

Shaohan Hu

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CONTACT INFORMATION

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University of Illinois at Urbana-Champaign
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RESEARCH INTERESTS

I am interested in designing and building mobile systems that sense the physical and social environments, make inferences about the contexts, and provide services to individual users as well as the population.

EDUCATION

University of Illinois at Urbana-Champaign, IL USA

- Ph.D., in Computer Science in progress
Advisor: Tarek F. Abdelzaher

Dartmouth College, NH USA

- M.S., in Computer Science June 2011
Advisor: Andrew T. Campbell

University of Massachusetts at Amherst, MA USA

- B.S., magna cum laude, in Computer Science May 2008
- B.S., magna cum laude, in Mathematics and Statistics May 2008

RESEARCH EXPERIENCES

University of Illinois at Urbana-Champaign

August 2011–Present

Advisor: Tarek F. Abdelzaher

- **eNav: Smartphone-based Energy-Efficient Vehicular Navigation**

In collaboration with Microsoft Research, this project aims at providing low-power reliable real-time road navigation services by taking advantage of the phone's on-board MEMS sensors (accelerometer, gyroscope, etc) to minimize the need for GPS localization, in order to best preserve phone battery to ultimately eliminate the need for carrying extra hardware (car charger, cable, car mount) or dedicated GPS units for navigation (resulting paper under submission to MobiSys 2014).

- **SmartRoad: Participatory Road Sensing**

Funded by NSF, Siebel Foundation, this project aims at providing the next generation road services by taking advantage of sensor-packed mobile phones in a vehicular environment. Various applications/services include:

- Vehicular mobile sensing and communication system, for which we implement and deploy a participatory vehicle mobile sensing system, and study and analyze how to most efficiently carry out car-to-car data sharing when two cars meet, and how to balance among available transmission channels (WiFi, cellular, etc) for server offloading (resulting papers published in INFOCOM 2013 and INFOCOM 2014).
- Traffic regulator detection and identification, for which we design, build, and deploy a participatory sensing system that collects and intelligently handles noisy crowd-sourced data, and robustly, efficiently and effectively detects and identifies traffic regulators, such as stop signs and traffic lights, under various energy/bandwidth conditions (resulting work published in IPSN 2013 POSTER and RTSS 2013; one journal paper under submission to TOSN).
- GreenGPS: Fuel-efficient mapping and routing, which aims at providing, in addition to the shortest and fastest, the most fuel-efficient route between any pair of source and destination points on the map. Currently we are in the process of progressively deploying our system to the UIUC Facility & Service department, for a final targeted 300-car study.

- **NDN: Named Data Networking**

Funded by NSF, in collaboration with 10 other Universities and PARC. NDN is a recently proposed next-generation networking framework design, which aims at basing addresses on data names instead of machine locations. We focus on two aspects:

- NDN based mobile participatory sensing testbed, which aims at bringing NDN stack onto Android mobile phones, and implementing, deploying and evaluating participatory sensing applications on top of NDN.
- Information-centric networking, which targets on taking advantage of the “named data” nature of the NDN network and putting focus on maximizing information coverage rather than just data throughput when designing communication mechanisms under resource constraints (resulting paper published in ICCCN 2013).

- **Resource-Efficient Data Classification in Distributed Sensing Systems**

This project aims at building a resource-efficient system to classify sensory data distributed over a large number of sensor nodes under stringent network resources. We focus on two aspects of the sensor network nodes: data reliability and data redundancy, where reliability implies the degree to which a sensor node contributes to the classification mission, and redundancy represents the information overlap among different sensor nodes. We formulate and solve an optimization problem that maximizes the reliability of sensory data while eliminating their redundancies under the constraint of network resources (resulting paper published in RTSS 2012).

Dartmouth College

September 2009–June 2011

Advisor: Andrew T. Campbell

- **Large Scale Activity Recognition using Community Similarity Networks**

This work targets on building a mobile phone human activity recognition system that can accurately carry out the recognition tasks on diverse populations by exploiting crowd-sourced sensor data, incorporating inter-person similarity measurements, and automatically personalizing classifiers with data contributed from other similar users (resulting paper published in UBIComp 2011).

- **Bridging Consumer Neural-Headset with Mobile Platforms**

In this work, we build NeuroPhone, a mobile system that is driven by neural signals, using a newly available off-the-shelf neural headset, for hands-free, silent and effortless human-mobile interaction. We build an address book dialing app on iPhone, which natively runs a lightweight classifier that extracts and detects the P300 brain potential from the EEG signal wirelessly transmitted by the headset (resulting paper published in MOBIHELD 2010).

University of Massachusetts at Amherst

January 2008–May 2008

Advisor: Andrew McCallum

- **Resource-bounded Information Extraction**

This work aims to design a general framework for the task of extracting specific information “on demand” from a large corpus such as the Web under resource constraints. Given a database with missing or uncertain information, our system automatically formulates queries, issues them to a search interface, selects a subset of the documents, extracts the required information from them, and fills the missing values in the original database (resulting paper published in PAKDD 2010).

PUBLICATIONS

ICDCS14

Shen Li, **Shaohan Hu**, Shiguang Wang, Lu Su, Tarek F. Abdelzaher, Indranil Gupta, Richard Pace, *WOHA: Deadline-Aware Map-Reduce Workflow Scheduling Framework over Hadoop Cluster*, The 34th International Conference on Distributed Computing Systems (ICDCS 2014), Madrid, Spain. June 30–July 3, 2014.

- ICAC14 Shen Li, **Shaohan Hu**, Shiguang Wang, Siyu Gu, Chenji Pan, Tarek F. Abdelzaher, *WattValet: Heterogenous Energy Storage Management in Data Centers for Improved Power Capping*, The 11th International Conference on Autonomic Computing (ICAC 2014), Philadelphia, PA USA, June 18–20, 2014.
- DCOSS14 Siyu Gu, Chenji Pan, Hengchang Liu, Shen Li, **Shaohan Hu**, Lu Su, Shiguang Wang, Dong Wang, Md Tanvir A Amin, Ramesh Govindan, Charu Aggarwal, Raghu Ganti, Mudhakar Srivatsa, Amotz Bar-Noy, Peter Terlecky, Tarek Abdelzaher, *Data Extrapolation in Social Sensing for Disaster Response*, The 9th IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS 2014), Marina Del Rey, CA USA, May 16–28, 2014.
- UIUC TR Dong Wang, Tarek F. Abdelzaher, Lance Kaplan, Raghu Ganti, **Shaohan Hu**, Hengchang Liu, *Reliable Social Sensing with Physical Dependencies: Analytic Bounds and Performance Evaluation*, UIUC Technical Report, May 15, 2014.
- INFOCOM14 **Shaohan Hu**, Hengchang Liu, Lu Su, Hongyan Wang, Tarek F. Abdelzaher, Pan Hui, Wei Zheng, Zhiheng Xie, John Stankovic, *Towards Automatic Phone-to-Phone Communication for Vehicular Networking Applications*, The 33rd IEEE International Conference on Computer Communications (INFOCOM 2014), Toronto, Canada, April 27–May 2, 2014.
- UIUC TR **Shaohan Hu**, Lu Su, Shen Li, Shiguang Wang, Chenji Pan, Siyu Gu, Md Tanvir Amin, Hengchang Liu, Suman Nath, Romit Roy Choudhury, Tarek F. Abdelzaher, *eNav: Smartphone-based Energy Efficient Location Sensing for Low-Power Vehicular Navigation*, UIUC Technical Report, April 25, 2014.
- IPSN14 **Shaohan Hu**, Lu Su, Shen Li, Shiguang Wang, Chenji Pan, Siyu Gu, Md Tanvir Al Amin, Hengchang Liu, Suman Nath, Romit Roy Choudhury, Tarek F. Abdelzaher, *Poster Abstract: eNav – a Smartphone-based Energy Efficient Vehicular Navigation System*, The 13th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2014), Berlin, Germany, April 15–17, 2014. (**Best poster award**)
- RTSS13 Dong Wang, Tarek F. Abdelzaher, Lance Kaplan, Raghu Ganti, **Shaohan Hu**, Hengchang Liu, *Exploitation of Physical Constraints for Reliable Social Sensing*, The 34th IEEE Real-Time Systems Symposium (RTSS 2013), Vancouver, Canada, December 4–6, 2013.
- SENSYS13 Hengchang Liu, Siyu Gu, Chenji Pan, Wei Zheng, Shen Li, **Shaohan Hu**, Shiguang Wang, Dong Wang, Tanvir Amin, Lu Su, Zhiheng Xie, Ramesh Govindan, Charu Aggarwal, Amotz Barnoy, Tarek F. Abdelzaher, *Demo Abstract: Extrapolation from Participatory Sensing Data*, The 11th ACM Conference on Embedded Networked Sensor Systems (SenSys 2013), Rome, Italy, November 11–15, 2013.
- UIUC TR **Shaohan Hu**, Hengchang Liu, Lu Su, Hongyan Wang, Tarek F. Abdelzaher, *SmartRoad: A Mobile Phone Based Crowd-Sourced Road Sensing System*, UIUC Technical Report, August 30, 2013.
- ICCCN13 Shiguang Wang, **Shaohan Hu**, Shen Li, Hengchang Liu, Md Yusuf Sarwar Uddin, and Tarek F. Abdelzaher, *MINERVA: Information-Centric Programming for Social Sensing*, The 22nd International Conference on Computer Communications and Networks (ICCCN 2013), Nassau, Bahamas, July 30–August 2, 2013.

ICDCS13	Shen Li, Shiguang Wang, Fan Yang, Shaohan Hu , Fatemeh Saremi, Tarek F. Abdelzaher, <i>Proteus: Power Proportional Memory Cache Cluster in Data Centers</i> , The 33rd International Conference on Distributed Computing Systems (ICDCS 2013), Philadelphia, PA USA, July 8–11, 2013.
PUC	Nicholas D. Lane, Ye Xu, Hong Lu, Shaohan Hu , Tanzeem Choudhury, Andrew T. Campbell, and Feng Zhao, <i>Community Similarity Networks</i> , ACM/Springer Journal of Personal and Ubiquitous Computing (PUC), Special Issue on Cross-Community Mining, May, 2013.
UIUC TR	Shaohan Hu , Lu Su, Hengchang Liu, Hongyan Wang, Tarek F. Abdelzaher, <i>SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System</i> , UIUC Technical Report, April 18, 2013.
INFOCOM13	Hengchang Liu, Shaohan Hu , Wei Zheng, Zhiheng Xie, Shiguang Wang, Pan Hui, and Tarek F. Abdelzaher, <i>Efficient 3G Budget Utilization in Mobile Participatory Sensing Applications</i> , The 32nd IEEE International Conference on Computer Communications (INFOCOM 2013), Turin, Italy, April 14–19, 2013.
IPSN13	Shaohan Hu , Lu Su, Hengchang Liu, Hongyan Wang, Tarek F. Abdelzaher, <i>Poster Abstract: SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System</i> , The 12th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2013), Philadelphia, PA USA, April 8–11, 2013.
UIUC TR	Shiguang Wang, Shaohan Hu , Shen Li, Hengchang Liu, Md Yusuf Sarwar Uddin, and Tarek F. Abdelzaher, <i>MINERVA: Information-Centric Programming for Social Sensing</i> , UIUC, January 15, 2013
RTSS12	Lu Su, Shaohan Hu , Shen Li, Feng Liang, Jing Gao, Tarek F. Abdelzaher, and Jiawei Han, <i>Quality of Information based Data Selection and Transmission in Wireless Sensor Networks</i> , The 33rd IEEE Real-Time Systems Symposium (RTSS 2012), San Juan, Puerto Rico, December 4–7, 2012.
UBICOMP11	Nicholas D. Lane, Ye Xu, Hong Lu, Shaohan Hu , Tanzeem Choudhury, Andrew T. Campbell, and Feng Zhao, <i>Enabling Large-scale Human Activity Inference on Smartphones using Community Similarity Networks (CSN)</i> , The 13th International Conference on Ubiquitous Computing (UBICOMP 2011), Beijing, China, September 17–21, 2011. (Nominated for best paper award)
MOBIHELD10	Andrew T. Campbell, Tanzeem Choudhury, Shaohan Hu , Hong Lu, Matthew K. Mukerjee, Mashfiqui Rabbi, and Rajeev D. S. Raizada, <i>NeuroPhone: Brain-Mobile Phone Interface using a Wireless EEG Headset</i> , Proceedings of The Second ACM SIGCOMM Workshop on Networking, Systems, and Applications on Mobile Handhelds (MobiHeld 2010), New Delhi, India, August 30, 2010.
PAKDD10	Pallika Kanani, Andrew McCallum and Shaohan Hu , <i>Resource-bounded Information Extraction: Acquiring Missing Feature Values On Demand</i> , Proceedings of the 14th PA Conference on Knowledge Discovery and Data Mining (PAKDD 2010), Hyderabad, India. June 21–24, 2010. (Best student paper runner-up award)
SUBMITTED TO RTSS14	Yunlong Gao, Shaohan Hu , Renato Mancuso, Minje Kim, Po-Liang Wu, Lu Su, Lui Sha, Tarek F. Abdelzaher, <i>The Emergency Transcriber: A Workflow-aware Recording System for Noisy Acoustic Environments</i> , Under Submission to RTSS14
SUBMITTED TO RTSS14	Shen Li, Shaohan Hu , Tarek F. Abdelzaher, <i>Real-Time Scheduling Analysis for MapReduce Workflows</i> , Under Submission to RTSS14

SUBMITTED TO RTSS14	Lu Su, Qi Li, Shaohan Hu , Shiguang Wang, Jing Gao, Hengchang Liu, Tarek F. Abdelzaher, Jiawei Han, Xue Liu, Yan Gao, Lance Kaplan, <i>Generalized Decision Aggregation in Distributed Sensing Systems</i> , Under Submission to RTSS14
SUBMITTED	Shaohan Hu , Lu Su, Shen Li, Shiguang Wang, Chenji Pan, Siyu Gu, Md Tanvir Amin, Hengchang Liu, Suman Nath, Romit Roy Choudhury, Tarek F. Abdelzaher, <i>eNav: Smartphone-based Energy Efficient Location Sensing for Low-Power Vehicular Navigation</i> , Under Submission.
SUBMITTED TO TMC	Fatemeh Saremi, Omid Fatemieh, Hossein Ahmadi, Hongyan Wang, Hasan Babaei, Hengchang Liu, Shaohan Hu , Shen Li, Lu Su, Raghu Ganti, Tarek Abdelzaher, <i>Experiences with GreenGPS Fuel-Efficient Navigation using Participatory Sensing</i> , Under Submission to IEEE Transactions on Mobile Computing.
SUBMITTED TO TOSN	Shaohan Hu , Lu Su, Hengchang Liu, Hongyan Wang, Tarek F. Abdelzaher, <i>SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System</i> , Under Submission to ACM Transactions on Sensor Networks.
PROFESSIONAL SERVICES	<p>Technical Program Committee UBICOMM – 2012, 2013, 2014</p> <p>Conference Reviewer SECON – 2014 ICDM – 2013 ICCCT – 2013 UBICOMP – 2012</p> <p>Journal Reviewer IEEE TRANSACTIONS ON MOBILE COMPUTING – 2014 IEEE/ACM TRANSACTIONS ON NETWORKING – 2014 AD HOC & SENSOR WIRELESS NETWORKS – 2013 INTERNATIONAL JOURNAL OF GEO-INFORMATION – 2012</p>
TEACHING EXPERIENCES	<p>University of Illinois at Urbana-Champaign</p> <ul style="list-style-type: none"> • Teaching Assistant CS 125: Introduction to Computer Science Basic Data Structure, Algorithm, OOP using Java <p>Dartmouth College</p> <ul style="list-style-type: none"> • Teaching Assistant CS 23: Software Design and Implementation – or, how to be a hacker Linux Bash scripting, design and implementation using C: web search (data crawling, indexing, and querying), and embedded Linux environment distributed concurrent system (remote robot control system) • Teaching Assistant CS 8: Problem Solving with Computer Science Functional programming, Haskell language • Teaching Assistant CS 5: Introduction to Computer Science Basic Data Structure, OOP using Java • Teaching Assistant CS 4: Concepts in Computing

Overview of computing and computer science, basic programming using html/css/javascript, debugging, design

University of Massachusetts at Amherst

- **Teaching Assistant**

Math 300: Fundamental Concepts of Mathematics

Discrete mathematics, number theory, logics, set theory, rigorous proofs

- **Grader**

CS 311: Introduction to Algorithms

Basic algorithm design, analysis, and implementations, sorting, searching, string processing, graphs

PRESS COVERAGES *The Next Step in Bionics*, CBS NEWS, <http://www.cbsnews.com/stories/2011/10/09/sunday/main20117796.shtml>, October 2011

The Cyborg in Us All, THE NEW YORK TIMES, <http://www.nytimes.com/2011/09/18/magazine/the-cyborg-in-us-all.html>, September 2011

Mobile Phone Mind Control, TECHNOLOGY REVIEW, <http://www.technologyreview.com/blog/editors/24993/>, March 2010

**HONORS AND
AWARDS**

Teachers Rated Excellent, Department of Computer Science, UIUC, March 2012

Best TA, Department of Computer Science, Dartmouth College, September 2010

Outstanding Graduate Student Teacher, Dartmouth Center for the Advancement of Learning, Dartmouth College, April 2010

CSEM (Computer Science, Engineering and Mathematics) Scholarship, UMass Amherst, January 2005–May 2008

Dean's List Honors, UMass Amherst, January 2005–May 2008

Barkesdale Scholarship, UMass Amherst, March 2007

First Place Winner, Henry Jacob Mathematics Competition, UMass Amherst, March 2006

Second Place Winner, Henry Jacob Mathematics Competition, UMass Amherst, March 2005

COMPUTER SKILLS Languages: C, Java, Python, Matlab, L^AT_EX
Platforms: Linux, Mac OS X, Windows, Android, iOS

**WORK
AUTHORIZATION** U.S. Citizen

REFERENCES Tarek F. Abdelzaher
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