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Citizen of India, US Permanent Resident

## RESEARCH INTERESTS

Activity recognition systems, perception algorithms, technology for elder care, depth-augmented vision, web-scale model extraction, statistical reasoning, artificial intelligence

## EDUCATION

Ph.D., Computer Science and Engineering, 2005  
“Automatic Staged Compilation”  
Adviser: Dr. Craig Chambers  
University of Washington, Seattle, WA

M.S., Computer Science and Engineering, 1996  
University of Washington, Seattle, WA

B.S., Computer Science, 1994  
Cornell University, Ithaca, NY

## EXPERIENCE

*Researcher*  
*Mobile Computing Research Center*

**Microsoft Research**  
**Sep 2011 – present**

Developing algorithms and systems for mobile computing, using phone-based sensors (especially cameras) to understand the phone’s user better.

*Project Lead*  
*Everyday Sensing and Perception*

**Intel Labs**  
**Jan 2008 – Nov 2010**

Project co-lead on the Everyday Sensing and Perception (ESP) project, setting technical direction for a team of twelve researchers and engineers. ESP developed sensors, algorithms, systems and usages to “understand 90% of your life with 90% accuracy”, focusing on high-datarate sensors (RGB and 3-D video). Key results include online semi-supervised learning algorithms for enhanced perception, signal-processing techniques for de-noising 3-D video, a state-of-the art real-time face recognition system, 3-D/RGB algorithms for recognizing handled objects and related daily activities, a projector-camera system (Bonfire) for augmenting interactions with notebooks, a vision-based system (Classmate Assist) for tutoring kindergartners in manipulation-based math tasks, and infrastructure for low-latency power-efficient vision. Yielded over a dozen top academic publications and joint product development with three Intel business units.

*Project Lead*  
*Technology for Long-Term Care*

**Intel Research**  
**Sep 2006 – Dec 2008**

Project lead on the Technology for Long-Term Care (TLC) project, leading a team of ten researchers and engineers. TLC was a technology-hardening and deployment effort aimed at demonstrating the utility of automated human activity recognition technologies to care givers for the elderly. TLC was a joint project between Intel Research, Intel’s Digital Health business group, the University of Washington, the US Department of Veterans Affairs, Providence Washington, Elderhealth Northwest and Swedish Home Care. Developed use cases for sensor-based technologies for care, recruited collaborators including lead customers and business group, secured funding, recruited team members, led system specification, design, implementation, intellectual property harvesting and evaluation. Resulted in an offer for a nationwide validation

deployment from the VA, accepted by Intel's Digital Health business unit. Strongly influenced the design of Digital Health's sensor-based monitoring technology.

*Project Lead*  
*Human Activity Recognition*

**Intel Research**  
**Jul 2002 – Aug 2006**

Project lead on the Human Activity Recognition (HAR) project, leading a team of four Ph.D.-level researchers and two support engineers. Led research resulting in the development of Radio Frequency Identification (RFID)-based sensors, large-scale common sense mining and reasoning techniques, and anomaly detection techniques. Led the production of a suite of sensors, software and prototype applications centered around large-scale human activity recognition. Led the transfer of HAR infrastructure to business groups within Intel and to outside entities. Developed a technology demonstration shown to U.S. Congress, the National Governor's Association and at a variety of other academic, industrial and press venues.

*Research Assistant*  
*Dynamic Compilation Group*

**University of Washington**  
**Seattle, WA**  
**1995 – 2002**

Developed techniques to enable very fast optimization of programs at run time, i.e., dynamic compilation. Designed, implemented and evaluated prototype dynamic compilation systems. Wrote or modified several compiler pipelines during the course of this work. Some of the work involved extensive modification of a commercial-quality compiler for wide machines, the Multiflow compiler.

*Summer Intern*  
*Compiler & Architecture Research Group*  
*Supervisor: Dr. Scott Mahlke*

**Hewlett Packard Laboratories**  
**Palo Alto, CA**  
**Summer 1996**

Extended the Elcor optimizing compiler (a research compiler for the Intel/HP EPIC architecture) to identify and prepare novel kinds of regions for predication and scheduling. Produced a detailed report documenting the technique and changes to the compiler framework. This work has become part of the Trimaran compiler infrastructure release.

*Teaching Assistant*  
*Department of Computer Science & Engg.*

**University of Washington**  
**Seattle, WA**  
**1994 – 1996**

Lectured, graded and held office hours for a mid-level programming language class taught by Professor Craig Chambers. Graded and held office hours for an introduction to programming class taught by professors Martin Tompa and Larry Ruzzo (two quarters).

*Technical Staff*  
*Cornell Theory Center*  
*Supervisor: Dr. Adolfy Hoisie*

**Cornell University**  
**Ithaca, NY**  
**1992 – 1994**

Measured the impact of various system characteristics (e.g. bandwidth, latency, process creation and synchronization overheads) of the KSR and SP-1 supercomputers on Theory Center workloads. Worked with two computer scientists and two physicists on parallelizing corning, a large quantum-mechanics simulation in FORTRAN from Corning, Inc.

## HONORS

2010 **OLCV-10 Best Paper Award**: 4th IEEE Online Learning for Computer Vision Workshop, "Online Semi-Supervised Perception: Real-Time Learning without Explicit Feedback", 2010

2005 **ISWC-05 Best Paper Award**: International Symposium on Wearable Computers, "Fine-Grained Activity Recognition by Aggregating Abstract Object Usage", 2005.

2004 **ACM SIGPLAN Best of PLDI**: “An Evaluation of Staged Run-Time Optimizations in DyC” was selected as one of the 50 most influential papers of the last 20 years in the *Programming Language Design and Implementation* conference.

1994 Douglas Whitney prize for writing in engineering, Cornell University

1990-94 Cornell University Foreign Student Scholarship, Cornell University

SERVICE

Program committee member for IJCAI 2009, Pervasive 2009, LoCA 2009, AAAI Fall Symposium 2009, AAAI 2008, Conference on Supporting Technology and Design for Healthy Aging 2008

KEYNOTES

NIPS Workshop on Machine Learning for Assistive Technologies, Whistler, 2010

Conference on Supporting Technology and Design for Health Aging, Seattle, 2007

Workshop on Intelligent Systems for Assisted Cognition, Rochester, NY, 2007

National Academic of Engineering Frontiers of Engineering, Niskayuna, NY, 2006

REFEREED JOURNAL/MAGAZINE ARTICLES

R. Beckwith, G. Theocharous, D. Avrahami and M. Philipose, “Tabletop ESP: Everyday Sensing and Perception In The Classroom”, *Intel Technology Journal* 14 (1), 2010

S. Reder, G. Ambler, M. Philipose, S. Hedrick, “Technology and Long-term Care (TLC): A pilot evaluation of remote monitoring of elders”, In *Gerontechnology* 9 (1), Winter 2010

Tamara L. Hayes, Kofi Cobbinah, Terry Dishongh, Jeffrey A. Kaye, Janna Kimel, Michael Labhard, Todd Leen, Jay Lundell, Umut Ozertem, Misha Pavel, Matthai Philipose, Kevin Rhodes, Sengul Vurgun, “A study of medication-taking and unobtrusive, intelligent reminding”, *Journal of Telemedicine and e-Health*, 15 (8), pp. 770–776, October 2009

N. Landwehr, B. Gutmann, I. Thon, M. Philipose, L. De Raedt, “Relational Transformation-based Tagging for Activity Recognition”, *Fundamenta Informaticae*, vol 89, No. 1, pp. 111–129, 2008

J. Letchner, C. Re, M. Balazinska, M. Philipose, “Challenges for Event Queries Over Markovian Streams”, *IEEE Internet Computing Magazine*, Special Issue on Data Management, December 2008

B. Jiang, J. Smith, M. Philipose, S. Roy, K. Sundara-Rajan, A. Mamishev, “Energy Scavenging for Inductively Coupled Passive RFID Systems”, *IEEE Transactions on Instrumentation and Measurement Technology*, vol 56, No. 1, February 2007

J. R. Smith, K. Fishkin, B. Jiang, A. Mamishev, M. Philipose, A. Rea, S. Roy, and K. Sundara-Rajan, “RFID-Based Techniques for Human Activity Recognition,” *Communications of the ACM*, vol. 48, no. 9, Sep 2005

M. Philipose, J. R. Smith, B. Jiang, K. Sundara-Rajan, A. Mamishev, and S. Roy, “Battery-Free Wireless Identification and Sensing,” *IEEE Pervasive Computing*, vol. 4, no. 1, pp. 37–45, January 2005

M. Philipose, K. P. Fishkin, M. Perkowitz, D. J. Patterson, D. Fox, H. Kautz, and D. Hähnel, “Inferring Activities from Interactions with Objects,” *IEEE Pervasive Computing*, vol. 3 no. 4, pp. 50–57, October 2004

B. Grant, M. Mock, M. Philipose, C. Chambers, and S. J. Eggers, “DyC: An Expressive Annotation-Directed Dynamic Compiler for C,” *Theoretical Computer Science*, vol. 248, no.

1-2, pp. 147–199, October 2000

REFEREED  
CONFERENCE  
ARTICLES

N. Butko, G. Theodorou, M. Philipose and J. Movellan, “Automated Facial Affect Analysis for one-on-one Tutoring Applications”, *IEEE International Conference on Automatic Face and Gesture Recognition (FG)*, Santa Barbara, March 2011

J. Letchner, C. Re, M. Balazinska, M. Philipose, “Approximation Tradeoffs in a Markovian Stream Warehouse: An Empirical Study”, In *Proceedings of ICDE 2010*, 2010

M. Buettner, R. Prasad, M. Philipose, D. Wetherall, “Recognizing Daily Activities with RFID-Based Sensors”, In *Proceedings of the Eleventh International Conference on Ubiquitous Computing (UbiComp)*, Orlando, September 2009

Shaun K. Kane, Daniel Avrahami, Jacob O. Wobbrock, Beverly Harrison, Adam Rea, Matthai Philipose, Anthony LaMarca, “Bonfire: A Nomadic System for Hybrid Laptop-Tabletop Interaction”, *Proceedings of the 22nd Symposium on User Interface Software and Technology*, Victoria, Canada, October 2009

J. Letchner, C. Re, M. Balazinska, M. Philipose, “Access Methods for Markovian Streams”, *Proceedings of the 25th International Conference on Data Engineering (ICDE)*, Shanghai, April 2009

W. Pentney, M. Philipose, J. Bilmes, “Structure Learning on Large-Scale Statistical Models of Human State,” *Proceedings of the National Conference on Artificial Intelligence (AAAI)*, Chicago, July 2008

J. Wu, A. Osuntogun, T. Choudhury, M. Philipose, J. Rehg, “A Scalable Approach to Activity Recognition Based on Object Use”, In *Proceedings of the Eleventh International Conference on Computer Vision (ICCV)*, Rio de Janeiro, Brazil, October 2007

B. Logan, J. Healey, M. Philipose, E. Munguia-Tapia and S. Intille, “A Longitudinal Evaluation of Sensing Modalities for Activity Recognition,” *Proceedings of the Ninth International Conference on Ubiquitous Computing (UbiComp)*, Innsbruck, September 2007

S. Vurgun, M. Philipose, M. Pavel, “A Statistical Reasoning System for Medication Prompting,” *Proceedings of the Ninth International Conference on Ubiquitous Computing (UbiComp)*, Innsbruck, September 2007

W. Pentney, M. Philipose, J. Bilmes, H. Kautz, “Learning Large Scale Common Sense Models of Everyday Life,” *Proceedings of the National Conference on Artificial Intelligence (AAAI)*, Vancouver B. C. July 2007

S. Wang, W. Pentney, A. –M. Popescu, T. Choudhury, M. Philipose, “Common Sense Based Joint Training of Human Activity Recognizers,” *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI)*, Hyderabad, January 2007

W. Pentney, A. –M. Popescu, S. Wang, H. Kautz, M. Philipose, “Sensor-Based Understanding of Daily Life via Large-Scale Use of Common Sense,” *Proceedings of the National Conference on Artificial Intelligence (AAAI)*, Boston, July 2006

E. Munguia-Tapia, T. Choudhury, M. Philipose, “Building Reliable Activity Models using Hierarchical Shrinkage and Mined Ontology,” *Proceedings of the Fourth International Conference on Pervasive Computing (Pervasive)*, Dublin, May 2006

A. Rea, K. Fishkin and M. Philipose, “Hands-On RFID: Wireless Wearables for Detecting Use of Objects,” In *Proceedings of the International Symposium on Wearable Computers (ISWC)*, Osaka, October 2005

D. Patterson, D. Fox, H. Kautz, and M. Philipose, "Fine-Grained Activity Recognition by Aggregating Abstract Object Usage," In *Proceedings of the International Symposium on Wearable Computers (ISWC)*, Osaka, October 2005

D. H. Wilson and M. Philipose, "Maximum A Posteriori Path Estimation with Input Trace Perturbation: Algorithms and Application to Credible Rating of Human Routines," *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI)*, Edinburgh, August 2005

D. Wyatt, M. Philipose, and T. Choudhury, "Unsupervised Activity Recognition Using Automatically Mined Common Sense," *Proceedings of the National Conference on Artificial Intelligence (AAAI)*, Pittsburgh, July 2005

B. Jiang, J. Smith, M. Philipose, S. Roy, K. Sundara-Rajan, A. Mamishev, "Energy Scavenging for Inductively Coupled Passive RFID Systems," *Proceedings of IEEE Instrumentation and Measurement Technology Conference (IMTC)*, Ottawa, May 2005

K. P. Fishkin, B. Jiang, M. Philipose, and S. Roy, "I Sense a Disturbance in the Force: Long-range Detection of Interactions with RFID-tagged Objects," *Proceedings of the Sixth International Conference on Ubiquitous Computing (UbiComp)*, Nottingham, September 2004

D. Hähnel, W. Burgard, D. Fox, K. Fishkin, and M. Philipose, "Mapping and Localization with RFID Technology," In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, New Orleans, April 2004

M. Perkowitz, M. Philipose, D. J. Patterson, K. P. Fishkin, "Mining Models of Human Activities from the Web," In *Proceedings of the Thirteenth International World Wide Web Conference (WWW)*, New York, May 2004

M. Philipose, C. Chambers, S. J. Eggers, "Towards Automatic Construction of Staged Compilers," In *Proceedings of the 29th Annual ACM SIGPLAN-SIGACT Conference on Principles of Programming Languages (POPL)*, Portland, January 2002

B. Grant, M. Philipose, M. Mock, C. Chambers, S. J. Eggers, "An Evaluation of Staged Run-time Optimizations in DyC," In *Proceedings of the 1999 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, Atlanta, May 1999

B. Grant, M. Mock, M. Philipose, C. Chambers and S. J. Eggers, "Annotation-Directed Run-Time Specialization in C," in *Proceedings of the ACM SIGPLAN Symposium on Partial Evaluation and Semantics Based Program Manipulation (PEPM)*, Amsterdam, June 1997

J. Auslander, M. Philipose, C. Chambers, S. J. Eggers and B. N. Bershad, "Fast, Effective Dynamic Compilation," In *Proceedings of the 1996 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, Philadelphia, May 1996

REFEREED  
WORKSHOP  
ARTICLES

G. Theocharous, N. Butko and M. Philipose, "The Research Challenges of ClassmateAssist: A Personal and Physical Math Coin Tutoring System", *Workshop on Machine Learning for Assistive Technologies (NIPS)*, Whistler, December 2010

G. Theocharous, R. Beckwith, N. Butko and M. Philipose, "Tractable POMDP Planning Algorithms for Optimal Teaching in SPAIS", *Workshop on Plan Activity, and Intent Recognition (PAIR)*, *International Joint Conference on Artificial Intelligence (IJCAI)*, Pasadena, July 2009.

B. Kveton, M. Valko, M. Philipose, and L. Huang, "Online Semi-Supervised Perception: Real-Time Learning without Explicit Feedback", In *Proceedings of the 4th IEEE Online Learning for Computer Vision Workshop*, San Francisco, June 2010 (**Best paper award**)

- G. Theocharous, N. Butko and M. Philipose, "Designing a Mathematical Manipulatives Tutoring System Using POMDPs", *POMDP Practitioners Workshop: Solving Real-world POMDP Problems, International Conference on Automated Planning and Scheduling (ICAPS)*, Toronto, May 2010
- Richard Beckwith, G. Theocharous, M. Philipose, N. Butko, N. Schmied and V. Mathew. IRL: Virtual Reality and Physical Manipulatives. Workshop on Next Generation of HCI and Education, CHI (ACM Conference on Human Factors in Computing Systems), Atlanta, April 2010
- X. Ren, M. Philipose, "Egocentric Recognition of Handled Objects", In Proceedings of the *First CVPR Workshop on Egocentric Vision*, Miami, June 2009
- J. Letchner, C. Re, M. Balazinska, M. Philipose. "Lahar Demonstration: Warehousing Markovian Streams", In *Proceedings of VLDB*, Volume 2, 2009, p. 1610–1613
- N. Landwehr, B. Gutmann, I. Thon, M. Philipose, L. De Raedt, "Relational Transformation-Based Tagging for Human Activity Recognition", In *Proceedings of the 6th Workshop on Multi-Relational Data Mining (MRDM)*, Warsaw, Poland, September 2007
- W. Pentney, A. –M. Popescu, S. Wang, J. Bilmes, H. Kautz, M. Philipose, "Human State Estimation Through Learning Over Common Sense Data," *Proceedings of NIPS 2006 Workshop on Grounding Perception, Knowledge and Cognition in Sensori-Motor Experience*, Whistler, Canada, December 2006
- D. H. Wilson, S. Consolvo, K. Fishkin and M. Philipose, "In-Home Assessment of the Activities of Daily Living of the Elderly", In *Extended Abstracts of CHI 2005: Workshops - HCI Challenges in Health Assessment*, page 2130, Portland, OR, April 2005
- J. R. Smith, B. Jiang, S. Roy, M. Philipose, K. Sundara-Rajan, and A. Mamishev, "ID Modulation: Embedding Sensor Data in RFID Timeseries", In *Proceedings of the Information Hiding Workshop 2005*, LNCS 3727, pp 234-246, Barcelona, February 2005
- Donald J. Patterson, Ken Fishkin, Dieter Fox, Henry Kautz, Mike Perkowitz, and M. Philipose, "Contextual Computer Support for Human Activity", *AAAI 2004 Spring Symposium on Interaction Between Humans and Autonomous Systems over Extended Operation*, Stanford, 2004
- Jong Hee Kang, M. Philipose, Gaetano Borriello, "River: An Infrastructure for Context Dependent, Reactive Communication Primitives", In *Proceedings of the Workshop on Mobile Computing systems and Architectures (WMCSA)*, Monterrey, October 2003
- M. Philipose, Kenneth P. Fishkin, Dieter Fox, Henry Kautz, Donald Patterson, and Mike Perkowitz, "Guide: Towards Understanding Daily Life via Auto-Identification and Statistical Analysis", *Ubihealth 2003: The 2nd International Workshop on Ubiquitous Computing for Pervasive Healthcare Applications*, Seattle, September 2003
- Donald J. Patterson, Dieter Fox, Henry Kautz, M. Philipose, "Expressive, Tractable and Scalable Techniques for Modeling Activities of Daily Living", *Ubihealth 2003: The 2nd International Workshop on Ubiquitous Computing for Pervasive Healthcare Applications*, Seattle, September 2003
- C. Chambers, S. J. Eggers, J. Auslander, M. Philipose, M. Mock and P. Pardyak, "Automatic Dynamic Compilation Support for Event Dispatching in Extensible Systems", *Workshop on Compiler Support for Systems Software (WCSSS)*, Tucson, February 1996