

Heng-Tze Cheng

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SUMMARY

- 6 years of research experience in machine learning, audio/image processing, and context-aware mobile systems.
- Published over 15 papers, 2 U.S. patents, and a Ph.D. dissertation in the related fields.
- 4 internship experiences at Google, Qualcomm Research Center, and Motorola Mobility Research.
- Strong programming skills in C++, Java, Python, and MATLAB. Experience in mobile application development.
- Expertise in various machine learning algorithms including classification, clustering, and probabilistic graphical models.
- Extensive experience in big data analytics using Google/Hadoop MapReduce framework.

EDUCATION

- Carnegie Mellon University (CMU)** 2009-2013
Ph.D., Electrical and Computer Engineering, GPA: 3.85/4.0
Research area: Machine learning and audio/image/multimodal signal processing for context-aware mobile and ubiquitous computing, human activity recognition, and indoor positioning/location recognition.
Dissertation: Learning and Recognizing The Hierarchical and Sequential Structure of Human Activities
- National Taiwan University (NTU)** 2004-2008
B.S., Electrical Engineering, GPA: 3.94/4.0 (overall), 4.0/4.0 (major)

WORK EXPERIENCE

- Google, U.S.** | Software Engineering Intern May-Aug 2013
- Designed two feature selection algorithms for conversion rate and click-through rate prediction models in Google Ads ranking. Implemented scalable algorithms using MapReduce framework.
 - Proposed model outperformed the model used in production, leading to a potential revenue gain.
- Motorola Mobility Research Center, U.S.** | Research Intern May-Aug 2012
- Designed and implemented a novel human activity recognition system using sensor data from mobile devices. Developed an Android app prototype with the activity recognition engine.
 - Filed a U.S. patent application.
- Motorola Mobility, U.S.** | Software Engineering Intern May-Aug 2011
- Designed a context-based multimedia recommender system using mobile phone sensors.
 - Developed/released the recommender app in Android for future production.
- Qualcomm Research Center, U.S.** | Engineering Research Intern May-Aug 2010
- Designed and implemented a set of new methods and apparatus for contactless gesture recognition using proximity sensor arrays for mobile devices.
 - Filed one U.S. patent application and published two conference papers [6][7].

RESEARCH EXPERIENCE

- CyLab Mobility Research Center** | Carnegie Mellon University Advisor: Martin Griss
- Semantic Attribute-Based Zero-Shot Learning for Human Activity Recognition** 2011-Present
- Designed and implemented zero-shot learning algorithms for time-series sensor data that can generalize knowledge to recognize unseen new activity without training data.
 - Achieved 70-80% accuracy recognizing previously unseen exercise/daily life activities [1][2].
- SensOrchestra: Collaborative Indoor Location Recognition for Context-Aware Applications** 2009-2011
- Developed a location recognition system using ambient features and multi-phone classifier fusion.
 - Achieved 92% accuracy using SVM classifier. Reduced single-phone error rate by 2X [3][8].

Chord Recognition and Audio Segmentation for Music Search and Recommendation

2007-2008

- Designed an HMM-based chord recognition system. Outperformed MFCC/MPEG-7 features for music classification and retrieval [17].
- Proposed a multimodal approach for emotion-based music retrieval using Topic Models [18][19].
- Adopted by music retrieval service of Chunghwa Telecom, Taiwan's largest telecom company.

Speech Processing Lab | National Taiwan University

Advisor: Lin-shan Lee

Histogram-Based Quantization for Robust and Distributed Speech Recognition

2007-2008

- Modified the assumption of probability distribution used in histogram-based quantization.
- Improved the robustness of speech recognition under low SNR using quantized audio features.

SKILLS

Programming Languages	C/C++, Java, MATLAB, Python, JavaScript, PHP, Verilog, UNIX shell script
Software & Platforms	Google/Hadoop MapReduce, Android Development, OpenCV, OpenMP, CUDA, HTK Toolkit, Quartus, H.264/AVC JM Software
Languages	English (fluent), Chinese (native), Japanese (JLPT level 3), Spanish (basic)

PATENTS

- [1] [Heng-Tze Cheng](#), Paul Davis, Jianguo Li, Di You, "System and Method for Activity Recognition," U.S. Patent Application, 2012.
- [2] An Mei Chen, [Heng-Tze Cheng](#), Ashu Razdan, Elliot Buller, "Methods And Apparatus For Contactless Gesture Recognition," U.S. Patent Application 13/161955, 2011.
- [3] An Mei Chen, [Heng-Tze Cheng](#), Ashu Razdan, Elliot Buller, "Methods And Apparatus For Contactless Gesture Recognition and Power Reduction," European Patent Application EP2583164A1, 2011.

PUBLICATIONS

- [1] [Heng-Tze Cheng](#), Feng-Tso Sun, Martin Griss, Paul Davis, Jianguo Li, Di You, "NuActiv: Recognizing Unseen New Activities Using Semantic Attribute-Based Learning," in Proc. ACM Int'l Conf. Mobile Systems, Applications, and Services (MobiSys), 2013 (acceptance rate: 15.7%).
- [2] [Heng-Tze Cheng](#), Martin Griss, Paul Davis, Jianguo Li, Di You, "Towards Zero-Shot Learning for Human Activity Recognition Using Semantic Attribute Sequence Model," in Proc. ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp), 2013 (acceptance rate: 18%).
- [3] Feng-Tso Sun, Yi-Ting Yeh, [Heng-Tze Cheng](#), Cynthia Kuo, Martin Griss, "Nonparametric Discovery of Human Routine from Sensor Data," IEEE Int'l Conf. Pervasive Computing and Communications (PerCom), 2014 (acceptance rate: 14%).
- [4] [Heng-Tze Cheng](#), Senaka Buthpitiya, Feng-Tso Sun, Martin Griss, "SensOrchestra: Collaborative Sensing for Symbolic Location Recognition," Int'l Conf. Mobile Computing, Applications, Services, 2010. (**Best Paper Award**)
- [5] [Heng-Tze Cheng](#), Zheng Sun, Pei Zhang, "Imirok: Real-Time Imitative Robotic Arm Control for Home Robot Applications," in Proc. IEEE Int'l Conf. Pervasive Computing and Communications (PerCom), 2011.
- [6] [Heng-Tze Cheng](#), An Mei Chen, Ashu Razdan, Elliot Buller, "Contactless Gesture Recognition System Using Proximity Sensors," in Proc. IEEE Int'l Conf. Consumer Electronics (ICCE), 2011.
- [7] [Heng-Tze Cheng](#), An Mei Chen, Ashu Razdan, Elliot Buller, "Contactless Gesture Recognition for Mobile Devices," in Proc. ACM Int'l Conf. Intelligent User Interfaces (IUI) MIAA Workshop, 2011.
- [8] [Heng-Tze Cheng](#), Senaka Buthpitiya, Feng-Tso Sun, Martin Griss, "OmniSense: A Collaborative Sensing Framework for User Context Recognition Using Mobile Phones," in Proc. ACM International Workshop on Mobile Computing Systems and Applications (HotMobile), 2010.
- [9] [Heng-Tze Cheng](#), Feng-Tso Sun, Senaka Buthpitiya, Ying Zhang, Ara V. Nefian, "Lunar Image Classification for Terrain Detection," in Proc. Symposium on Visual Computing (ISVC), 2010.
- [10] Le T. Nguyen, [Heng-Tze Cheng](#), Pang Wu, Senaka Buthpitiya, and Ying Zhang, "PnLUM: System for Prediction of Next Location for Users with Mobility," in Proc. Int'l Conf. Pervasive Computing (Pervasive) Mobile Data Challenge, 2012.
- [11] Feng-Tso Sun, Cynthia Kuo, [Heng-Tze Cheng](#), Senaka Buthpitiya, Patricia Collins, Martin Griss, "Activity-Aware Mental

- Stress Recognition Using Physiological Sensors," in Proc. Int'l Conf. Mobile Computing, Applications, and Services, 2010.
- [12] Senaka Buthpitiya, Feng-Tso Sun, Heng-Tze Cheng, et al., "Anubis: An attestation protocol for distributed context-aware applications," in Int'l Conf. Intelligent Sensors, Sensor Networks & Information Processing, 2010.
- [13] Faisal Luqman, Feng-Tso Sun, Heng-Tze Cheng, Senaka Buthpitiya, Martin Griss, "Prioritizing data in emergency response based on context, message content and role," in Proc. ACM ACWR, 2011.
- [14] Senaka Buthpitiya, Heng-Tze Cheng, Feng-Tso Sun, Martin Griss, Anind K. Dey, "Hermes: a Context-Aware Application Development Framework for the Mobile Environment," in Proc. ACM International Workshop on Mobile Computing Systems and Applications (HotMobile), 2010.
- [15] Feng-Tso Sun, Heng-Tze Cheng, Senaka Buthpitiya, Martin Griss, "PainSense: Pain Assessment Through Reality Sensing," International Conference on Pervasive Computing (Pervasive), 2010.
- [16] Heng-Tze Cheng, Yi-Hsuan Yang, Yu-Ching Lin, Homer H. Chen, "Multimodal Structure Segmentation and Analysis of Music Using Audio and Textual Information", in Proc. IEEE Int'l Symposium on Circuits and Systems, 2009.
- [17] Heng-Tze Cheng, Yi-Hsuan Yang, Yu-Ching Lin, I-Bin Liao, and Homer H. Chen, "Automatic Chord Recognition for Music Classification and Retrieval," in IEEE Int'l Conf. Multimedia and Expo, 2008.
- [18] Yi-Hsuan Yang, Yu-Ching Lin, Heng-Tze Cheng, Homer H. Chen, "Mr. Emo: Music Retrieval in The Emotion Plane," in Proc. ACM Multimedia, Vancouver, BC, Canada, 2008.
- [19] Yi-Hsuan Yang, Yu-Ching Lin, Heng-Tze Cheng, I-Bin Liao, Yeh-Chin Ho, and Homer H. Chen, "Toward multi-modal music emotion classification," in Proc. Pacific-Rim Conf. Multimedia, pp. 70-79, 2008.

HONORS AND AWARDS

NSF & ACM SIGMOBILE MobiSys 2013 Travel Award	2013
Awarded to selected Ph.D. candidates with academic excellence and contributions to the research community.	
Qualcomm Innovation Fellowship 2012 Finalist	2012
Awarded to 32 out of 109 Ph.D. research proposals selected from 12 top schools in the U.S.	
Google GRAD CS Forum 2012	2012
Granted to 75 U.S./Canada students with academic excellence and leadership in computer science.	
McKinsey Insight Program 2012	2012
One of the 36 selected advanced degree holders to work in a team with McKinsey consultants and fellow participants to research, develop, and present a business strategy for a technology company.	
Best Paper Award	2010
International Conference on Mobile Computing, Applications, Services, 2010.	
Qualcomm Scholarship	2010
Granted by Office of The Chief Scientist, Qualcomm Research Center.	
Qualcomm Qualstar Outstanding Contribution Award	2010
Nokia Research Center Fellowship	2009
Granted to 2 students in Carnegie Mellon University.	
Carnegie Institute of Technology Dean's Fellowship	2009
Full tuition and stipend support granted to Ph.D. students with outstanding academic achievement.	
1st prize, National Engineering Paper Competition	2008
Awarded to one outstanding undergraduate research paper in Taiwan annually.	
1st prize, National Taiwan University Engineering Technology Paper Contest	2008
The largest undergraduate engineering research contest at National Taiwan University.	
Presidential Award	2008
Awarded to top 5% students in National Taiwan University (ranked 3/217).	
Dean's List Student	2007
An honor for top 10% students in each department of National Taiwan University.	
Undergraduate Research Participation Program Fellowship	2007
Project on music information retrieval, granted by National Science Council.	

PROFESSIONAL SERVICES

Guest Lecturer , Advanced Machine Learning, Carnegie Mellon University	2013
Invited Speaker , High Performance Computing & GPU Supercomputing Group of Silicon Valley	2013
Teaching Assistant , Advanced Machine Learning	2013
Teaching Assistant , Special Topics in Computer Systems: Mobile Hardware for Software Engineers	2012
Invited Reviewer , Neurocomputing Journal	2011
Invited Reviewer , International Conference on Mobile Computing, Applications, Services	2011

SHORT-TERM AND TEAM PROJECTS

Large-Scale Parallel Computing for Text Clustering, Natural Language Processing, and Social Media Analysis	
<ul style="list-style-type: none">Discovered contextually similar hashtags from 90 million Twitter tweets and 1 million unique hashtags.Modeled the correlation of popularity and text of 1 million songs using natural language processing.Achieved over 4X speedup on pairwise song similarity computation using Hadoop MapReduce.	Fall 2012
Semi-Supervised User Gender Prediction Using Browser Interaction Patterns	
<ul style="list-style-type: none">Devised a set of browser UI pattern features. Incorporated self-training to leverage unlabeled data.Achieved 72% accuracy on the Firefox 4 Beta Dataset of 1,134 users. (in Machine Learning)	Spring 2011
Vision-Based Robotic Arm Control Using Human Gestures	
<ul style="list-style-type: none">Designed a real-time system to control a robotic arm using human gestures [5].Implemented the optical-flow-based motion tracking algorithm using OpenCV.	Spring 2010
Lunar Image Classification for Terrain Detection (collaborated with NASA Research Center)	
<ul style="list-style-type: none">Investigated features and classification algorithm for terrain detection on lunar images from NASA.Achieved 95% accuracy using histogram of gradient orientation feature [9]. (in Statistical Learning)	Fall 2009
Time-of-flight Based Indoor Localization Using 802.15.4a Radio	
<ul style="list-style-type: none">Developed an indoor localization system using time-of-flight based ranging and multilateration.Implemented using 5 sensor nodes with Chirp Spread Spectrum radio. Achieved 2m error range.	Fall 2009
Automatic Image Segmentation Based on Markov Random Field	
<ul style="list-style-type: none">Devised an algorithm to segment cloth region given face locations using Graph Cut algorithm. (in Advanced Topics in Multimedia Analysis and Indexing)	Spring 2008
Interactive Billiards System on FPGA	
<ul style="list-style-type: none">Developed a billiards game featuring real cue sticks, CMOS Camera, and physical motion model.Implemented on FPGA with SRAM controller and VGA display. (in Digital Circuit Lab)	Spring 2007

LEADERSHIP AND ACTIVITIES

Conductor, National Taiwan University Chorus	2006-2007
Music director and conductor of a choir of more than 100 people, with 2 public performances.	
<ul style="list-style-type: none">Conductor, in <i>"To Dream The Impossible Dream"</i>, National Concert Hall.Conductor and Tenor Soloist, in <i>"Reminiscence"</i>, Zhongshan Hall.	2007 2006
Tenor Leader, National Taiwan University Chorus	2005-2006
1st prize, 11th Taiwan National Chorus Competition. Tenor Soloist in <i>"Path of The Centuries"</i> .	2006
Tenor/Music Arranger, SealyCorn A Cappella Group	2005-2007
2nd prize, 5th Taiwan Int'l Choral Ensemble Competition, 2005.	