirla Rafaela Rafael Braga Chucre, Samara Martins Nascimento, José Antônio Fernandes De Macêdo, José Maria Da Silva Monteiro Filho, and Marco Antônio Casanova</i>	

A Flexible Real-Time Ridesharing System Considering Current Road Conditions .....	186
---	-----

*San Yeung, Evan Miller, and Sanjay Madria*

PRI-Navigator: An Efficient Approach for Logistic Route Planning with Pick-up and Delivery .....	192
--	-----

*Eric Hsueh-Chan Lu, Ya-Wen Yang, and Zeal Li-Tse Su*

## **Research Session 7: Systems and Platforms**

From Human Mobility to Data Mobility: Leveraging Spatiotemporal History in Device-to-Device Information Diffusion .....	198
---	-----

*Jonas Michel and Christine Julien*

Opportunistic Computation Offloading in Mobile Edge Cloud Computing Environments .....	208
--	-----

*Muhammad Habib ur Rehman, Chee Sun, Teh Ying Wah, Ahsan Iqbal, and Prem Prakash Jayaraman*

Experiences with Sensor-Based Research for Critical, Socio-technical Systems .....	214
--	-----

*Henrik Surm, Nick Rüssmeier, Marco Grawunder, Daniela Nicklas, and Oliver Zielinski*

Presumably Simple: Monitoring Crowds Using WiFi .....	220
---	-----

*Cristian Chilipirea, Andreea-Cristina Petre, Ciprian Dobre, and Maarten van Steen*

A Mobile Chinese Character Image Recognition Platform .....	226
---	-----

*Gang Gu and Jiangqin Wu*

## **Research Session 8: Indexing and Querying: Road Networks, Moving Objects, and Trajectories**

K-Closest Pairs Queries in Road Networks .....	232
--	-----

*Elham Ahmadi and Mario A. Nascimento*

ParDiSP: A Partition-Based Framework for Distance and Shortest Path Queries on Road Networks .....	242
--	-----

*Theodoros Chondrogiannis and Johann Gamper*

D-Grid: An In-Memory Dual Space Grid Index for Moving Object Databases .....	252
--	-----

*Xiaofeng Xu, Li Xiong, and Vaidy Sunderam*

Efficient Access to Temporally Overlaying Spatial and Textual Trajectories .....	262
--	-----

*Hamza Issa and Maria Luisa Damiani*

## **Research Session 9: Privacy and Security**

Differentially-Private Mining of Representative Travel Patterns .....	272
<i>Mihai Maruseac and Gabriel Ghinita</i>	
On the Privacy of Frequently Visited User Locations .....	282
<i>Zohaib Riaz, Frank Dürr, and Kurt Rothermel</i>	
The Secure Data Container: An Approach to Harmonize Data Sharing with Information Security .....	292
<i>Christoph Stach and Bernhard Mitschang</i>	

## **Industrial Papers**

A Case Study of Mobile User Behaviors Using Spatio-temporal Data .....	298
<i>Ying Li, Wesley M. Gifford, and Anshul Sheopuri</i>	
Modeling and Analyzing Electric Vehicle Charging .....	302
<i>Ove Andersen, Benjamin B. Krogh, Christian Thomsen, and Kristian Torp</i>	
An Unsupervised Collaborative Approach to Identifying Home and Work Locations .....	310
<i>Rong Liu, Swapna Buccapatnam, Wesley M. Gifford, and Anshul Sheopuri</i>	
Understanding Urban Mobility via Taxi Trip Clustering .....	318
<i>Dheeraj Kumar, Huayu Wu, Yu Lu, Shonali Krishnaswamy, and Marimuthu Palaniswami</i>	

## **Demo Papers**

FoGBAT: Combining Bluetooth and GPS Data for Better Traffic Analytics .....	325
<i>Johannes L. Borresen, Christian S. Jensen, and Kristian Torp</i>	
Tethys: Sensor-Based Aquatic Quality Monitoring in Waterways .....	329
<i>Gavriil Tzortzakis, Eli Katsiri, George Karavokiros, Christos Makropoulos, and Alex Delis</i>	
Incorporating Weather Updates for Public Transportation Users of Recommendation Systems .....	333
<i>Muhammed Mas-ud Hussain, Besim Avci, Goce Trajcevski, and Peter Scheuermann</i>	
Efficient Trajectory Analysis for Several Time-Dependent Attributes: A Case Study for Roe Deer .....	337
<i>Fabio Valdés, Ralf Hartmut Güting, and Federico Ossi</i>	
Visualize People's Mobility - Both individually and Collectively - Using Mobile Phone Cellular Data .....	341
<i>Manoranjan Dash, Kee Kiat Koo, Shonali P. Krishnaswamy, Yunye Jin, and Amy Shi-Nash</i>	

Enhancing Virtual Reality Systems with Smart Wearable Devices .....	345
<i>Salah Eddin Alshaal, Stylianos Michael, Andreas Pamporis, Herodotos Herodotou, George Samaras, and Panayiotis Andreou</i>	
UTE: A Ubiquitous Data Exploration Platform for Mobile Sensing Experiments .....	349
<i>Jonathan Lino, Thuong Nguyen, Prem Prakash Jayaraman, and Flora D. Salim</i>	
CrowdRankEval: A Ranking Function Evaluation Framework for Spatial Keyword Queries .....	353
<i>Ilkcan Keles, Christian S. Jensen, and Simonas Šaltenis</i>	
Dynamic and Personalized Routing in PreGo .....	357
<i>Abdeltawab M. Hendawi, Aqeel Rustum, Amr A. Ahmadain, Dev Oliver, David Hazel, Ankur Teredesai, and Mohamed Ali</i>	
Secure Candy Castle - A Prototype for Privacy-Aware mHealth Apps .....	361
<i>Christoph Stach</i>	
A Framework for Online Mobility Pattern Discovery from Trajectory Data Streams .....	365
<i>Ticiana L. Coelho da Silva, Karine Zeitouni, José A.F. de Macêdo, and Marco A. Casanova</i>	
BusesinRio: Buses as Mobile Traffic Sensors: Managing the Bus GPS Data in the City of Rio de Janeiro .....	369
<i>Bruno Guberfain Do Amaral, Rafael Nasser, Marco Antonio Casanova, and Hélio Lopes</i>	
<b>Author Index .....</b>	<b>373</b>

# **2016 17th IEEE International Conference on Mobile Data Management (MDM 2016)**

**Porto, Portugal  
13-16 June 2016**

**Volume 2  
Pages 1-78**



IEEE Catalog Number: CFP16299-POD  
ISBN: 978-1-5090-0884-1

# **2016 17th IEEE International Conference on Mobile Data Management**

## **MDM 2016**

### **Table of Contents Volume - 2**

#### **Message from the Advanced Seminar**

<b>Co-Chairs.....</b>	viii
<b>Message from the Doctoral Colloquium</b>	
<b>Co-Chairs.....</b>	ix
<b>Message from the Workshop Co-Chairs.....</b>	x
<b>Message from the MobDM Workshop</b>	
<b>Co-Chairs.....</b>	xii
<b>Message from the ECAAS Workshop</b>	
<b>Co-Chairs.....</b>	xiii
<b>Workshop Organization.....</b>	xv

---

#### **Advanced Seminar Abstracts**

Geometric Aspects and Auxiliary Features to Top-k Processing .....	1
<i>Kyriakos Mouratidis</i>	
Compression of Spatio-temporal Data .....	4
<i>Goce Trajcevski</i>	
Mobile Computing, Internet of Things, and Big Data for Urban Informatics .....	8
<i>Anirban Mondal, Praveen Rao, and Sanjay Kumar Madria</i>	

#### **Doctoral Colloquium Papers**

Social Influence Analysis Using Mobile Phone Dataset .....	12
<i>Qiwei Han</i>	

Event Detection: Monitoring and Tracking the Dynamics of Social Networks	
Communities .....	18
<i>Mário Miguel Fernandes Cordeiro</i>	
Social Network Analysis of Mobile Streaming Networks .....	20
<i>Shazia Tabassum</i>	
Optimal Task Assignment in Sensor Networks .....	26
<i>Vassilis Papataxiarhis</i>	

## **MobDM Workshop**

### **Keynote Paper**

The Use of Autonomous UAVs to Improve Pesticide Application in Crop Fields .....	32
<i>Bruno S. Faical, Jo Ueyama, and Andre C. P. L. F. de Carvalho</i>	

### **Workshop Papers**

A Framework for Chainsaw Detection Using One-Class Kernel and Wireless Acoustic Sensor Networks into the Amazon Rainforest .....	34
<i>Juan Gabriel Colonna, Bernardo Gatto, Eulanda Miranda Dos Santos, and Eduardo Freire Nakamura</i>	
Active Learning for On-Line Partial Discharge Monitoring in Noisy Environments .....	37
<i>João Bárto Gomes, Hai-Long Nguyen, Min Wu, Jianneng Cao, and Shonali Krishnaswamy</i>	
Evolving Centralities in Temporal Graphs: A Twitter Network Analysis .....	43
<i>Fabiola S.F. Pereira, Sandra de Amo, and João Gama</i>	
Mining the Twitter Stream: Unravel Events, Interactions, and Communities in Real-Time .....	49
<i>Mário Miguel Fernandes Cordeiro</i>	
Sampling Evolving Ego-Networks with forgetting Factor .....	55
<i>Shazia Tabassum and João Gama</i>	

## **ECAAS Workshop**

### **Keynote Talks**

New Challenges and Research Trend in Activity Recognition .....	60
<i>Juan Ye</i>	
APISENSE ( <a href="http://apisense.io">http://apisense.io</a> ) .....	61
<i>Romain Rouvoy</i>	

## **Invited Talks**

Scaling a Real-Time Driving Behaviour Analysis System .....	62
<i>Bruno Cabral</i>	
Emerging Applications of Context-Aware Systems in Healthcare .....	63
<i>Hugo Placido da Silva</i>	

## **Workshop Papers**

SmartVent: A Context Aware IoT System to Measure Indoor Air Quality and Ventilation Rate .....	64
<i>Divya Lohani and Debopam Acharya</i>	
Context-Aware Mobile Recommender System Based on Activity Patterns .....	70
<i>Nelson Mendes, Bruno Alves, and Sara Paiva</i>	
Human Activity Recognition by Means of Online Semi-supervised Learning .....	75
<i>Hugo Louro Cardoso and João Mendes Moreira</i>	
<b>Author Index</b> .....	78