Proposal for Ph.D. General Examinations

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Introduction

I am interested in building context-aware applications for mobile communication devices. A mobile user is, almost by definition, performing another task simultaneously, and will often be in a hands- and eyes-busy situation. Therefore, such applications require interaction metaphors and input/output channels that are different than the desktop computer and take into account cognitive resource availability. A mobile user may be constantly changing location and situation. Consequently, a system which is aware of the user's context, and preferably is capable of predicting it, can leverage this knowledge to better serve the user (whether that be acquiring some relevant information or presenting it in an appropriate mode or format).

The numerous communication devices that people carry around clearly indicate that there is a desire to be able to communicate all the time and from anywhere. Building appropriate interfaces for such devices, taking into account the various contexts in which they will be used, is a challenging task. For my main area I will concentrate on the underlying issues involved in building effective interfaces for mobile communication devices. My supporting technical area covers methods in pattern recognition and analysis, since I need to be competent in techniques of salient feature extraction out of large quantities of contextual data. Any system incorporating user tracking and capable of sophisticated pattern analysis raises privacy concerns. My supporting contextual area addresses these concerns from several perspectives.

Main area:
User Interface Design for Mobile Communication Devices
Christopher M. Schmandt, Examination Chair
Principal Research Scientist, Program in Media Arts and Sciences
Massachusetts Institute of Technology

Technical area:
Pattern Recognition and Analysis
Deb K. Roy, Ph.D.
Assistant Professor, Program in Media Arts and Sciences
Massachusetts Institute of Technology

Contextual area:
Privacy
Mark Ackerman, Ph.D.
Research Scientist, Laboratory for Computer Science
Massachusetts Institute of Technology

Main Area: ***User Interface Design for Mobile Communication Devices***

Examiner: Chris Schmandt
Principal Research Scientist, Program in Media Arts and Sciences
Massachusetts Institute of Technology

Description
Mobile technology that delivers asynchronous communication has demanding user interface requirements. Since they are to be used in the "real world", almost by definition, the user will simultaneously be performing another task. This places a high cognitive demand on the user, which is further increased due to the small displays and miniature keyboards.

This domain can benefit from knowledge gained in three broader but relevant areas:
- UI for Small Devices and Multi-modality
- Context and Attention
- Mobile Communications

For this topic, I plan to explore the relevant underlying issues of these three areas, in order to better understand how to build effective user interfaces for mobile communication devices.

Written Requirement
The written requirement for this area will consist of a publishable-quality paper.

Signature: _____ Date: _____

Reading list

UI for Small Devices and Multi-modality

1. Myers, Brad and Hudson SE, Pausch R. *Past, Present and Future of User Interface Software Tools*. ACM Transactions on Computer-Human Interaction (toCHI), 7(1), March 2000, p.3-28.

2. Abowd, Gregory and Mynatt, Elizabeth. *Charting past, present, and future research in ubiquitous computing.* ACM Transactions on Computer-Human Interaction (toCHI), 7(1), March 2000, p.29-58.

3. Gong, Li and Lai, Jennifer. *Shall We Mix Synthetic Speech and Human Speech? Impact on Users' Performance, Perception and Attitude*. ACM CHI 2001 Proceedings.

4. Lai, Jennifer and Cheng K, Green P, Tsimhoni O. *On the Road and On the Web? Comprehension of Synthetic and Human Speech While Driving*. ACM CHI 2001 Proceedings.

5. Fukumoto, Masaaki and Tonomura, Yosinobu. *Whisper: A Wristwatch Style Wearable Handset.* ACM CHI'99 Proceedings, p.112-119.

6. Fukumoto, Masaaki and Tonomura, Yosinobu. *Body Coupled FingeRing: Wireless Wearable Keyboard*. ACM CHI'97 Proceedings, p.147-154.

7. Nelson, Les and Bly S, Sokoler T. *Quiet calls: talking silently on mobile phones*. ACM CHI 2001 Proceedings.

8. Suhm, Bernhard and Myers B, Waibel A. *Model-based and empirical evaluation of multi-modal interactive error correction*. ACM CHI'99 Proceedings, p.584-591.

9. Walker, Marilyn and Fromer J, Di Fabbrizio G, Mestel C, Hindle D. *What can I say?: Evaluating a Spoken Language Interface to Email.* ACM CHI'98 Proceedings, p.289-290

10. Oviatt, Sharon and Cohen P. *Multimodal Interfaces That Process What Comes Naturally.* Communications of the ACM, Vol. 43(3), March 2000, p. 45-53.

11. Jacobsson M, and Goldstein M, Anneroth M, Werdenhoff J, Chincholle D. (Ericsson Research). *An Action Control but no Action: Users Dismiss Single-Handed Navigation on PDAs*. NordiCHI 2000, p.1-10.

12. *Data egg*. Online at URL http://www.e2solutions.com/dataegg/

13. Nielsen, Jakob. *Noncommand user interfaces*.
An updated version of a paper that appeared in the Revised version of Communications of the ACM 36(4), April 1993, p.83-99, is available online at URL http://www.useit.com/papers/noncommand.html

14. Rahman, Tarjin and Muter, Paul. *Designing an Interface to Optimize Reading with Small Display Windows*. Human Factors 41(1), 1999, p.106-117.

15. Lai, Jennifer, and Wood D, Considine M. *The Effects of Task Conditions on the Comprehensibilty of Synthetic Speech*. ACM CHI 2000 Proceedings, p.321-328

16. Pisoni, David and Nusbaum H, Breene B. P*erception of Synthetic Speech Generated by Rule.* Proceedings of the IEEE 73(11), November 1985, p1665-1676

17. Norman, Donald. *The Invisible Computer*. MIT Press, 1999.
Selected chapters.

Context and Attention

18. Weiser, Mark. *The computer for the 21st Century*.
Scientific American, Volume 265, Number 3, September 1991, p.94-104.

19. Rhodes, Bradley. *Just-In-Time Information Retrieval.* Ph.D. Dissertation, MIT Media Lab, May 2000, Sections 3.1 and 3.3.

20. Allport, Allan. *Visual Attention.*
In Foundations of Cognitive Science, Michael Posner (ed), 1989

21. Wickens, CD. *Engineering Psychology and Human Performance*, 1992, p. 375-382

22. Mynatt, Elizabeth and Back M, Want R, Baer M, Ellis J. *Designing Audio Aura.*
ACM CHI'98 Proceedings, p.566-573.

23. Sawhney, Nitin and Schmandt, Chris. *Nomadic Radio: Speech & Audio Interaction for Contextual Messaging in Nomadic Environments.* ACM Transactions on Computer Human Interaction (toCHI), 7(3), Sept. 2000, p.353-383.

24. Philip E. Agre. *Changing places*. Version of December 17, 2000.

Mobile Communications

25. Pascoe, Jason and Ryan N, Morse D. *Using while moving: HCI issues in fieldwork environments*.
ACM Transactions on Computer-Human Interaction (toCHI), 7(3), September 2000, p.417-437.

26. Dix, Alan and Rodden T, Davies N, Trevor J, Friday A, Palfreyman K. *Exploiting space and location as a design framework for interactive mobile systems*. ACM Transactions on Computer-Human Interaction (toCHI), 7(3), Sept. 2000, p.285-321.

27. Buyukkokten, Orkut and Garcia-Molina H, Paepcke A. *Accordion Summarization for End-Game Browsing on PDAs and Cellular Phones*. ACM CHI 2001 Proceedings.

28. Heath, Christian and Luff, Paul. *Mobility in collaboration*.
ACM CSCW '98 Proceedings, p.305-314.

29. Hjelm, Johan. *Designing Wireless Information Services.* John Wiley & Sons, June 2000.
Selected chapters.

30. Hjelm, Johan and Cheng-Lin T, Fabry L, Fanchon T, Reichert F. *Building a UMTS User Interface*.
ACTS Mobile Communications Summit, 1996.

Supporting Technical Area: ***Pattern Recognition and Analysis***

Examiner
Prof. Deb K. Roy
Assistant Professor, Program in Media Arts and Sciences
Massachusetts Institute of Technology

Description
My goal is to familiarize myself with the main techniques/algorithms of the field, to understand high-level limitations and comparative advantages of the approaches (topics) below, in order to appreciate where and how they can be used.

Bayes Decision Theory
Parametric Estimation and Supervised Learning (maximum likelihood, Bayes)
Non-parametric Techniques (Parzen windows, k-nearest neighbour, Fischer linear disc.)
Linear Discriminant Techniques
Neural Networks (back-propagation)
Unsupervised Learning (maximum likelihood, Bayes)
HMMs
Bayes Nets
Learning from Temporal Differences

Written Requirement
The written requirement will consist of a 24-hour take home exam to be administered and evaluated by Prof. Roy.

Signature: _____ Date: _____

Reading list
1. Duda R., Hart P. & Stork D. (2000). *Pattern Classification*. John Wiley & Sons. Ch 1–6

2. Bishop C.M. (1995). *Neural Networks for Pattern Recognition*. Oxford University Press
Ch 1: Statistical Pattern Recognition
Ch 2: Probability Density Estimation
Ch 3: Single Layer Networks
Ch 4: The Multi-layer Perceptron
Ch 5: Radial Basis Functions
Ch 8: Pre-processing and Feature Extraction

3. Jain AK, Murty MN, Flynn PJ (1999). *Data Clustering: A review*
ACM Computing Surveys, 31: (3) 264-323 Sep 1999

4. Jain AK, Duin RPW, Mao JC (2000). *Statistical Pattern Recognition: A Review*
IEEE Transactions on Pattern Analysis and Machine Intelligence, 22: (1) 4-37, Jan 2000

5. Rabiner LR (1989). *A Tutorial on Hidden Markov Models and Selected Applications in Speech Recognition* Proceedings of IEEE, Vol 7, No. 2, Feb 1989

6. Burges CJC (1998). *A Tutorial on Support Vector Machines for Pattern Recognition*
Data Mining and Knowledge Discovery, 2: (2) 121-167 Jun 1998

7. Jain AK, Mao JC, Moniuddin KM (1996). *Artificial Neural Networks: A Tutorial*
IEEE Computer Special Issue on Neural Computing, March 1996

8. Sutton RS (1998). *Learning to Predict by the Method of Temporal Differences*
Machine Learning, 3: 9-44

9. Jensen, FV (1996). *An Introduction to Bayesian Networks*. Springer-Verlag, London.

10. McCallum, RA (1995). *Instance-based State Identification for Reinforcement Learning*
In Advances In Neural Information Processing Systems 7, MIT Press

11. Whitehead, SD (1992). *Reinforcement Learning for the Adaptive Control of Perception and Action*
Ph.D. Thesis, University of Rochester Computer Science Dept.

Supporting Contextual Area: ***Privacy***

Examiner
Prof. Mark Ackerman,
Research Scientist, Laboratory for Computer Science
Massachusetts Institute of Technology

Description
For this topic I plan to familiarize myself with background on the different aspects of privacy (moral, social, legal, etc) in western liberal societies. I will then focus more on how technologies, such as the Internet and wireless telephony, have impacted privacy. And how technology can, at least partially, be used to protect against what is perceived as an invasion of privacy.

Written Requirement
The written requirement will consist of a 24-hour take home exam to be administered and evaluated by Prof. Ackerman.

Signature: _____ Date: _____

Reading list
1. Schoeman, Ferdinand (1984). *Privacy: Philosophical Dimensions*
in Philosophical Dimensions of Privacy: An Anthology, Schoeman F, Cambridge University Press

2. Westin, Allan (1970). *The Origins of Modern Claims to Privacy*
in Privacy and Freedom, The Association of the Bar of the City of New York

3. Rachels, James. (1975). *Why privacy is Important*
Philosophy & Public Affairs 4(4) (Summer): 323-33, Princeton University Press

4. Gavison, Ruth. (1980). *Privacy and the Limits of Law*
Yale Law Journal 89: 421-71.

5. Posner, Richard A (1978). *An Economic Theory of Privacy*
Regulation (May/June): 19-26, American Enterprise Institute

6. Diffie, Whitfield and Landau, Susan (1999). *Privacy on the Line: the politics of wiretapping and encryption*, MIT Press. Selected chapters.

7. Agre, Philip (1994). *Surveillance and Capture: Two Models of Privacy*
The Information Society 10(2), June 1994

8. Berman, Jerry and Mulligan, Deirdre (1999). *Privacy in the Digital Age: Work in Progress*
Nova Law Review, 23(2), winter. The Internet and Law.

9. Agre, Philip (1995). *Looking Down the Road: Transport Informatics and the New Landscape of Privacy Issues*. CPSR Newsletter 13(3)

10. Hunter, Christopher (2000). *Recoding the Architecture of Cyberspace Privacy: Why Self-Regulation and Technology Are Not Enough*. http://www.asc.upenn.edu/usr/chunter/net_privacy_architecture.html

11. Ackerman, Mark and Cranor, Lorrie (1999). *Privacy Critics: UI Components to Safeguard Users' Privacy*. ACM Conference on Human Factors in Computing Systems (CHI'99), short papers, p.258-259

12. Cranor, Lorrie and Reagle, Joseph (1999). *The Platform for privacy Preferences* Communications of the ACM Vol 42, issue 2, p. 48-55

13. Coyle, Karen (1999). *P3P: Pretty Poor Privacy? A Social Analysis of the Platform for Privacy Preferences.* http://www.kcoyle.netp3p.html