# Shaohan Hu

Last Updated on February 19, 2014


**Contact Information**

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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

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.

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.

SUBMITTED TO MOBISYS14 **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*, Under Submission to MobiSys 2014.

SUBMITTED TO TOSN **Shaohan Hu**, Lu Su, Hengchang Liu, Hongyan Wang, Tarek F. Abdelzaher, *SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System*, Under Submission to ACM Transactions on Sensor Networks.

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, *Proteus: Power Proportional Memory Cache Cluster in Data Centers*, The 33rd International Conference on Distributed Computing Systems (ICDCS 2013), Philadelphia, PA, July 8–11, 2013.

UIUC TR **Shaohan Hu**, Lu Su, Hengchang Liu, Hongyan Wang, Tarek F. Abdelzaher, *SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System*, UIUC Technical Report, April 18, 2013.

INFOCOM13 Hengchang Liu, **Shaohan Hu**, Wei Zheng, Zhiheng Xie, Shiguang Wang, Pan Hui, and Tarek F. Abdelzaher, *Efficient 3G Budget Utilization in Mobile Participatory Sensing Applications*, 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, *Poster Abstract: SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System*, The 12th ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN 2013), Philadelphia, PA, April 8–11, 2013.

PUC — Nicholas D. Lane, Ye Xu, Hong Lu, **Shaohan Hu**, Tanzeem Choudhury, Andrew T. Campbell, and Feng Zhao, *Community Similarity Networks*, ACM/Springer Journal of Personal and Ubiquitous Computing (PUC), Special Issue on Cross-Community Mining, May, 2013.

UIUC TR — Shiguang Wang, **Shaohan Hu**, Shen Li, Hengchang Liu, Md Yusuf Sarwar Uddin, and Tarek F. Abdelzaher, *MINERVA: Information-Centric Programming for Social Sensing*, UIUC, January 15, 2013

RTSS12 — Lu Su, **Shaohan Hu**, Shen Li, Feng Liang, Jing Gao, Tarek F. Abdelzaher, and Jiawei Han, *Quality of Information based Data Selection and Transmission in Wireless Sensor Networks*, 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, *Enabling Large-scale Human Activity Inference on Smartphones using Community Similarity Networks (CSN)*, 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, *NeuroPhone: Brain-Mobile Phone Interface using a Wireless EEG Headset*, 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**, *Resource-bounded Information Extraction: Acquiring Missing Feature Values On Demand*, 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)

SUBMITTED TO 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*, Under Submission to DCOSS 2014.

SUBMITTED — Zongwei Zhu, **Shaohan Hu**, Hengchang Liu, Xuehai Zhou, *A Thread Behavior-based Memory Address Mapping Schema for Memory Power Optimization on Smartphones*, Under Submission.

SUBMITTED TO 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*, Under Submission to ICDCS 2014.

PROFESSIONAL SERVICES

**Technical Program Committee**
UBICOMM – 2012, 2013, 2014

**Conference Reviewer**
SECON – 2014
ICDM – 2013
ICCCT – 2013
UBICOMP – 2012

**Journal Reviewer**
IEEE/ACM TRANSACTIONS ON NETWORKING – 2014
AD HOC & SENSOR WIRELESS NETWORKS – 2013
INTERNATIONAL JOURNAL OF GEO-INFORMATION – 2012

## Teaching Experiences

**University of Illinois at Urbana-Champaign**

- **Teaching Assistant**
  CS 125: Introduction to Computer Science
  Basic Data Structure, Algorithm, OOP using Java

**Dartmouth College**

- **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, LaTeX
Platforms: Linux, Mac OS X, Windows, Android, iOS

REFERENCES

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