Aaron Bobick
Dean
Engineering and Applied Science
Washington University in St. Louis

Awards and honors and year received (list--no more than *five* items):
- IEEE Fellow - 2014
- Georgia Tech College of Computing Deans Award - 2012
- ACM Distinguished Scientist - 2011

Have you previously been involved in any CRA activities? If so, describe.
- Attended CRA Snowbird conferences 2006 – 2102

List any other relevant experience and year(s) it occurred (list--no more than *five* items).
- Dean, School of Engineering and Applied Science, Washington Univ in St. Louis, 2015 - present
- Director Graphics, Visualization and Usability Center, Georgia Tech, 2001 - 2005, including establishing the Aware Home Research Initiative
- Founding Chair of Interactive Computing, College of Computing, Georgia Tech 2004 -2012 - including launching Computational Media Major

Research interests: (list only)
- Computer Vision with focus on activity recognition
- Robotics, primarily visual perception
- Cognitive modeling of activity perception

Personal Statement
Beyond traditional research accomplishments and leadership (organizing the first workshops on activity recognition, CVPR Program chair, IEEE Fellow) I have always worked on connecting computing research to a variety of domains. As GVU Director at Georgia Tech, I connected computing to the Music Technology group, which grew into an Arts@Tech institutional initiative. As department chair I hired roboticists to build a center bridging Computing, MechE, ECE, and others. Now as Dean of Engineering I am further promoting computing intersections with the sciences. Much fundamental computing research is now done outside traditional CS departments and my goal is develop those collaborations.

Brief Biography or CV
(Attached)

Aaron Bobick

School of Engineering and Applied Science
Washington University in St. Louis
St. Louis, MO 63130
afb@wustl.edu

Educational Background

Massachusetts Institute of Technology	S.B. Mathematics	1981
Massachusetts Institute of Technology	S.B. Computer Science	1981
Massachusetts Institute of Technology	Ph.D. Cognitive Science	1987

Employment History

Washington University in St. Louis School of Engineering and Applied Science	Dean and Professor	2015-Present
Georgia Institute of Technology College of Computing	Professor	2003-2015
Georgia Institute of Technology College of Computing	Founding Chair, School of Interactive Computing	2007-2012
Georgia Institute of Technology College of Computing	Chair, Interactive Computing Division	2004-2007
Georgia Institute of Technology College of Computing	Director, Graphics, Visualization and Usability Center	2001–2005
Georgia Institute of Technology College of Computing	Associate Director, Graphics, Visualization and Usability Center	1999-2000
Georgia Institute of Technology College of Computing	Associate Professor	1999-2002
Massachusetts Institute of Technology, Media Laboratory	Associate Professor	1997-1999
Massachusetts Institute of Technology, Media Laboratory	LG Electronic Career Development Asst. Professor	1995-1997
Massachusetts Institute of Technology, Media Laboratory	Assistant Professor	1992-1995
CyberGear	Founder and CTO	1993-1996
SRI International	Computer Scientist	1987-1992
Stanford University	Visiting Scholar	1987-1992
Massachusetts Institute of Technology	Research Assistant	1981-1987
CS Draper Laboratory	Computer Scientist	1979-1981

TEACHING

Courses Taught

MIT Courses

Term	Course #	Course Title	Instructor Status	Enrollment
Fall 92	4.996	Learning, Seeing and Deciding	Co-Instructor	6
Spring 93	4.998	High Level Computer Vision	Instructor	2
Fall 93	MAS 620	Learning, Seeing and Deciding	Co-Instructor	9
Spring 94	MAS 624	High Level Computer Vision	Instructor	2
Fall 94	MAS 626	Image Representation for Vision	Co-Instructor	15
Spring 95	MAS 624	High Level Computer Vision	Instructor	6
Fall 95	MAS 626	Image Representation for Vision	Co-Instructor	15
Spring 96	MAS 622J	Pattern Recognition and Analysis	Instructor	21
Fall 96	MAS 626	Image Representation	Co-Instructor	20
Spring 97	MAS 624	High Level Computer Vision	Instructor	5
Fall 97	MAS 626	Image Representation	Co-Instructor	20
Fall 97	MAS 964	Interaction Techniques for Interactive Virtual Environments	Co-Instructor	30
Spring 98	MAS 622J	Pattern Recognition and Analysis	Co-Instructor	15
Fall 98	MAS 964	Interaction Techniques for Interactive Virtual Environments	Co-Instructor	20
Spring 99	MAS 986	Machine Learning for Synthetic Characters	Co-Instructor	20

Georgia Tech Courses

Term	Course #	Course Title	Enrollment
Spring 00	CS 4803-C CS 8803-H	Pattern Recognition	20
Fall 00	CS4495 CS7495	Computer Vision (Co-instructor)	33
Spring 01	CS 4803-B CS 8803-B	Pattern Recognition	12
Fall 01	CS 4495 CS 7495	Computer Vision	33
Spring 03	CS 4803-A CS 8803-A	Pattern Recognition	24
Fall 03	CS 8803MCP	Mathematical Models For Computational Perception	20
Fall 04	CS 1371D	Intro Computing for Engineers	225
Fall 05	CS 1371	Intro Computing for Engineers	235
Spring 07	CS 2261	Media Device Architecture (w/ Leahy)	40
Spring 08	CS 2261	Media Device Architecture (w/ Leahy)	44

Spring 09	CS 2261	Media Device Architecture (w/ Leahy)	45
Spring 10	CS 2261	Media Device Architecture (w/ Leahy)	39
Spring 11	CS 2261	Media Device Architecture (w/ Leahy)	35
Fall 11	CS 4495	Computer Vision	42
Fall 12	CS4495A & GR	Computer Vision – Undergrad and Grad (joint A/GR)	51
Fall 12	CS 7001	Introduction to Graduate Studies (w/ Fortnow)	34
Fall 13	CS4495A& GR	Computer Vision – Undergrad and Grad (joint A/GR)	63
Spring 14	CS7616	Pattern Recognition - Graduate	65
Fall 14	CS4495A& GR	Computer Vision – Undergrad and Grad (joint A/GR)	85
Fall 14	CS7495	Advanced Computer Vision – PhD	20

Curriculum and Degree Development

Degree Programs Developed

Originated and developed (along with chair of Literature, Culture, and Communication) the Computational Media Degree. Includes computer science and narrative elements; within 5 years had 300 majors. Fall 2004.

New Courses Developed

CS 4803-C/8803-H Pattern Recognition, Spring 2000.
CS 8803 Mathematical Methods for Computational Perception, Fall 2003
CS 2261 Media Architecture Devices, Spring 2007
CS 4495 completely revamped Computer Vision course for undergraduates 2011
CS 7616 completely revamped Pattern Recognition course for graduates 2014

Individual Student Guidance

Postdoctoral Fellows Supervised

Nassir Navab, (France), Relative Affine Structure-from-Motion, September 1992 – April 1994, Senior Researcher at Siemens Corporate Research.

Ph.D. Students Supervised (in progress as well as graduated)

Stephen Intille, "Visual recognition of multi-agent action", (MIT Media Laboratory) July 1999 Professor of Computer Science, Northeastern University

Claudio Pinhanez, "Representation and Recognition of Action in Interactive Spaces", (MIT Media Laboratory) August, 1999, Computer Scientist, IBM Watson Research Center, NY.

James Davis, "Representation and Recognition of Oscillatory Motion", (MIT Media Laboratory) April, 2000, Professor of Computer Science, Ohio State University.

Andrew Wilson, "Learning Parametric Variation for the Interpretation of Gesture", (MIT Media Laboratory), August, 2000. Principal Computer Scientist, Microsoft Research, Seattle, WA.

Lee Campbell, "The Use of HMMs in Natural Gesture Recognition", (MIT Media Laboratory) May, 2001, Researcher at Boston Heart Association

Amos Johnson, "A Method for Human Identification Using Static, Activity-Specific Parameters", (ECE Student), March, 2002, Professor, Morehouse College.Rawesak Tanawongsuwan, "Impact of Speed Variations in Gait Recognition", 2003. Lecturer and researcher in Thailand University.

Vivek Kwatra (with Irfan Essa), "Example-based Rendering of Textural Phenomena", 2005. Research Scientist Google Research..

Yifan Shi, "Representing and Recognizing Temporal Sequences", 2006, Research engineer, Google.

Delphine Nain (with Allen Tanenbaum), "Scale-based Decomposable Shape Representations for Medical Imaging Segmentation and Shape Analysis", August 2007, Consultant McKinnsey.

 Raffay Hamid, "A Computational Framework For Unsupervised Analysis of Everyday Human Activities", 2008 Post-doc CMU/Disney.

Jie Sun (with Jim Rehg),   "Object Categorization for Affordance Learning" August 2008, Analyst for Lehman Bros.

Salman Aslam (ECE, with Chris Barnes), "Target Tracking Using Residual Vector Quantization", Nov 2011

Tucker Hermans, "Representing and Learning Affordance-Based Behaviors", March, 2014

Nam Vo, Area: Predicting Human Actions, (started Fall, 2012)

Kelsey Hawkins, Area: Rationally safe robotics , (started Fall, 2012)

Andrew Price, Area: Affordance based planning , (started Fall, 2012)

Shray Bansal, Area: Predicting human behvaior , (started Fall, 2014)

Ph.D. Special Problems Students
Total CS 8903 Students: 30

M.S. Thesis Students Supervised
Donald, Tanguay, "Multiple Feature Hidden Markov Models for Human Gesture Recognition," (MIT Media Laboratory) September 1995.

Katerina Nguyen, "Hand Gesture Recognition, Prediction, and Coding Using Hidden Markov Models." (MIT Media Laboratory) May 1996.

Peter Yao,, "Image Enhancement Using Statistical Spatial Segmentation." (MIT Media Laboratory) May 1996.

Samir Batta, Topic area: Visual surveillance, 2006

PhD Thesis Committees
Trevor Darrell, Nuno Vasconzalez, Victor Zhordan, Ron Metoyer, Arno Schoedel, Tami Johson, Drew Steedly, Gabe Brostow, Tony Haro, Yushi Jing, Hai Nguyen, Alireza Fathi, Jake Huckaby

External PhD Thesis Committees

> Dima Damen (Leeds), Perttu Hämäläinen (Finland), Konstantinos Derpanis (Toronto), Dennis Levin Herzog (Aarlborg)

Faculty Visitors

> None

E. Teaching Honors and Awards

> None

RESEARCH AND CREATIVE SCHOLARSHIP

Thesis

> Ph.D. Brain and Cognitive Science Department, Massachusetts Institute of Technology, "Natural Object Categorization", Thesis advisor: Whitman Richards, August 1987.

Published Journal Papers (refereed)

> J 1. Zucker, M., S. Joo, M. Grey, C. Rasmussen, M. Stilman, & A. Bobick, "A general-purpose system for teleoperation of the DRC-HUBO humanoid robot," *Journal of Field Robotics,* to appear.

> J 2. Lee, J., Chao, C., Bobick, A. F., & Thomaz, A. L. . "Multi-cue contingency detection. ", *International Journal of Social Robotics*, 2012, 4(2), 147-161.

> J 3. Sun, J., J. Moore, A. Bobick, and J. Rehg, "Learning Visual Object Categories for Robot Affordance Prediction", *International Journal of Robotics Research,* **29**(3), February/March 2010, pp. 174–197

> J 4. R. Hamid, S. Maddi, A. Johnson, A. Bobick, I. Essa, C. Isbell. A Novel Sequence Representation for Unsupervised Analysis of Human Activities. *Artificial Intelligence Journal* **14**(173), 2009.

> J 5. Nain,D. S. Haker, A. Bobick, and A. Tannenbaum, "Multiscale 3-D Shape Representation and Segmentation Using Spherical Wavelets", IEEE *Transactions on Medical Imaging* **26,** 4, April 2007.

> J 6. V. Kwatra, I. Essa, A. Bobick, and N. Kwatra, "Texture Optimization for Example based Synthesis," *Proc. ACM Transactions on Graphics, SIGGRAPH* 2005, 24(3):795-802, August 20

> J 7. V. Kwatra, A. Sch¨odl, I. Essa, G. Turk, and A. Bobick, "Graphcut Textures: Image and Video Synthesis Using Graph Cuts," *Proc. ACM Transactions on Graphics, SIGGRAPH* 2003, 24(3):277-286, July 2003.

> J 8. Pinhanez, C. and A. Bobick, "Interval Scripts: a Programming Paradigm for Interactive Environments and Agents" *Pervasive and Ubiquitous Computing* **7**(1), 2003, 1-21.

> J 9. Pinhanez, C. and A. Bobick, "It/I: A Theater Play Featuring an Autonomous Computer Character, " *Presence* **11**(5), 2002, 536-548.

> J 10. Wilson,A., and A.. Bobick, "Hidden Markov Models for Modeling and Recognizing Gesture Under Variation*", Int'l J. of Pattern Recognition and Artificial Intelligence* **15**(1): 123-160 (2001)

> J 11. Bobick, A. and J. Davis, "The recognition of human movement using temporal templates," *IEEE Transaction on Pattern Analysis & Machine Intelligence*, **23**(3), March 2001.

J 12. Intille, S. and A.F. Bobick, "Recognizing planned, multi-person action", Computer Vision and Image Understanding 81, 414–445 (2001)

J 13. Pinhanez, C., J. Davis , S. Intille, M. Johnson, A. Wilson, A. Bobick, B. Blumberg, "Physically Interactive Story Environments, *IBM Systems Journal,* **39** (3&4): 438-455, 2000

J 14. Bobick, A., S.Intille, J.Davis, F.Baird, C.Pinhanez, L.Campbell, Y.Ivanov, A.Schutte, and A.Wilson. The KidsRoom. *Communications of the ACM*, **43**(3). 2000

J 15. Ivanov, Y. and Aaron F. Bobick, "Recognition of Visual Activities and Interactions by Stochastic Parsing", *IEEE Transactions on Pattern Analysis & Machine Intelligence,* **22**(8), August, 2000.

J 16. Ivanov, Y., A. Bobick, and J. Liu, "Fast lighting independent background subtraction," *International Journal of Computer Vision,* **37**(2), June 2000, pp. 199-209.

J 17. Wilson, A. and A. Bobick, "Parametric Hidden Markov Models for Gesture Recognition," *IEEE Transaction on Pattern Analysis & Machine Intelligence,* **21**(9), September 1999, pp. 884-900.

J 18. Bobick, A. and S. Intille, "Large Occlusion Stereo." *International Journal of Computer Vision*, **33**(3), September 1999. pp. 181-200.

J 19. Bobick, A., S. Intille, J. Davis, F. Baird, C. Pinhanez, L. Campbell, Y. Ivanov, A. Schutte, A. Wilson, "The KidsRoom: A Perceptually-based Interactive and Immersive Story Environment," PRESENCE: Teleoperators and Virtual Environments, 8(4), August 1999. pp. 367-391.

J 20. Mase, K., P. Pinhanez, and A. Bobick,, "Scripting Method Based on Temporal Intervals for Designing Interactive Systems". *Transaction of IPSJ (Information Processing Society of Japan),* Vol. 39. No. 5, pp. 1403--1413, May 1998.

J 21. Bobick, A. "Movement, Activity, and Action: The Role of Knowledge in the Perception of Motion." *Phil. Trans. Royal Society London B,* 352, pp. 1257-1265, 1997.

J 22. Bobick, A. and A. Wilson, "A State-based Approach to the Representation and Recognition of Gesture." *IEEE Transaction on Pattern Analysis & Machine Intelligence*, Vol. 19, No. 12, December 1997.

J 23. Pinhanez, C. and A. Bobick, "Intelligent Studios: Modeling Space and Action to Control TV Cameras." *Applications of Artificial Intelligence,* Vol. 11(4), pp. 285-306, 1997.

J 24. Bobick, A. and R. C. Bolles, "The Representation Space Paradigm of Concurrent Evolving Scene Descriptions." *IEEE Transactions Pattern Analysis and Machine Intelligence,* Vol. 14, No. 2, pp. 146-156, February 1992.

Published Books and Parts of Books

B 1. Bobick, A. and V. Krueger, "On Human Action" in T. Moesland, A. Hilton, V. Kruger, and L. Sigal (eds) *Visual Analysis of Humans: Looking at People,* Springer, 2012

B 2. Lee, J., C. Chao, A. Thomaz, and A. Bobick, "Adaptive Integration of Multiple Cues for Contingency Detection," in A. Salah and B. Lepri (ed) *Human Behavior Understanding,* Lecture Notes in Computer Science Volume 7065, 2011

B 3. Essa, I. and A. Bobick, "Simulating Humans", in W. Rouse (ed) *Organizational Simulation*, 2005..

B 4.   Bobick, A. and A. Wilson, "State-based recognition of Gesture." in M. Shah and R. Jain (eds.), Motion-Based Recognition, pp. 201-226, 1997.

B 5.   Bobick, A. and J. Davis, "Action Recognition Using Temporal Templates." in M. Shah and R. Jain (eds.), Motion-Based Recognition, pp. 125-146, 1997.

B 6.   Bobick, A., "Video Annotation: Computers Watching Video." in Lecture Notes in Computer Science: Recent Developments in Computer Vision, Vol. 1035, S. Z. Li, D. P. Mital, E. K. Teoh and H. Wang (eds.), Springer, pp. 23-31, 1995.

B 7.   Richards, W. and A. Bobick, "Playing Twenty Questions with Nature." Chapter 1, in Z. Pylyshyn (eds.), Computational Processes in Human Vision: An Interdisciplinary Perspective, Ablex, Norwood, NJ, pp. 3-26, 1988

Edited Proceedings

P 1.   Bobick, A. (Ed.) IEEE Workshop on the Interpretation of Visual Motion, Santa Barbara, CA, 1998.

Invited Keynote addresses

K 1.   Representation and Recognition of Human Behavior for Perception, Plenary presentation at *Uncertainty in Artificial Intelligence*, Palo Alto, July, 2000.

K 2.   Recognition of Human Behavior In Interactive Environments, *IEEE Conference Managing Smart Environments,* Dublin, December, 1999

K 3.   Representation and Recognition of Multi-agent Behavior, *Workshop on Cooperative Distributed Vision,* Kyoto, November 1999.

K 4.   Computers Seeing Action, *British Machine Vision Conference*, Edinburgh, September 1996.

Conference Presentations with Proceedings (refereed) [Conferences indicated in bold represent papers in stringently reviewed, international conferences (<30% acceptance)]

C 1.   Vo, N. and A.F. Bobick, "From Stochastic Grammar to Bayes Network: Probabilistic Parsing of Complex Activity", ***IEEE International Conference on Computer Vision and Pattern Recognition,* Columbus,** 2014

C 2.   Hawkins, K., S. Bansal, N. Vo, and A.F. Bobick, "Anticipating human actions for collaboration in the presence of task and sensor uncertainty", *IEEE International Conference on Robotics and Automation (ICRA),* Hong Kong, 2014

C 3.   Hermans, T., F. Li, J.M. Rehg and A.F. Bobick. "Learning Contact Locations for Pushing and Orienting Unknown Objects." *IEEE-RAS International Conference on Humanoid Robotics (Humanoids),* Atlanta, GA, USA, October 2013

C 4.   Hawkins, K., S. Bansal, N. Vo, and A.F. Bobick , "Modeling structured activity to support human-robot collaboration in the presence of task and sensor uncertainty," *IROS Workshop on Cognitive Robotics Systems*, 2013

C 5.   Hawkins, K., N. Vo, S. Bansal, and A.F. Bobick, "Probabilistic Human Action Prediction and Wait-Sensitive Planning for Responsive Human-Robot Collaboration," IEEE-RAS International Conference on Humanoid Robots (Humanoids), 2013

C 6.   Hermans, T., Rehg, J. M., & Bobick, A., "Decoupling Behavior, Perception, and Control for Autonomous Learning of Affordances" *IEEE International Conference on Robotics and Automation* (ICRA), Karlsruhe, 2013

C 7.   O'Flaherty**,** R., S. Vieira, M. Grey, P. Oh, A. Bobick, M. Egerstedt, M. Stilman, *"*Humanoid Robot Teleoperation for Tasks with Power Tools" in *IEEE Int'l Conference on Technologies for Practical Robot Application,* Boston, 2013.

C 8.   Grey, M., N. Dantam, D. Lofaro, A. Bobick, M. Egerstedt, P. Oh, M. Stilman, *"*Multi-Process Control Software for Humanoid Robots" in *IEEE Int'l Conference on Technologies for Practical Robot Application,* Boston, 2013.

C 9.   Hermans, T., J. M. Rehg, & A. Bobick, "Guided Pushing for Object Singulation", *IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS 2012), 7-12 2012

C 10. Huang, P., R. Sawhney, D.Walker, K. Wallen, A. Bobick, S. Qin, & T. Balch, "Learning a projective mapping to locate animals in video using RFID" *IEEE/RSJ Intelligent Robots and Systems (IROS),* 2012. **Finalist for Best Paper in Robot Entertainment and Systems category.**

C 11. Lee, J., J. Kiser, A. Bobick, and A. Thomaz, "Vision-based Contingency Detection", ***Human Robot Interaction****,* 2011

C 12. Aslam, S., A. Bobick and C. Barnes, "Modeling the Staircase Quantization Function," *Data Compression Conference (DCC),* 2010

C 13. Aslam, S., A. Bobick and C. Barnes, "Robust real time vehicle contour tracking on moving camera aerial infrared imagery," *Geoscience and Remote Sensing IEEE International Symposium – IGARSS,* 2010

C 14. Aslam, S. M., C. F. Barnes, and A. F. Bobick. "Robust real time vehicle contour tracking on low quality aerial infra-red imagery.*" IEEE International Geoscience and Remote Sensing Symposium* (IGARSS2010). 2010.

C 15. Aslam, S. M., C. Barnes, and A. Bobick , "Multi Target Video Tracking Using Residual Vector Quantization," *Int'l Conf on Image Processing, Computer Vision, and Pattern Recognition IPCV*, 2010.

C 16. Aslam, S. M., C. Barnes, and A. Bobick, "Video Action Recognition Using Residual Vector Quantization and Hidden Markov Models", *Int'l Conf on Image Processing, Computer Vision, and Pattern Recognition*, 2010.

C 17. Levchuk, G., A. Bobick and E. Jones, ""Activity and function recognition for moving and static objects in urban environments from wide-area persistent surveillance inputs*", Proc. SPIE*, 2010

C 18. Lee, K.,   J. Lee;   A. Thomaz and A. Bobick, "Effective Robot Task Learning by focusing on Task-relevant objects" *Proceedings of Intelligent Robots and Systems (IROS)* St. Louis 2009*.*

C 19. Aslam, S., C. Barnes, and A. Bobick, "Robust Surveillance on Compressed Video: Uniform Performance from High to Low Bitrates," *Advanced Video and Signal Based Surveillance,* Sept. 2009

C 20. Aslam, S. M., A. Bobick and C. Barnes, "Better Computer Vision Under Video Compression, An Example Using Mean Shift Tracking," *IEEE Int'l Conf on Image Processing,* 2009.

C 21. Aslam, S., C. Barnes, and A. Bobick, "Compensation methods using signal processing and adaptive quantization for better mean shift tracking on compressed video", *International Conference on Image Processing, Computer Vision, and Pattern Recognition,* 2009

C 22. R. Hamid, S. Maddi, A. Bobick, I. Essa. "Structure from Statistics: Unsupervised Analysis of Activities Using Suffix Trees". In ***Proceedings of IEEE International Conference of Computer Vision***, 2007

C 23. Yifan Shi, Aaron Bobick, Irfan Essa, "Learning Temporal Sequence Model from Partially Labeled Data", ***Proceedings of IEEE Computer Vision and Pattern Recognition (CVPR 2006)***, New York, June 2006.

C 24. D. Nain, S. Haker, A. Bobick, and A.Tannenbaum, "Shape-Driven 3D Segmentation using using Spherical Wavelets" In ***Proceedings of MICCAI,*** Copenhagen, 2006. ***Note: Best Student Paper Award in the category Segmentation and Registration***

C 25. R. Hamid, S. Maddi, A. Bobick, I. Essa. "Unsupervised Analysis of Activity Sequences Using Event Motifs" *Proceedings of 4th ACM International Workshop on Video Surveillance and Sensor Networks (in conjunction with ACM Multimedia 2006).*

C 26. R. Hamid, S. Maddi, A. Johnson, A. Bobick, I. Essa, C. Isbell. "Discovery and Characterization of Activities from Event-Streams", ***Proceedings of Uncertainty in Artificial Intelligence (UAI 2005)*** August 2005.

C 27. Dongshin Kim, Jie Sun, Sangmin Oh, James Rehg, Aaron Bobick, "Traversability Classification Using Unsupervised On-Line Visual Learning for Outdoor Robot Navigation," *IEEE International Conference on Robotics and Automation (ICRA 06)*, Orlando, FL, May 2006.

C 28. R. Hamid, A. Johnson, S. Batta, A. Bobick, C. Isbell, G. Coleman. "Detection and Explanation of Anomalous Activities: Representing Activities as Bags of Event n-Grams" ***Proceedings of IEEE Computer Vision and Pattern Recognition (CVPR 2005)*** June 2005

C 29. Delphine Nain, Steven Haker, Aaron Bobick, and Allen Tannenbaum. "Multiscale 3D Shape Analysis using Spherical Wavelets" ***Proceedings of MICCAI,*** Palm Springs, 2005

C 30. Z. Yang and A. Bobick, Visual integration from multiple cameras, *IEEE Workshop on applications for computer vision (WACV 2005)*, Denver, January 2005.

C 31. Sun, J., J.M. Rehg, and A. Bobick, "Automatic Cascade Training with Perturbation Bias," ***Proceedings of IEEE Computer Vision and Pattern Recognition (CVPR 2004),*** Washington, DC, June, 2004

C 32. Y. Shi, Y. Huang, D. Minnen, A. Bobick, and I. Essa, "Propagation Networks for recognition of partially ordered sequential action", ***Proceedings of IEEE Computer Vision and Pattern Recognition (CVPR 2004)***, Washington, DC, June, 2004

C 33. R. Hamid, A. Bobick, A. Yezzi. Audio-Visual Flow – "A Variational Approach to Multi-Modal Flow Estimation,"*12th International Conference on Image Processing (ICIP) 2004*, Singapore.

C 34. Johnson, A., J. Sun, and A. Bobick, "Using Similarity Scores from a Small Gallery to Estimate Recognition Performance for Larger Galleries", *IEEE International Workshop on Analysis and Modeling of Faces and Gestures*, in conjunction with the International Conference on Computer Vision (ICCV 2003), Nice, France, October 2003

C 35. Tanawongsuwan, R. and A.F. Bobick, "Performance Analysis of Time-Distance Gait Parameters under Different Speeds" *Audio- And Video-Based Biometric Person Authentication* July 2003.*.*

C 36. Johnson, A., J. Sun, and A. Bobick, "Predicting Large Population Data Cumulative Match Characteristic Performance from Small Population Data," *4th International Conference on Audio and Video Based Biometric Person Authentication (AVBPA 2003)*, University of Surrey, Guildford, UK June 9-11, 2003

C 37. Shi, Y. and A. Bobick, "The Representation and Recognition of Activity Using Propagation Nets", *Visual Interface 2003*, Halifax, Canada

C 38. Shi, Y. and A. Bobick, "P-Net: A Representation for Partially-Sequenced, Multi-stream Activity", *Workshop on Event Mining in CVPR'2003*, Madison, USA

C 39. Johnson, A. and A.Bobick, "Relation between Expected Confusion and ROC curves," *Int'l Conference of Pattern Recognition,* Quebec, Canada, August, 2002.

C 40. Bobick, A.F., and A. Johnson "Gait recognition using static activity-specific parameters" " ***Proceedings of IEEE Computer Vision and Pattern Recognition,*** Kauai, Hawaii, December 2001.

C 41. Tanawongsuwan, R. and A.F. Bobick, "Gait recognition from time-normalized joint-angle trajectories in the walking plane" ***Proceedings of IEEE Computer Vision and Pattern Recognition***, Kauai, Hawaii, December 2001.

C 42. Kwatra, V., A.F. Bobick, and A. Johnson, " Temporal Integration of Multiple Silhouette-based Body-part Hypotheses" ***Proceedings of IEEE Computer Vision and Pattern Recognition***, Kauai, Hawaii, December 2001.

C 43. Johnson, A. and A.F. Bobick, "A Multi-view Method for Gait Recognition Using Static Body Parameters" *3rd International Conference on Audio- and Video Based Biometric Person Authentication,* 301-311, Halmstad, Sweden, June 2001.

C 44. C. Pinhanez and A. Bobick. Scripting Interactive Environments with Interval Scripts. *Proc. of VI Brazilian Symposium on Multimedia and Hypermedia Systems*. Natal, Brazil. June 2000

C 45. Wilson, A. and A. Bobick, "Realtime Online Adaptive Gesture Recognition," *Proceedings of the International Conference on Pattern Recognition,* Barcelona, Spain, September 2000

C 46. Davis, J., A. Bobick, and W. Richards, "Categorical Representation and Recognition of Oscillatory Motion Patterns, ***Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition***, Hilton Head, NC, June 2000.

C 47. Wilson, A. and A. F. Bobick, "Real-time online adaptive gesture recognition," *International Workshop on Recognition, Analysis, and Tracking of Faces and Gestures in Real-Time Systems,* Corfu, Greece, September 1999.

C 48. Ivanov, Y. and A. F. Bobick, "Recognition of Multi-agent Interaction in Video Surveillance", ***Proc. of Intl Conference on Computer Vision***, Corfu, Greece, pg. 169-176, September 1999.

C 49. Ivanov, Y., C. Stauffer, A.F. Bobick and W.E.L Grimson, "Video Surveillance of Interactions", *Workshop on Video Surveillance*, June 1999, Ft. Collins, CO

C 50. Intille, S. and A.. Bobick,. "A framework for recognizing multi-agent action from visual evidence". ***Proceedings of the Sixteenth National Conference on Artificial Intelligence***, pp. 518-525, Orlando, Florida, July 1999.

C 51. Pinhanez, C. and A. F. Bobick. "'It/I': A Theater Play Featuring an Autonomous Computer Graphics Character", *Proc. of the ACM Multimedia'98 Workshop on Technologies for Interactive Movies*, Bristol, England, pp. 22-29. September. 1999.

C 52. Intille, S. and A.F. Bobick. "Visual recognition of multi-agent action using binary temporal relations". ***Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition***, pp. 56-62, Fort Collins, Colorado, June 1999.

C 53. Johnson, M.P., A. Wilson, B. Blumberg, C. Kline, and A. Bobick, "Sympathetic interfaces: using a plush toy to direct synthetic classes", ***Proceedings of Computer Human Interface,*** Pittsburgh, pp. 152 – 158, May 1999

C 54. Pinhanez, C. and A. Bobick, " Using Computer Vision to Control a Reactive Computer Graphics Character in a Theater Play", *Proceedings of International Conference on Vision Systems (ICVS'99),* Las Palmas, Gran Canaria, Spain, January 1999.

C 55. Davis, J. and A. Bobick, "Virtual PAT: A Virtual Personal Aerobics Trainer", *Proceedings of Workshop on Perceptual User Interfaces (PUI98),* November 1998.

C 56. Davis, J. and A. Bobick, "A Robust Human-Silhouette Extraction Technique for Interactive Virtual Environments", *IFIP Workshop on Modeling and Motion Capture Techniques for Virtual Environments (CAPTECH98),* November 1998.

C 57. Pinhanez, C. and A. Bobick, "It/I: Theater with an Automatic and Reactive Computer Graphics", *SIGGRAPH'98 Conference Abstracts and Applications,* p. 302, Orlando, Florida, July 1998.

C 58. Bobick, A. and Y. Ivanov, " Action Recognition Using Probabilistic Parsing", *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition,*** , Santa Barbara, CA, pp. 196-202, June 1998.

C 59. Pinhanez, C. and A. Bobick, "Human Action Detection Using PNF Propagation of Temporal Constraints", *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition***, Santa Barbara, CA, pp. 898-904, June 1998.

C 60. Wilson, D. and A. Bobick, "Nonlinear PHMMs for the Interpretation of Parameterized Gesture", *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition***, Santa Barbara, CA, pp. 879-884, June 1998.

C 61. Pinhanez, C. and A. Bobick, " It/I: An Experiment Towards Interactive Theatrical Performances", *Proceedings of Computer Human Interface,* Los Angeles, CA, pp. 333-334, April 1998.

C 62. Wilson, D. and A. Bobick, "Recognition and interpretation of parametric gesture", ***Proceedings of International Conference on Computer Vision***, Bombay, India, pp. 329-336, 1998.

C 63. Bobick, A. and C. Pinhanez, "Controlling View-Based Algorithms Using Approximate World Models and Action Information." *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition,** Puerto* Rico, pp. 955-961, June 1997.

C 64. Davis, J. and A. Bobick, "The Representation and Recognition of Action Using Temporal Templates." *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition***, Puerto Rico, pp. 928-934, June 1997.

C 65. Wilson, D., A. Bobick and J. Cassell, "Temporal classification of natural gesture and application to video coding", *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition***, Puerto Rico, pp. 948-954, June 1997.

C 66. Intille, S., J. Davis and A. Bobick, "Real-Time Closed-World Tracking." *Proceedings of **IEEE Conference on Computer Vision and Pattern Recognition***, pp. 697-703, Puerto Rico, June 1997.

C 67. Pinhanez, C., K. Mase and A. Bobick, "Interval Scripts: A Design Paradigm for Story-Based Interactive Systems." *Proceedings of CHI '97, Atlanta*, GA, pp. 287-294, March 1997.

C 68. Pinhanez, C., K. Mase and A. Bobick, "Designing Story-Based Interfaces by Interval Scripts." *Proceedings of Interaction '97,* Tokyo, Japan, 8 pages, February 1997.

C 69. Bobick, A. and J., "Real-time Recognition of Activity Using Temporal Templates." *IEEE Workshop on Applications of Computer Vision, Sarasota*, FL, 4 pages, December 1996.

C 70. Campbell, L., D. Becker, A. Azarbayejani, A. Bobick and A. Pentland, "Invariant Features for 3-D Gesture Recognition." *Proceedings of the Second International Conference on Automatic Face and Gesture Recognition*, Killington, VT, pp. 157-162, October 1996.

C 71. Wilson, A., A. Bobick and J. Cassell, "Recovering the Temporal Structure of Natural Gesture." *Proceedings of the Second International Conference on Automatic Face and Gesture Recognition*, Killington, VT, pp. 66-71, October 1996.

C 72. Bobick, A. "Computers Seeing Action." *British Machine Vision Conference,* Edinburgh, Scotland, pp. 13-22, September 1996.

C 73. Bobick A. and J. Davis, "An Appearance-based Representation of Action." *Proceedings of International Conference on Pattern Recognition,* Vienna, Austria, Track A, pp. 307-312, August 1996.

C 74. Pinhanez, C. and A. Bobick, "Computer Theater: Stage for Action Understanding." *Proceedings of the AAAI '96 Workshop on AI/A-Life Entertainment*, *AAAI Press Technical Report WS-96-03*, Portland, OR, pp. 28-33, August 1996.

C 75. Pinhanez, C. and A. Bobick, "Approximate World Models: Incorporating Qualitative and Linguistic Information into Vision Systems." *Proceedings of the **AAAI '96**,* Portland, OR, pp. 1116-1123, August 1996.

C 76. Bobick, A., "Video Annotation: Computers watching video." *Second Asian Conference on Computer Vision,* Vol. I, Singapore, pp. 19-23, December 1995.

C 77. Pinhanez, C. and A. Bobick, "Scripts in Machine Understanding of Image Sequences." *Proceedings of the 1995 AAAI Fall Symposium on Computational Models for Integrating Language and Vision,* Cambridge, MA, pp. 96-101, November 1995.

C 78. Wilson, A. and A. Bobick, "Learning Visual Behavior for Gesture Analysis." *Proceedings of the **IEEE Symposium on Computer Vision**,* Coral Gables, FL, pp. 229-234, November 1995.

C 79. Pinhanez, C. and A. Bobick, "Intelligent Studios: Using Computer Vision to Control TV Cameras." *Proceedings of the International Joint Conference on Artificial Intelligence Workshop on Entertainment and AI/Alife*, Montreal, Canada, pp. 69-76, August 1995.

C 80. Bobick, A. and S. Intille, "Exploiting Contextual Information for Tracking by Using Closed-Worlds." *Proceedings of the Workshop on Context-Based Vision,* Cambridge, MA, pp. 87-98, June 1995.

C 81. Bobick, A. and C. Pinhanez, "Using Approximate Models as Source of Contextual Information for Vision Processing." *Proceedings of the Workshop on Context-Based Vision,* Cambridge, MA, pp. 13-21, June 1995.

C 82. Bobick, A. and A. Wilson, "A State-Based Technique for the Summarization and Recognition of Gesture." ***Fifth International Conference on Computer Vision***, Cambridge, MA, pp. 382-388, June 1995.

C 83. Campbell, L. and A. Bobick, "Recognition of Human Body Motion Using Phase Space Constraints." ***Fifth International Conference on Computer Vision***, Cambridge, MA, 624-630, June 1995.

C 84. Campbell, L. and A. Bobick, "Using Phase Space Constraints to Represent Human Body Motion." *International Workshop on Automatic-Face and Gesture-Recognition,* Zurich, Switzerland, pp. 338-343, June 1995.

C 85. Intille, S. and A. Bobick, "Closed-World Tracking." ***Fifth International Conference on Computer Vision***, Cambridge, MA, pp. 672-678, June 1995.

C 86. Wilson, A. and A. Bobick, "Configuration States for the Representation and Recognition of Gesture." *International Workshop on Automatic-Face and Gesture-Recognition,* Zurich, Switzerland, pp. 129-134, June 1995.

C 87. Intille, S. and A. Bobick, "Incorporating Intensity Edges in the Recovery of Occlusion Regions." ***International Conference on Pattern Recognition***, Jerusalem, Israel, Vol. I, pp. 674-677, October 1994.

C 88. Bobick, A, "Representational Frames in Dynamic Scene Annotation." *Proceedings of the Workshop on Visual Behaviors,* Seattle, WA, pp. 54-59, June 1994.

C 89. Intille, S. and A. Bobick, "Disparity-Space Images and Large Occlusion Stereo." ***European Conference on Computer Vision***, J-O. Eklundh (ed.), Stockholm, Sweden, Vol. 801, pp. 179-186, May 1994.

C 90. Bobick, A, "Representational Frames in Video Annotation." *The Twenty-Seventh Asilomar Conference on Signals and Systems,* Pacific Grove, CA, Vol. 1, pp. 111-115, November 1993.

C 91. Bobick, A, "Using Stability of Interpretation as Verification for Low Level Processing: An example from ego motion and optic flow." ***IEEE Computer Vision and Pattern Recognition***, New York, NY, pp. 718-719, June 1993.

C 92. Bobick, A. and R. Bolles, "Multiple Concurrent Object Descriptions in Support of Autonomous Navigation." P. S. Schenker (ed.), *Proceedings SPIE Sensor Fusion,* Vol. 1828, No. 5, Boston, MA, pp. 383-392, November 1992.

C 93. Leclerc, Y. and A. Bobick, "The Direct Computation of Height from Shading." ***IEEE Computer Vision and Pattern Recognition***, Lahaina, Maui, HI, pp. 552-558, June 1991.

C 94. Bobick, A. and R. Bolles, "An Evolutionary Approach to Constructing Object Descriptions." H. Miura and S. Arimoto (ed.), ***Fifth International Symposium on Robotics Research***, Tokyo, Japan, pp. 107-115, August 1989.

C 95. Bobick, A. and R. Bolles, "Representation Space: An Approach to the Integration of Visual Information." ***IEEE Computer Vision and Pattern Recognition***, San Diego, CA, pp. 492-499, June 1989.

C 96. Bolles, R. and A. Bobick, "Exploiting Temporal Coherence in Scene Analysis for Autonomous Navigation." *Robotics and Automation*, Scottsdale, AR, Vol. 2, pp. 990-996, May 1989.

C 97. Bobick, A., "Using Mirror Reflections to Recover Shape." *Technical Program, Optical Society of America Annual Meeting*, San Diego, CA, Abstract, October 1984.

      C 98. Bobick, A., "A Hybrid Approach to Structure-From-Motion." N. Badler and J. Tsotsos (ed.), *Motion: Representation and Perception, Proceedings of Association of Computing Machinery Siggraph Workshop on Motion*, Toronto, Canada, pp. 91-109, April 1983

Other Major Publications

Submitted Journal Papers:

        None

Research Proposals and Grants (Principal Investigator)

F 1.   Dynamic Scene Analysis, Office of Research and Development CIA, October, 1994 – December, 1996, $479,872.

F 2.   Dynamic Scene Analysis, Office of Research and Development CIA, October, 1996 – September, 1997, $250,000.

F 3.   Learning and Understanding Action in Video Imagery (with Co-PI Tommy Poggio and Sandy Pentland), DARPA/ARL, October, April, 1997 – December, 1999, $622,000.

F 4.   Understanding Human Movement for Recognition, DARPA/ARO, May 1999 – December,1999, $92,000.

F 5.   Project for Initial Specification and Construction of Human Motion data to Support Human Identification at a Distance, (J. Hodgins is Co-PI) ARO/Battelle, May, 2000 – November 2000, $147,000.

F 6.   HumanID from Movement, (with Co-PIs J. Hodgins and I. Essa), DARPA, August, 2000 – December, 2002, $1,102,300.

F 7.   Aware Home Research Initiative. Organized and serve as director of a consortium of industrial sponsors to fund Aware Home research. Anticipated gift donations for FY'01 approximately $450,000.

F 8.   Recognition of Group and Crowd Activity, Joint proposal with MIT (Grimson), CIA, June 2002-June 2003, $450,000.

F 9.   Cognitive Assistant that Learns and Observes, Subcontract from SRI International from DARPA, May 2003 – June 2005, $1,200,000.

F 10. RI: SMALL: Category-Driven Affordance Prediction For Autonomous Robots (w/ J. Rehg), NSF August 2009- June 2013. $499,000 .

F 11. Support on the shop-floor using modern robots (w/ H. Christensen), BMW, Dec, 2012 – July 2015, $800,000.

F 12. NSF: NRI: Representing and Anticipating Actions in Human-Robot Collaborative Assembly Tasks, National Science Foundation, $800,000 06/01/2014-05/31/2017

Pending: None

Research Proposals and Grants (Contributor)

F 13. ITR Proposal Successful Aging: Sustaining the Quality of Life, (Abowd, PI; Bobick Co-PI), $1,500,000), April 2001 – April 2006

Pending: None

Research Honors and Awards

KidsRoom selected for inclusion at the Millennium Dome, London, 2000

Best Paper Award, Segmentation and Registration Category, *Int'l Conference on Medical Image Computing and Computer Assisted Intervention,* 2006

Elected ACM Distinguished Scientist, 2011

Finalist, Best Paper Award in Robot Entertainment and Systems Category, *IEEE/RSJ Intelligent Robots and Systems (IROS),* 2012

Deans Award, College of Computing, 2012

Elected Fellow of the IEEE, 2014

SERVICE

Professional Activities

Program Chairs

2004 Computer Vision and Pattern Recognition Program Chair
2000 IEEE Conference of Human Motion, Program Co-Chair
2001 IEEE Computer Vision and Pattern Recognition, Innovations Chair
Area Chair for Computer Vision and Pattern Recognition Program Committees,
    1996, 1997, 1999, 2000, 2002, 2003
IEEE Interpretation of Visual Motion, General and Program Chair, 1998
NSF/DARPA Perception of Action, General Chair and Organizer,1996 -- 1997
Program Co-Chair DARPA Image Understanding Meeting, 1997
Workshop Chair International Joint Conference Artificial Intelligence, 1993

Program Committees

Computer Vision and Pattern Recognition Program Committees,
    1993, 1994, 1996, 1997, 1999, 2000,2002,2003,2005-2014
International Conference on Robotics and Automation, 2012 – 2014
IEEE Humanoid Robotics 2013
Ubiquitous Computing: 2001, 2002
Computer Vision Systems, 1999, 2000, 2002
International Conference on Computer Vision, 1995, 1997, 2001,2007, 2011
National Artificial Intelligence Conference, 1996
International Face and Gesture Conference Program Committee, 1995, 1997, 1999, 2000,2002

NSF Review Panels

NSF Robotics and Human Augmentation Program Review Panel 1995, 1998

Other Professional Activities

DARPA HCI Steering Group, 1995-1996
ARDA Executive Committee, 2000-2004
Visiting Committee, Arizona State University, Arts, Media and Engineering School 2012

On-Campus Committees

  Chair, Council of the Arts, 2012 - Present
  Chair, TechArts Strategic Initiative 2011
  Provost Innovation task force, 2010
  President's Strategic Planning Committee, 2009-2010
  Summer Committee on Computer Education, 2002
  Dean Search Committee, College of Computing, 2002
  College of Computing Task Force on Research, 2001.
  Institute Ad-hoc Committee on Intellectual Property, 1999 – Present.
  College of Computing Faculty Hiring Committee, 1999 – 2000.

Selected Consulting

Company	Dates
Edda Technologies	2002 – Present
Vistascape/Siemens Technologies	2002 – 2014
Siemens, Corporate Research	1997 – 2002
Walt Disney, Imagineering Research	1997 – 1999
Tectrix, Inc.	1996 – 1997
CyberGear, Inc.	1993 – 1996
Tekscan, Inc.	1985 – 1992
Barry Wright Corporation	1983 – 1984

NATIONAL & INTERNATIONAL PROFESSIONAL RECOGNITION

Patents and Patent Applications Pending

  Patents #5462503, 5466200, 5690582, 5785630, 5890995 "Interactive Exercise Apparatus"
  Patent # 6,983,063, "Computer-aided diagnosis method for aiding diagnosis of three dimensional
      digital image data
  Patent # 8,310,521 "Insertion of virtual video into live video"

Expert Witness

  Expert for Darby and Darby, New York For defense, in international patent infringement case
      regarding computer vision technology. Deposed and testified in district court.
  Expert for Pillsbury Winthrop, Washington, DC For plaintiff, in patent infringement case regarding
      machine vision programming environment. Deposed.
  Consultant for Foley and Hoag, Boston, MA. For defense, in patent infringement case regarding
      machine vision and automatic programming.
  Expert for Kaye Scholer, New York For defense, in international patent infringement case regarding
      computer graphics technology. Deposed and testified in Markman hearing.
  Expert for Sughrue, Mion, Washington, DC For defense, in international patent infringement case
      before the ITC regarding computer vision-based surveillance technology. Deposed.
  Expert for Gilliam and Smith, East Marshall, Texas, For defense, infringement case regarding
      computer vision-based surveillance system technology.
  Expert Jenner Block, Chicago, IL (Case #1) For defense, infringement case regarding computer
      vision-based camera surveillance technology.
  Expert Jenner Block, Chicago, IL (Case #2) For defense, infringement case regarding computer
      vision-based surveillance technology.
  Expert for Fish and Richardson, Washington, DC For defense, infringement case regarding
      interactive virtual environments. Testified in Markman hearing.
  Expert for Boies, Schiller and Flexner; Hunton and Williams, Washington, DC For plaintiff,
      infringement case regarding computer vision methods of registration.

Advisory boards
Scientific Advisory board, Aptima Inc.

Professional registration
Member of the following:
ACM, AAAI, IEEE Computer Society

Editorial and Reviewer Work for Technical Journals
Invited as Charter Associate Editor of new Kluwer Journal: Video Image Computing
Editorial Board AAAI Press
Referee for IEEE Transactions on Pattern Analysis and Machine Intelligence
Referee for Computer Vision and Image Understanding,
Referee for International Journal of Computer Vision
Referee for Machine Vision and Applications
Referee for Neural Computation
Referee for Visual Computer
Referee for Biological Cybernetics
Referee for Journal of Pattern Recognition
Referee of Artificial Intelligence Journal