Shaohan Hu

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

- **SmartRoad: Participatory Road Sensing**
  Funded by NSF, Siebel Foundation; in collaboration with Microsoft Research. 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 (resulted paper published in Infocom 2013).
  - 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.
  - 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 (resulted paper under submission).
  - Mobile phone energy-efficient vehicle navigation, which aims at providing 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 unites for navigation.
- **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.

- **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 (resulted 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 (resulted 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 (resulted 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 (resulted paper published in PAKDD 2010).

PUBLICATIONS

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.

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 Shen Li, Shiguang Wang, Fan Yang, **Shaohan Hu**, Fatemeh Saremi, Tarek Abdelzaher, *Proteus: Power Proportional Memory Cache Cluster in Data Centers*, under submission

SUBMITTED **Shaohan Hu**, Lu Su, Hengchang Liu, Hongyan Wang, Tarek Abdelzaher, *SmartRoad: A Crowd-Sourced Traffic Regulator Detection and Identification System*, under submission

PROFESSIONAL SERVICES

Technical Program Committee
UBICOMM 2012

Conference Reviewer
UBICOMP 2012

Journal Reviewer
INTERNATIONAL JOURNAL OF GEO-INFORMATION May, July 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, 10/09/2011, `http://www.cbsnews.com/stories/2011/10/09/sunday/main20117796.shtml`

The Cyborg in Us All, The New York Times, 09/14/2011, `http://www.nytimes.com/2011/09/18/magazine/the-cyborg-in-us-all.html`

Mobile Phone Mind Control, Technology Review, 03/2010, `http://www.technologyreview.com/blog/editors/24993/`

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