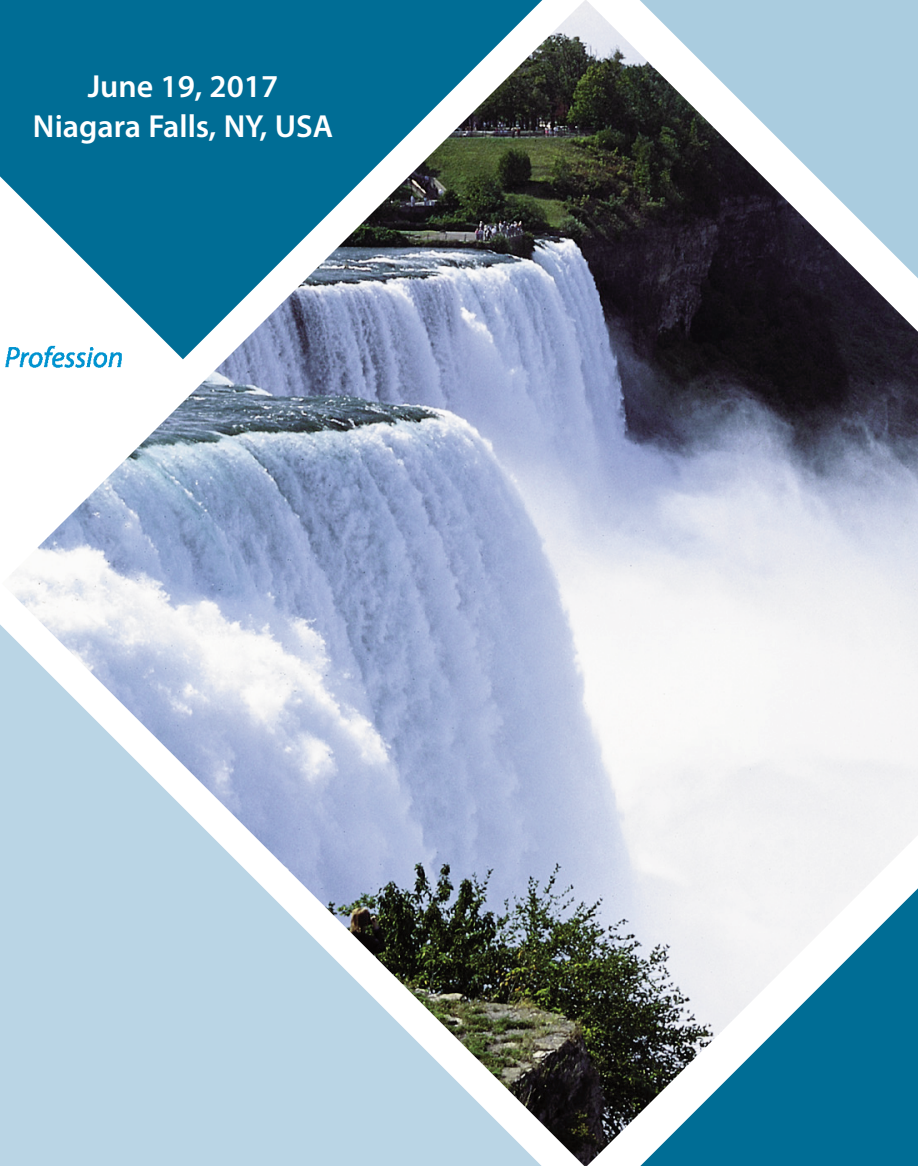


June 19, 2017  
Niagara Falls, NY, USA



Association for  
Computing Machinery

*Advancing Computing as a Science & Profession*



# WPA'17

Proceedings of the 4th International  
Workshop on Physical Analytics

*Sponsored by:*

**ACM SIGMOBILE**

*In-cooperation with:*

**ACM SIGOPS**

*Co-located with:*

**MobiSys 2017**



**Association for  
Computing Machinery**

*Advancing Computing as a Science & Profession*

**The Association for Computing Machinery**  
**2 Penn Plaza, Suite 701**  
**New York, New York 10121-0701**

Copyright © 2017 by the Association for Computing Machinery, Inc. (ACM). Permission to make digital or hard copies of portions of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyright for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permission to republish from: [permissions@acm.org](mailto:permissions@acm.org) or Fax +1 (212) 869-0481.

For other copying of articles that carry a code at the bottom of the first or last page, copying is permitted provided that the per-copy fee indicated in the code is paid through [www.copyright.com](http://www.copyright.com).

**ISBN:** 978-1-4503-4958-1

Additional copies may be ordered prepaid from:

**ACM Order Department**  
PO Box 30777  
New York, NY 10087-0777, USA

Phone: 1-800-342-6626 (USA and Canada)  
+1-212-626-0500 (Global)  
Fax: +1-212-944-1318  
E-mail: [acmhelp@acm.org](mailto:acmhelp@acm.org)  
Hours of Operation: 8:30 am – 4:30 pm ET

Printed in the USA.

# Chairs' Welcome

It is our great pleasure to welcome you to the *4th Workshop on Physical Analytics*, co-located with *ACM MobiSys 2017 (WPA'17)*. This workshop continues a tradition of soliciting papers that describe technologies, experiments and practical applications that center on the capture and understanding of the physical behavior of individuals, groups, and crowds in the physical world. This year's WPA'17 has three sessions, covering topics ranging from analytics for mental and physical health, analytics for detection of persons and objects, to analytics using crowdsourcing and crowdsensing. In bringing together researchers, with diverse interest, from both academia and industry into this common forum, we hope to stimulate new research agendas for the research community.

We are honored to have Dr. Matthai Philipose from Microsoft Research deliver a keynote to kickoff the WPA'17 program. We are also grateful to have invited talks from Prof. Tam Vu from University of Colorado Boulder, Prof. Xia Zhou from Dartmouth College, and Prof Youngki Lee from Singapore Management University.

We would like to thank both our distinguished program committee for their insightful reviews, and the MobiSys organizing team for their support of this workshop. WPA'17 would not be possible without their gracious help. Finally we would like to thank the authors for submitting their work and we look forward to a fantastic workshop.

**Robert LiKamWa**

*Arizona State University*

*WPA'17 Co-Chair*

**Rajesh Krishna Balan**

*Singapore Management University*

*WPA'17 Co-Chair*

# Table of Contents

<b>WPA 2017 Organization List</b> .....	vi
---	----

## **Session 1: Analytics for Mental and Physical Health**

Session Chair: Rajesh Krishna Balan (*Singapore Management University*)

- **Towards Unobtrusive Mental Well-Being Monitoring for Independent-Living Elderly**..... 1  
Sinh Huynh, Hwee-Pink Tan, Youngki Lee (*Singapore Management University*)
- **Experiences in Building a Real-World Eating Recogniser**..... 7  
Sougata Sen, Vigneshwaran Subbaraju, Archan Misra, Rajesh Krishna Balan, Youngki Lee (*Singapore Management University*)

## **Session 2: Analytics for Detection of Persons and Objects**

Session Chair: Robert LiKamWa (*Arizona State University*)

- **Peripheral WiFi Vision: Exploiting Multipath Reflections for More Sensitive Human Sensing** ..... 13  
Elahe Soltanaghaci, Avinash Kalyanaraman, Kamin Whitehouse (*University of Virginia*)
- **Konark: A RFID based System for Enhancing In-store Shopping Experience**..... 19  
Swadhin Pradhan (*The University of Texas at Austin*),  
Eugene Chai, Karthik Sundaresan, Sampath Rangarajan (*NEC Laboratories America*),  
Lili Qiu (*The University of Texas at Austin*)
- **CamMirror: Single-Camera-based Distance Estimation for Physical Analytics Applications** ..... 25  
Vivek Yenamandra (*Ohio State University*),  
Akshay Uttama Nambi, Venkata Padmanabhan, Vishnu Navda (*Microsoft Reserach India*),  
Kannan Srinivasan (*Ohio State University*)

## **Session 3: Analytics through Crowds**

Session Chair: Robert LiKamWa (*Arizona State University*)

- **Can Mobile Workforce Revolutionize Country-Scale Crowdsourcing?**..... 31  
Utku Gunay Acer, Marc van den Broeck, Marc Godon, Claudio Forlivesi, Fahim Kawsar (*Nokia Bell Labs*)
- **ENACT: Encounter-based Architecture for Contact Tracing** ..... 37  
Aarathi Prasad (*Amherst College*), David Kotz (*Dartmouth College*)

<b>Author Index</b> .....	43
---------------------------	----

# WPA'17 Workshop Organization

**Program Chairs:** Robert LiKamWa (*Arizona State University, USA*)  
Rajesh Krishna Balan (*Singapore Management University, Singapore*)

**Program Committee:** Yingying Chen (*Stevens Institute of Technology, USA*)  
Rajesh Krishna Balan (*Singapore Management University, Singapore*)  
June-hwa Song (*KAIST, Korea*)  
Youngki Lee (*Singapore Management University, Singapore*)  
Tadashi Okoshi (*Keio University, Korea*)  
Geoffrey Challen (*blue Systems Research Group, USA*)  
Lin Zhong (*Rice University, USA*)  
Venkat Padmanabhan (*Microsoft Research, India*)  
Archan Misra (*Singapore Management University, Singapore*)  
Robert Likamwa (*Arizona State University, USA*)  
Giovanni Pau (*University of California Los Angeles, USA*)  
Krishna Chintalapudi (*Microsoft Research, USA*)  
Xia Zhou (*Dartmouth College, USA*)  
Sharad Agarwal (*Microsoft, USA*)  
Jeonggil Ko (*Ajou University, Korea*)  
Marco Gruteser (*WINLAB, Rutgers University, USA*)  
Ramesh Govindan (*University of Southern California, USA*)  
Nicholas Lane (*University College London and Bell Labs, United Kingdom*)  
Vinayak Naik (*IIT-Delhi, India*)  
Ardalan Amiri Sani (*University of California Irvine, USA*)

**Sponsor:**

