

Keng-hao Chang

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RESEARCH INTEREST

Human-Computer Interaction, Ubiquitous Computing, Machine Learning, Sensors, Healthcare Technologies, Mobile Computing

EDUCATION

- Aug 2006 ~ present* **University of California, Berkeley, CA**
Ph.D. in Computer Science
Advisor: John Canny
- June 2006* **National Taiwan University, Taipei, Taiwan**
M.S. in Computer Science
Advisor: Hao-hua Chu
- June 2004* **National Taiwan University, Taipei, Taiwan**
B.S. in Computer Science

Honors and Awards

- Fall 2006 ~ Sp 2007* **Departmental Fellowship**
EECS, University of California, Berkeley
- 2004 July* **Honorable mentioned award**
The IEEE Computer Society 5th Annual International Design Competition
- 2003* **Presidential award, National Taiwan University**

RESEARCH EXPERIENCE

- Aug 2006 ~ present* **Graduate Student Researcher, University of California, Berkeley**

Project I: Applying Speech Analysis Techniques to Monitor Mental Health

The research is aimed toward exploring a continuous, ambulatory monitor of mental health. The monitor will be built with a computerized method that analyzes people's speech utterances. In particular, it extracts characteristics from speech, correlates the cues with mental status, and generates reports describing the longitudinal fluctuations of mental status.

The project has potential impacts in a variety of ways. First of all, it can facilitate physicians toward more effective diagnosis, by the track of longitudinal fluctuation of mental status, the identification of triggers for negative emotional states, the investigation of the time course of recovery from depression, and the symptoms indicating the onset of next episode. Secondly, it can reduce the impact of mental disorder on at-risk groups, by the identification of early signs of mental illness breakout. Thirdly, it can enable community support and

intervention, by the dissemination of up-to-date health status to care providers, including psychiatrists, family, friends, and support group members.

The project is partnered with a psychiatrist in UC Davis Medical Center and a professor in department of psychology at UC Berkeley. We are currently interviewing their diagnostic practice in order to understand the relationship between voice characteristics and mental health.

Project II: Towards Balanced Exercise Programs: Supporting Free Weight Exercises

We incorporated a three-axis accelerometer into a workout glove to monitor hand movements and put another accelerometer on a user's waist to track body posture. From our performance study of different machine learning methods (Naïve Bayes Classifier and Hidden Markov Models) and signal processing tools, we showed that the accelerometer-based approach can recognize (1) what type of free weight exercise you are doing by 80% of accuracy and count (2) how many repetitions you have done so far by 90% of accuracy. The work was published in Ubicomp 2007 (Innsbruck, Austria). We plan to build mobile applications that provide users with better representation of exercise progress, easier exercise management tool, and new exercise experience with visual/auditory feedbacks.

May-Aug 2008 **Research Intern, Intel Research Seattle, WA**

We showed that accelerometers embedded in a television remote control can be used to distinguish household members based on the unique way each person wields the remote. Based on five 1-3 week data sets collected from real homes, using 372 features including key press codes, key press timing, and 3-axis acceleration parameters including dominant frequency, energy, mean, and variance, we show household member identification accuracy of 70-92% with a Max-Margin Markov Network (M3 N) classifier.

May ~ Aug 2007 **Research Intern, IBM Almaden Research Center, CA**

We studied methods to achieve effective health monitoring in home environment. We chose a weight scale as a demonstration device and connected it to cellular network and speech user interface.

Sep 2004 ~ Jun 2006 **Graduate Research Assistant, National Taiwan University, Taiwan**

I designed and implemented several *intelligent artifacts*, which could be seamlessly applied to our everyday environment. These projects required skills of hardware prototyping, sensors knowledge, artificial intelligence, and game design.

Project I: Dietary-aware Dining Table

We are what we eat. We built a diet-aware dining table that can track what and how much we eat. The dining table is augmented with two layers of weighing and RFID sensor surfaces. Incorporating AI inference rules, the system can recognize multiple, concurrent dietary activities occurring on the table. This work was published in Pervasive 2006 (Dublin, Ireland) and is the topic of my master thesis.

Project II: Persuasive Game to Encourage Healthy Dietary Behaviors of Young Children

This project is an extension of the "diet-aware dining table", but this time we instrumented the lunch trays used by children in kindergarten. We designed and built an interactive game to persuade children to try the food they are afraid of. The game uses the eating activity as the input and engages children to color cartoon characters. This project was started when I studied my master degree and it continues after my graduation. There was a demonstration in Ubicomp 2006 (Orange County, USA) and a full paper in Ubicomp 2007 (Innsbruck, Austria).

Project III: Geta Sandals: Indoor Location System

This footprint-based indoor location system is built on a pair of traditional Japanese Geta sandals, in which ultrasonic transceivers, orientation sensors and pressure sensors are instrumented to measure the distance of each foot step. The system tracks a user's locations by summing up step distance vectors and requires little setup and calibration efforts. In addition, we did extensive study by combining multiple sensors (including accelerometers) and filter techniques to improve the accuracy (currently error <10% of walking distance, suitable for indoors environment). This is a joint work with other colleagues in NTU and it was demonstrated in Ubicomp 2005 (Tokyo, Japan), with great success.

Project IV: Model, Simulate, and Compare Two Synchronization Mechanisms

Research includes mathematical modeling and simulation comparison of two different synchronization protocols.

PUBLICATION

Conference Papers

Inferring Identity using Accelerometers in Television Remote Controls

Keng-hao Chang, Jeffrey Hightower, Branislav Kveton, in Proceedings of the 7th International Conference on Pervasive Computing (Pervasive 2009), Nara, Japan, May 2009

Simplifying home health monitoring by incorporating a cell phone in a weight scale

Thomas G. Zimmerman, Keng-hao Chang, in Proceedings of the 1st international conference on Pervasive Technologies Related to Assistive Environments, Athens, Greece, June 2008

Towards Balanced Exercise Programs: Tracking Free-weight Exercises

Keng-hao Chang, Mike Y. Chen, John Canny, in Proceedings of the 9th International Conference on Ubiquitous Computing (UBICOMP 2007), Innsbruck, Austria, September 2007.

Dietary-Aware Dining Table - Observing Dietary Behaviors over Tabletop Surface

Keng-hao Chang, Shih-yen Liu, Hao-hua Chu, Jane Yung-jen Hsu, Cheryl Chen, Tung-yun Lin, Polly Huang, in proceedings of the 4th International Conference on Pervasive Computing (Pervasive 2006), Dublin, Ireland, May 2006.

Journal Papers

The GETA Sandals: A Footprint Location Tracking System

Shun-yuan Yeh, Chon-in Wu, Keng-hao Chang, Hao-hua Chu, Jane Yung-jen Hsu, Springer Personal and Ubiquitous Computing Journal (PUC), special issue for

Location- and Context-Awareness, Feb. 2007.

Workshop Papers **The GETA Sandals: A Footprint Location Tracking System**

Kenji Okuda, Shun-yuan Yeh, Chon-in Wu, Keng-hao Chang, Hao-hua Chu, Workshop on Location- and Context-Awareness (LoCa 2005), in Cooperation with Pervasive 2005 , (also published as Lecture Notes in Computer Science 3479, Location- and Context-Awareness), Munich, Germany, May 2005, pages 120-131.

Dietary-Aware Dining Table - Tracking What and How Much You Eat

Keng-hao Chang, Shih-yen Liu, Jr-ben Tian, Hao-hua Chu, Cheryl Chen, Proceedings of Workshop on Smart Object Systems, in conjunction with the Seventh International Conference on Ubiquitous Computing (ACM UbiComp 2005), Tokyo, Japan, September 11, 2005, pages 61-68

Demos and Posters **Collaborative, context-aware experience sampling for depressive patients**

Li-shan Wang, Sheng-hsiang Yu, Keng-hao Chang, Sue-huei Chen, Hao-hua Chu, in the Late Breaking Results (LBR) session and Adjunct Proceedings of the 9th International Conference on Ubiquitous Computing (UBICOMP 2007), Innsbruck, Austria, September 2007.

A Smart Kitchen to Promote Healthy Cooking

Jen-hao Chen, Keng-hao Chang, Pei-yu Chi, Hao-hua Chu, Poster Paper & Adjunct Proceedings of the 8th International Conference on Ubiquitous Computing (ACM UbiComp 2006), California, September, 2006.

A Persuasive Game to Encourage Healthy Dietary Behaviors of Young Children

Tung-yun Lin, Keng-hao Chang, Shih-yen Liu, Hao-hua Chu, Demo Paper & Adjunct Proceedings of the 8th International Conference on Ubiquitous Computing (ACM UbiComp 2006), California, September, 2006.

GETA Sandals: Knowing Where You Walk To

Shun-yuan Yeh, Keng-hao Chang, Chon-in Wu, Okuda Kenji, Hao-hua Chu, the demo paper (adjunct proceedings) of the Seventh International Conference on Ubiquitous Computing (ACM UbiComp 2005), Tokyo, Japan, September 11, 2005.

Technical Report **Modeling and Simulation Comparison of Two Time Synchronization Protocols**

Keng-hao Chang, Tsung-Han Lin, Hao-hua Chu, Polly Huang, Technical Report, National Taiwan University, 2004

TEACHING AND PROFESSIONAL EXPERIENCE

Graduate Student Instructor, *University of California, Berkeley*

Spring 2008 Introduction to Database Systems

Teaching Assistant, *National Taiwan University*

Fall 2004, Fall 2005 Database Systems

Spring 2005 Programming Language Structures

COMMUNITY ACTIVITIES

- 2008 **Reviewer**, *the 10th International Conference on Ubiquitous Computing (UbiComp)*
2007 **Student Volunteer**, *conference on Human Factors in Computing Systems (CHI)*
2006 **Student Volunteer**, *the 4th International Conference on Pervasive Computing*
2005 **Vice Chair**, *IEEE Student Branch, National Taiwan University*

MEDIA

- Nov 16, 2007 "A Personal Trainer, in the Palm of Your Hand", Discovery News
Nov 27, 2007 "For Weight Lifters, a Glove Fit for Fitness", The Daily Californian
(Student press in University of California, Berkeley)

SKILL

Software and Hardware Development

C, C++, C#, Java, XML, Perl, UNIX shell script, ASP.Net, C#.Net., LaTeX, HTML, PHP, Jess rule scripts, SQL, UNIX (Solaris, Linux, OpenBSD), nesC (for tinyOS), CCS C (PIC microprocessor programming), Eagle circuit design

*References available upon request