

Purdue University
School of Industrial Engineering
315 N. Grant Street
West Lafayette, IN 47907

E-mail: jpwachs@purdue.edu
Web: <http://web.ics.purdue.edu/~jpwachs/>
Phone :+1 (765) 496-7380

RESEARCH INTERESTS

My research is focused on developing fundamental new theories and applications in the broad field of human-machine hybrid systems and supervised autonomy. I am particularly interested in medical applications of these theories.

RESEARCH EXPERIENCE

Naval Postgraduate School, MOVES Institute, Monterey, CA, US Jan. 2008-Aug. 2009
Postdoctoral Researcher
Parts-based classifiers design for marine detection and posture recognition. Activity detection for surveillance tasks in sub-pixel resolution images.

Inst. of Agricultural Engineering Volcani Center, Israel Jan. 2008-Aug. 2009
Ben Gurion University of the Negev, Israel
Postdoctoral Researcher
Enhancement of sensing technologies for selective tree fruit identification and targeting in robotic harvesting systems

EDUCATION & TRAINING

Ben Gurion University of the Negev, Israel
Ph.D. in Industrial Engineering and Management, June 2008
Area of Specialization: Intelligent Systems
Thesis: Optimal Hand Gesture Vocabulary Design Methodology for Virtual Robotic Control

Ben Gurion University of the Negev, Israel
M. Sc. in Industrial Engineering and Management, June 2003, *Magna Cum Laude*.
Area of Specialization: Information Systems

ORT Academic College, Hebrew University Campus, Israel
B.Ed.Tech in Electronics Teaching, 1995, *Cum Laude*

POSITIONS

School of Industrial Engineering, Purdue University, US
Associate Professor 8/2015- Now
Directors of the Intelligent Systems and Assistive Technologies Lab (ISAT) MGL 1332.

Assistant Professor 8/2009 – 8/2015
Director of the Intelligent Systems and Assistive Technologies Lab (ISAT) MGL 1332.
The ISAT lab displays a unique synergy between the areas of healthcare, surgical robotics, and human-robot interaction.

Washington Hospital Center, Washington, DC
Institute for Medical Informatics, IMI
Invited Researcher Jul. 2006
Tested a hand gesture system for medical image manipulation called “Gestix” during a brain biopsy. The major advantages of this approach are that it is natural (surgeon uses his hands), and provokes a rapid reaction in the medical informatics system (hand gesture commands are intuitive and faster than verbal voice commands).

Washington Hospital Center, Washington, DC
Institute for Medical Informatics, IMI
Informatics Fellow Aug. 2004 - Sept. 2005
Designed a sterile gesture interface for users, such as doctors/surgeons, to browse medical images in a dynamic medical environment. A vision-based gesture capture system interprets the user's gestures in real-time to navigate through and manipulate an image and data visualization environment.

Ben Gurion University of the Negev, Israel
Intelligent Systems Lab
Laboratory Engineer Oct. 2000- Jun. 2004
Responsible for the design and implementation of machine vision and robotics prototype systems. Technical advisor and support for fourth year final projects in automation track.

INDUSTRY EXPERIENCE

Dalet Digital Media Systems, Gefen - Dekel Technologies Ltd, Israel
Quality Assurance Engineer Sept. 1999- Sept. 2000
Performed quality assurance testing of new product features and new software releases. Built installation images for production environment deployment.

TEACHING

Purdue University, West Lafayette, USA Aug. 2009- Now
Associate Professor. Taught and prepared the following classes:

IE 474 (Fall 11, Spring 13, Fall 13, Spring 15, Fall 15)	Industrial Control Systems
IE 590 (Fall 2010, Spring 2010, Fall 2013, Fall 2014)	Robotics & Machine Vision
IE 690 (Spring 2013, Spring 2015)	Gestures & Body Interaction Systems
IE 486 (Fall 2009, Spring 2010)	Work Analysis and Design II
IE 332 (Fall 2012, Spring 2014)	Computing in Industrial Engineering

Ben-Gurion University of the Negev, Beer Sheva, Israel July 4-16, 2015
Summer Course in Applied Machine Vision for Robotics Applications
Introduction to image processing, pattern recognition and machine learning techniques and robotics vision.

Purdue University, West Lafayette, USA Aug. 10, 2011
Short Course in IEEE CIS Summer School 2011 "Computational Intelligence in Humanoid Robots"
Introduction to Object Recognition using Computer Vision and Learning objects appearance using a parts-based approach.

University of Buenos Aires, Argentina Jul. 23-Jul. 30 2008
Invited Professor (short course)
Visiting professor for the image processing winter school (ECIMAG 2008). Taught and prepared a one week, three hours per day program on learning and recognizing objects for 80 grad school students. Delivered daily lectures and hands-on labs which concluded with a final project.

Ben Gurion University of the Negev, Israel
Teaching Assistant Oct. 2000-Jul. 2004
Oct. 2005-Jul. 2006
Teaching assistant for the courses machine vision, mathematical methods in AI, applications of AI, human computer interfaces and development and applications of databases, respectively.

Collaborated on curriculum and exam development, assisted students with homework and course projects, graded all written work including final exam papers.

Erez College, Shlomi, Israel

Lecturer

Oct. 1998-Jul. 2000

Taught three semester three hours' weekly courses: Fundamentals of Programming with Visual Basic, Introduction to Web Programming and Development of Server Applications for technical college students. Delivered lectures and led students through programming lab assignments and final projects on HTML, Visual Basic, Perl and ASP.

ORT Academic College, Hebrew University Campus, Israel

Lecturer

Oct. 1996-Jul. 1998

Taught and prepared students to a practical engineer in electronics diploma as part of a training program for Intel-Israel employees. Lectured the overall **Digital Electronics** course program, including weekly lab practicum and administered all grades for the course.

AWARDS & HONORS

- Awarded the 2015 Helmsley Senior Scientist Fellow
- Best Poster Presentation Award AAAI 2015 (co-authored with student)
- Awarded IEEE Appreciation Award for outstanding contribution to the success of Spring 2013 Section Conference
- **Awarded the 2013 AFOSR Young Investigator Program (Air Force).**
- Awarded the 2012 Air Force Summer Faculty Fellowship Program (SFFP).
- Finalist Best Paper Award IEEE SMC 2011 (co-authored with student)
- **National Research Associateship Program Award, 2008-2009**
- Excellence Scholarship, Ben Gurion University of the Negev, 2004-2006
- X ELAVIO Latin American Association of Operations Research Summer School; Best paper selected by EURO, 2004
- The 12th Annual Conference of Industrial Engineering and Management. Student Paper Award, 2002

SYNERGISTIC ACTIVITIES

- Associate Editor for IEEE Transactions on Human-Machine Systems.
- Associate Editor for Frontiers in Robotics and AI.
- Associate Editor of the Journal of Real-Time Image Processing (Springer).
- Guest Editor of Human Computer Interaction Journal, Special Issue on Special Issue on Body Tracking In Healthcare.
 - Guest Editor of Pattern Recognition Letters, Special Issue on Special Issue on Robust Recognition Methods for Multimodal Interaction.
 - Program Committee of the IEEE 3rd International Workshop on Human Behavior Understanding (HBU 2012) as part of IROS 2012.
 - Session Chair of the IEEE SMC 2011 Conference. "Gesture-Based Interaction and Semiotics"
 - Reviewer for IEEE Systems, Machine and Cybernetics Journals (Part A and B).
 - Reviewer for NSF NRI and IIS programs.

INVITED TALKS

- Wisdom in our fingers - or how embodied interaction can shape future work. Dawn or Doom2. Purdue University, September 26, 2015.
- Augmenting Physical Action with Gaming Technologies: A Brave New World in Healthcare, Universidad del Norte, Colombia, August 5, 2015.
- Embodied Interaction in Healthcare - New Opportunities for Old Challenges. Universidad de Antioquia, Colombia. August, 3, 2015.

- IE for the Benefit of Society: A Non Traditional Take on Assistive Technologies. Universidad del Norte, Colombia, August, 6, 2015.
- Embodied Interaction in Healthcare - New Opportunities for Old Challenges. ABC robotics seminar, Ben Gurion University, Israel. June, 29, 2015.
- Hand Gesture Interaction for Healthcare - A New Challenge. IU School of Informatics and Computing. SOIC Colloquia. February 7, 2014.
- Robot, pass me the scissors! How robots can assist us in the Operating Room. 17th Iberoamerican Conference on Pattern Recognition, CIARP 2012, Buenos Aires, Argentina, Sept 3-6, 2012. **Keynote Speaker.**
- "Should robots work with us in the Operating Room?" IEEE Southeastern Michigan Spring Section Conference. Robotics and Automation Society. April 10, 2012, Dearborn, Michigan.
- Don't Give Knives to Robots: an Old-New Era in Surgical Robotics. 5th Annual Computational Science and Engineering Student Conference 2013. **Keynote speaker**
- "Gestures in the Operating Room- Can Save Lives." Body Tracking in Healthcare. Microsoft Research Symposium, UK, Nov.14-Nov-17, 2013.
- Surgical robotics and human robot interaction. Intelligent Systems Weekly Seminar. Dec. 26, 2011, Ben-Gurion University, Israel.
- Surgical robotics and human robot interaction. The William Davidson Faculty of Industrial Engineering and Management. Bi-weekly Faculty Workshop. Jan 1, 2012, Technion, Israel.
- Robotics, Collaboration and Human-Robot Interfaces. Special Talk; Mini Project in Industrial Engineering. Jan 3, 2012, Technion, Israel.
- Robot, pass me the scissors! How robots can assist us in the Operating Room. ITBA (Insituto Tecnológico de Buenos Aires), Buenos Aires, Argentina, Sept 7, 2012.
- New Faculty Orientation , "What to Expect Your First Year"!, Purdue University, Aug. 16, 2011 (presentation and panelist).
- Health and Vision. Universidad de Buenos Aires (UBA). Computer Vision Seminar, Sept. 3, 2010.
- Robotics, Gesture Language and Health. Argentinean Scientific Society, Buenos Aires, Argentina. Sept 3, 2010
- NASA Ames, Mountain View, Feb. 25, 2009.
- IE Department Seminar, Purdue University, Feb. 16, 2009.
- EE and CS Department Seminar, North Carolina State University, May 6, 2008
- Computer Science Department Seminar, *Naval Postgraduate School*, Monterey, CA, Feb 21, 2008
- Computational Interaction and Robotics Lab Seminar, *Johns Hopkins University*, Baltimore, MD, Jul 26, 2006.
- Imaging Science and Information Systems (ISIS) Seminar, *Georgetown University Medical Center*, DC, Jul 18 2006.
- Vision and Robotics seminar, Weizmann Institute, Rehovot, Israel, May 4, 2006.
- Industrial and Management Engineering Department Seminar, Ben Gurion University of the Negev, Israel, May 5, 2006.

JOURNALS

1. D. Andresen, V. Popescu, M. Cabrera, G. Gomez, S. Marley, B. Mullis, J. *Wachs. Virtual Annotations of the Surgical Field through an Augmented Reality Transparent Display. *The Visual Computer*. (2015): 1-18.
2. Bechar*, A., S. Y. Nof, and J. P. Wachs. A review and framework of laser-based collaboration support. *Annual Reviews in Control* 39 (2015): 30-45,
3. Blekhman*, A.; Wachs*, J. P. Dori*, D. (2015) Model-Based System Specification with Tesperanto: Readable Text from Formal Graphics. *IEEE*

- Transactions on Systems, Man and Cybernetics: Systems
4. J. H. Jiang*, J. P. Wachs*, B. S. Duerstock* (2014). Integrated Vision-Based System for Efficient, Semi-automated Control of a Robotic Manipulator. *International Journal of Intelligent Computing and Cybernetics*. 22–Mar-2014. <http://dx.doi.org/10.1108/IJICC-09-2013-0042>.
 5. J. P. Wachs*, D. Dori, B. Frenkel. Operation room tool handling and miscommunication scenarios: An Object-Process Methodology conceptual model. *Artificial Intelligence in Medicine*. 62.3 (2014): 153-163 .
 6. Pereira*, A; Wachs*, J. P.; Park, K; Rempel*, D. A User Developed 3D Hand Gesture Set for Common Human-Computer Interactions. *The Journal of Human Factors*. November 24, 2014, doi: 10.1177/0018720814559307.
 7. Déniz, LG., Wachs, JP., Berlles, JJ. (2014) Guest Editorial - Special Issue on Robust Recognition Methods for Multimodal Interaction. *Pattern Recognition Letters* 36: 187-188.
 8. Zhong, H; Nof, S, J.P. Wachs* (2014). Telerobot-enabled HUB-CI Model for Collaborative Lifecycle Management of Design and Prototyping" *Computers in Industry*. vol. 65, Issue 4, pp. 550–562.
 9. Y. T. Li, J. P. Wachs (2014). HEGM: A Hierarchical Elastic Graph Matching for Hand Gesture Recognition. *Pattern Recognition*. 47.1 (2014): 80-88
 10. M. Jacob, J. P. Wachs (2014). Context-based Hand Gesture Recognition for the ‘Operating Room. *Pattern Recognition Letters*. vol. 36, pp. 196-203.
 11. J. H. Jiang, J. P. Wachs, and B. S. Duerstock. (2014). A Machine Vision-Based Gestural Interface for People With Upper Extremity Physical Impairments. *IEEE Transactions on Systems, Man, and Cybernetics – Systems*, vol. 44, no. 5, pp. 630 – 641.
 12. J. P. Wachs, G. Gomez. (2013). Telementoring systems in the operating room: a new approach in medical training. *Medicina*. 73(6), 539-542.
 13. Y. T. Li, J. P. Wachs (2013). Recognizing Hand Gestures using the Hierarchical Elastic Graph Matching (HEGM) Method. *Image and Vision Computing*. 31.9 (2013): 649-657.
 14. J. H. Jiang, J. P. Wachs, and B. S. Duerstock. (2013) Real-time Facilitated Gesture Recognition Based Interfaces for Individuals with Upper-level Spinal Cord Injuries. *Journal of Real-Time Image Processing*. 1-14.
 15. Nof, S. Y., Cheng, G. ., Weiner, A. M., Chen, X. W., Bechar, A., Jones, M. G., ... & Zhang, X. C. (2013). Laser and Photonic Systems Integration: Emerging Innovations and Framework for Research and Education. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 23(6), 483-516.
 16. Zhang, S. S., & Wachs, J. P. (2013). The Improvement and Application of Intelligence Tracking Algorithm for Moving Logistics Objects Based on Machine Vision Sensor. *Sensor Letters*, 11(5), 862-869.
 17. M. Jacob, J. *Wachs , R. Packer (2012). Hand Gesture-based Sterile Interface for the Operating Room Using Contextual Cues for the Navigation of Radiological Images. *JAMIA*. 20.e1 (2013): e183-e186.
 18. M. Jacob, YT. Li, G. Akingba. J. Wachs* (2012). Collaboration with a Robotic Scrub Nurse. *Communications of the ACM*. Cover Article. May 2013 issue.
 19. A. Sadagic, M. Kölsch, G. Welch, C. Basu, C. Darken, J. P. Wachs, H. Fuchs, H. Towles, N. Rowe, J. M. Frahm, L. Guan, R. Kumar, H. Cheng (2012). Smart Instrumented Training Ranges: Bringing Automated System Solutions to Support Critical Domain Needs. *Journal of Defense Modeling and Simulation*. .
 20. M. Jacob, YT. Li, G. Akingba. J. Wachs* (2012). A Cyber-Physical Management System for Delivering and Monitoring Surgical Instruments in the OR. *Surgical Innovation*. 2012 Oct 4. [Epub ahead of print].
 21. Zhong, H; *Wachs, JP; *Nof, S. (2012). A collaborative telerobotics network framework with hand gesture interface and conflict prevention. *International Journal of Production Research*.
 22. M. Jacob, Y.-T. Li, G. Akingba, *J. Wachs. (2011). Gestonurse: a robotic surgical

- nurse for handling surgical instruments in the operating room. *Journal of Robotic Surgery*. ISSN: 1863-2483. pp. 1-11, 2011.
23. J. Wachs, M. Kölsch, H. Stern, and Y. Edan (2011). Vision-Based Hand Gesture Applications: Challenges and Innovations. *Communications of the ACM*, Cover Article, February Issue 2011; vol 54, No. 2; pp. 60-71;
 24. J. P. Wachs, H. I. Stern, T. Burks and V. Alchanatis, (2010). Low and high-level visual feature-based apple detection from multi-modal images. *Precision Agriculture*; Volume 11, Issue 6, Page 717-735.
 25. J. Wachs, M. Kölsch, D. Goshorn. (2010). Human Posture Detection for Intelligent Vehicles. *Journal of Real-Time Image Processing*. Special Issue on Real-Time Vision-Based Motion Analysis and Intelligent Transportation Systems, Springer, DOI 10.1007/s11554-010-0150-0.
 26. J. Wachs. (2010). *International Journal of Computers, Communications and Control (IJCCC)*. Volume: V (2010), No: 1
 27. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler (2009). A novel hand gesture-based image browsing system for the operating room. *Hospital IT Europe*, Vol. 2, No. 1, pp 43-45.
 28. H. Stern, J.P. Wachs. Y. Edan (2008). Designing Hand Gesture Vocabularies for Natural Interaction by Combining Psycho-Physiological and Recognition Factors. *Int. Journal of Semantic Computing*. Special Issue on Gesture in Multimodal Systems. 2008. Vol. 2, No. 1, pp. 137-160.
 29. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler (2008). A hand gesture sterile tool for browsing MRI images in the OR. *Journal of the American Medical Informatics Association*. Vol 15:3.
 30. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler (2008) "A Real-Time Hand Gesture Interface for a Medical Image Guided System". *International Journal of Intelligent Computing in Medical Sciences and Image Processing*. Vol. 1, No. 3, Issue 1, pp. 175-185.
 31. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler (2007). Gestix: A Doctor-Computer Sterile Gesture Interface for Dynamic Environments. *Soft Computing in Industrial Applications. Recent and Emerging Methods and Techniques Series: Advances in Soft Computing*, Vol. 39 Saad, A.; Avineri, E.; Dahal, K.; Sarfraz, M.; Roy, R. (Eds), pp. 30-39.
 32. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler (2006). A Real-Time Hand Gesture System Based on Evolutionary Search. *Vision*. vol. 22, no. 3, Oct. 2006, Dearborn, Mich.: *Society of Manufacturing Engineers*.
 33. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler. (2006). A Real-Time Hand Gesture Interface for Medical Visualization Applications. *Applications of Soft Computing: Recent Trends*. Springer Verlag, Germany, Series: Advances in Soft Computing ,Tiwari, A.; Knowles, J.; Avineri, E.; Dahal, K.; Roy, R. (Eds.), vol. 36, pp. 153-163.
 34. J. Wachs, H. Stern, Y. Edan (2005) Cluster Labeling and Parameter Estimation for the Automated Setup of a Hand-Gesture Recognition System. *IEEE Trans. on Systems, Man and Cybernetics*. Part A. vol. 35, no. 6, Nov. 2005, pp. 932-944.
 35. J. Wachs, O. Shapira, and H. Stern (2005) A Method to Enhance the 'Possibilistic C-Means with Repulsion' Algorithm based on Cluster Validity Index. *Applied Soft Computing Technologies: The Challenge of Complexity*, Springer Verlag, Germany, Series: Advances in Soft Computing, Abraham, A.; Baets, B.d.; Köppen, M.; Nickolay, B. (Eds.),vol. 34, pp. 77-90.
 36. Wachs, H. Stern, M. Last (2002). Segmentation of Faces Using Fuzzy Min-Max Neural Network. *J. International Journal of Image and Graphics*. vol. 2, no. 4, 2002, pp: 587-601.

CONFERENCES AND PROCEEDINGS

1. H. Jiang, Hsu, C. H., B. Duerstock, J. P. Wachs. (2015) Determining Natural and Accessible Gestures using Uncontrolled Manifolds and Cybernetics. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2015). September 28 - October 02, Hamburg, Germany.
2. T. Zhang, B. Duerstock, J. Wachs. A Computational Framework for Attention Inference Using a Bayesian Approach. ISACS 2015 - 8th International Symposium on Attention in Cognitive Systems. In conjunction with IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2015). September 28 - October 02, Hamburg, Germany.
3. T. Zhou, M. Cabrera, J. Wachs. (2015) Touchless telerobotic surgery—is it possible at all?. In Proceedings of the AAAI Conference on Artificial Intelligence (AAAI-15). Austin, Texas, January 25–30. Best Poster Presentation Award.
4. Y.T. Li, J. P. Wachs. A Bayesian Approach to Determine Focus of Attention in Spatial and Time-Sensitive Decision Making Scenarios. AAAI'14 Workshop on Cognitive Computing for Augmented Human Intelligence. AAAI Conference on Artificial Intelligence (AAAI-14). Québec City, Québec, Canada; July 27-31, 2014.
5. T. Loescher, S. Y. Lee, J. P. Wachs. (2014) An Augmented Reality Approach to Surgical Telementoring. In Proc. of IEEE Systems Man and Cybernetics (SMC 2014), Oct. 5-8, 2014, San Diego, USA, pp. 2341-2346.
6. H. Jiang, B. Duerstock, J. P. Wachs. (2014). An Analytic Approach to Decipher Usable Gestures for Quadriplegic Users, In Proc. of IEEE Systems Man and Cybernetics (SMC 2014), Oct. 5-8, 2014, San Diego, USA. pp. 3912-3917.
7. T. Zhang, G. J., Williams, B. Duerstock, J. P. Wachs. (2014) Multimodal Approach to Image Perception of Histology for the Blind or Visually Impaired, In Proc. of IEEE Systems Man and Cybernetics (SMC 2014), Oct. 5-8, 2014, San Diego, USA, pp. 3924-3929.
8. Y.T. Li, J. P. Wachs. (2014) Linking Attention to Physical Action in Complex Decision Making Problems, In Proc. Of IEEE Systems Man and Cybernetics (SMC 2014), Oct. 5-8, 2014, San Diego, USA, pp. 1241-1246.
9. M. Jacob, J. P. Wachs.(2014) Optimal Modality Selection for Multimodal Human-Machine Systems using RIMAG, IEEE Systems Man and Cybernetics (SMC 2014), Oct. 5-8, 2014, San Diego, USA, pp. 2108-2113.
10. Y.T. Li, J. P., Wachs* (2014). A Bayesian Approach to Determine Focus of Attention in Spatial and Time-Sensitive Decision Making Scenarios. AAAI'14 Workshop on Cognitive Computing for Augmented Human Intelligence. AAAI Conference on Artificial Intelligence (AAAI-14). Québec City, Québec, Canada; July 27-31, 2014.
11. Zhong, H., Wachs, IP. and Nof, SY. (2013) "HUB-CI Model for Collaborative Telerobotics in Manufacturing." Intelligent Manufacturing Systems. Vol. 11. No. 1.
12. Jiang, H., Wachs, J. P., Pendergast, M., and Duerstock, B. S. "3D Joystick for Robotic Arm Control by Individuals with High Level Spinal Cord Injuries." *In Proceedings of 13th International Conference on Rehabilitation Robotics (ICORR)*, University of Washington campus in Seattle, June 24-26, 2013.
13. Jiang, H., Wachs, J. P., Pendergast, M., and Duerstock, B. S. "Integrated Vision-Based Robotic Arm Interface for Operators with Upper Limb Mobility Impairments", *In Proceedings of 13th International Conference on Rehabilitation Robotics (ICORR)*, University of Washington campus in Seattle, June 24-26, 2013.
14. Jacob, M., Li, Y.T, Wachs*, J. P. (2013). Human-Robot Collaboration in the Operating Room. 2013 IEEE International Conference on Robotics and Automation (ICRA 2013).
15. *J. Wachs., M. Jacob, Y.T, Li,(2012). "Does a robotic scrub nurse improve

- economy of movements?". Image-Guided Procedures, Robotic Interventions, and Modeling Conference, SPIE Medical Imaging, 4-9 February 2012 in San Diego, California USA.
16. Jacob, M; YT Li, *Wachs, JP (2012). Gestonurse: A Multimodal Robotic Scrub Nurse. Accepted to the 7th ACM/IEEE International Conference on Human Robot Interaction (HRI 2012). March 5-8, 2012, Boston, Massachusetts.
 17. Jiang, H., Duerstock, B., *Wachs, JP (2012). Integrated gesture recognition based interface for people with upper extremity mobility impairments. 4th International Conference on Applied Human Factors and Ergonomics 2012 (AHFE 2012) and its affiliated conferences to be held in San Francisco, California, USA, July 21-25, 2012.
 18. *Wachs, J P. (2012) "Robot, Pass Me the Scissors! How Robots Can Assist Us in the Operating Room". Lecture Notes in Computer Science, 2012, Volume 7441, Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications, Pages 46-57.
 19. Jacob, M., Cange, C., Packer, R., and *Wachs, J.P (2012) "Intention, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room". Lecture Notes in Computer Science, 2012, Volume 7441, Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications, Pages 220-227.
 20. Li, Y.T., and *Wachs, J.P. (2012) "Hierarchical Elastic Graph Matching for Hand Gesture Recognition". Lecture Notes in Computer Science, 2012, Volume 7441, Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications, Pages 308-315.
 21. Jiang, H., *Wachs, J. P., and Duerstock B. S. (2012) "Facilitated Gesture Recognition Based Interfaces for People with Upper Extremity Physical Impairments". Lecture Notes in Computer Science, 2012, Volume 7441, Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications, 2012, Volume 7441/2012, 228-235.
 22. Jacob, M; YT Li, Wachs, JP (2011). A Gesture Driven Robotic Scrub Nurse. To appear in Proc. of IEEE International Conference on Systems, Man, and Cybernetics (SMC 2011). October 9-12, Anchorage, Alaska. **Finalist Best Student Paper Award.**
 23. Wachs, J.P., Adams, S. (2010). "A Window on Tissue" - Tissue Depth Visualization using Face Orientation for Flexible Endoscope Control. In Proceedings of the American Medical Informatics Association Symposium (AMIA) 2010, Page – 1291.
 24. Wachs, J.P. Vujjani, K. Matson, E.T. Adams, S. (2010). "A window on tissue" - Using facial orientation to control endoscopic views of tissue depth. Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). Aug. 31 2010-Sept. 4, 2010, pp. 935 – 938.
 25. J. Wachs, Duertsock, B. (2010). An Analytical Framework to Measure Effective Human Machine Interaction. Advances in Human Factors and Ergonomics in Healthcare. V. G. Duffy, Ed. CRC Press, pp. 611–621.
 26. D. Goshorn, J. Wachs, M. Kölsch. (2009). The Multi-Level Learning and Classification of Multi-class Parts-based Representations of US Marine Postures. 14th Iberoamerican Conference on Pattern Recognition, CIARP 2009, Guadalajara, Jalisco, Mexico, November 15-18, 2009. Proceedings. Lecture Notes in Computer Science 5856 Springer 2009, pp. 505-512..
 27. A. Sadagic, G. Welch, C. Basu, C. Darken, R. Kumar, H. Fuchs, H. Cheng, J.M. Frahm, M. Kolsch, N. Rowe, H. Towles, J. Wachs, and A. Lastra. (2009). New Generation of Instrumented Ranges: Enabling Automated Performance Analysis. In Proceedings of 2009 Interservice/Industry Training, Simulation, and Education Conference (IITSEC-2009), Orlando, Florida, U.S.A., November 30–December 3.
 28. J. Wachs, D. Goshorn and M. Kölsch. (2009). Recognizing Human Postures and Poses in Monocular Still Images. In Proceeding of the International Conference on

- Image Processing, Computer Vision, and Signal Processing. (IPCV09) Las Vegas, Nevada. July 2009.
29. J. Wachs, H. Stern, T. Burks and V. Alchanatis. (2009). Multi-modal Registration Using a Combined Similarity Measure. *Applications of Soft Computing: Updating the State of the Art Series: Advances in Intelligent and Soft Computing*, Avineri, E.; Köppen, M.; Dahal, K.; Sunitiyoso, Y.; Roy, R. (Eds.), Springer, 52:159-168.
 30. J. Wachs, H.I. Stern, T. Burks and V. Alchanatis (2009). Apple detection in natural tree canopies from multimodal images. In proceeding of the Joint International Agricultural Conference, JIAC 2009, pp. 293-302.
 31. V. Alchanatis, J. Wachs, H. Stern, O. Safren, and T. Burks. (2008). Enhancement of Sensing Technologies for Selective Tree Fruit Identification and Targeting in Robotic Harvesting Systems," *2nd Israeli Conference on Robotics ICR 2008*. 19-20 Nov, Herzlia, Israel.
 32. H. Stern, J. Wachs and Y. Edan (2008) Optimal Consensus Intuitive Hand Gesture Vocabulary Design. *In Proc. of IEEE Intl Conf on Semantic Computing*. pp. 96-103.
 33. J. Wachs, H. Stern, Y. Edan (2008) A Holistic Framework for Hand Gestures Design. *In Proc. of 2nd Annual Visual and Iconic Language Conf*. July 21-22, San Diego, CA, pp. 24-34.
 34. H. Stern, J. Wachs, Y. Edan (2007). An Analytic Approach for Optimal Hand Gestures. *In Proc. of the 7th Intl Workshop on Gesture in Human-Computer Interaction and Simulation, GW 2007*. 23-25 May, Lisbon, Portugal.
 35. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler (2006) A Real-Time Gesture Interface for Hands-Free Control of Electronic Medical Records. *Annual Symp of the American Medical Informatics Association (AMIA 2006)*, November 11-15, Washington DC.
 36. H. Stern, J. Wachs, Y. Edan (2006). Human factors for design of hand gesture Human - Machine Interaction. *Proceedings of 2006 IEEE Intl Conf on Systems, Man, and Cybernetics*, Oct. 8 -11, Taipei, Taiwan, 2006, pp. 4052-4056.
 37. H. Stern, J. Wachs, Y. Edan. (2006). Optimal Hand Gesture Vocabulary Design Using Psycho-Physiological and Technical Factors. *Proc. of 7th Intl Conf. on Automatic Face and Gesture Recognition, FG2006*, Southampton, UK, April 10-12 2006, pp. 257-262.
 38. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith and J. Handler. (2006) A Real-Time Hand Gesture Interface for a Medical Image Guided System. *In the Ninth Israeli Symp. on Computer-Aided Surgery, Medical Robotics, and Medical Imaging, ISRACAS 2006*, May 11, 2006, Israel.
 39. A. Eliav, T. Lavie, Y. Parmet, H. Stern, J. Wachs, Y. Edan (2005). KISS Human-Robot Interfaces. *In the 18th Intl. Conf. on Production Research (ICPR)*, July, 2005, Salerno, Italy.
 40. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith and J. Handler, (2005). A Real-Time Hand Gesture System based on Evolutionary Search. *In Genetic and Evolutionary Computation Conf. (GECCO '05)*, June, 2005 ,Washington DC, USA.
 41. H. Stern, J. Wachs, Y. Edan. (2004). Hand Gesture Vocabulary Design: A Multicriteria Optimization. *In Proceedings of the IEEE Intl Conf. on Systems, Man & Cybernetics*. The Hague, Netherlands, 2004.
 42. O. Shapira and J. Wachs (2004). A Graphical method based on the Xie-Beni Validity index to improve the 'Possibilistic C-Means with Repulsion' Algorithm. *In Proc. of the 4th Intl .Symp on Intelligent Manufact. Systems*, Sakarya, Turkey, 2004, pp. 958 – 967.
 43. H. Stern, J. Wachs, Y. Edan (2004). Optimization of hand gesture command vocabularies - A multiobjective quadratic assignment approach. Paper selected to represent Israel at X ELAVIO Latin American Association of Operations Research Societies Summer School for Young Scholars. Montevideo, Uruguay, 2004.
 44. H. Stern, J. Wachs, Y. Edan (2004). Parameter Calibration for Reconfiguration of

- a Hand Gesture Tele-Robotic Control System. *In Proc. of the U.S.A.-Japan Symp. on Flexible Automation*, Denver, Colorado.
45. J. Wachs, H. Stern, Y. Edan (2003). Parameter search for an image processing fuzzy C-means hand gesture recognition system. *In Proc. of IEEE Intl Conf. on Image Processing ICIP 2003*, Spain, vol 3, pp. 341.
 46. J. Wachs, U. Kartoun, Y. Edan, H. Stern. (2002). Real-Time Hand Gesture Telerobotic System Using the Fuzzy C-Means Clustering Algorithm. *In IE&M, Proc. 2th annual Conf of Industrial Eng and Management*, Tel-Aviv, Israel, pp. 94-98. Received Student Paper Award.
 47. J. Wachs, U. Kartoun, Y. Edan, H. Stern. (2002). Real-Time Hand Gesture Telerobotic System Using the Fuzzy C-Means Clustering Algorithm. *In Proc. of the World Automation Congress, WAC 2002*, Orlando, FL, USA, vol. 13, pp. 403 – 409.

CHAPTERS

- Kölsch, M., Wachs, J., & Sadagic, A. (2013). Visual Analysis and Filtering to Augment Cognition. In *Foundations of Augmented Cognition*. Springer Berlin Heidelberg. pp. 695-702.
- J. P Wachs. Designing Embodied and Virtual Agents for the Operating Room: Taking a Closer Look at Multimodal Medical Service Robots and Other Cyber-Physical Systems. *Speech and Automata in Healthcare Voice-Controlled Medical and Surgical Robots Series: Speech Technology and Text Mining in Medicine and Healthcare*. A. Neustein (Ed). De Gruyter, 2014; To be published: November 2014; ISBN: 978-1-61451-515-9
- Zhou, T., Cabrera, M.E. Wachs, J.; A comparative study for touchless telerobotic surgery. *Computer-assisted surgery in orthopaedics*. Springer. (under review).

PRESS

- “Surgical Technology Aims to Mimic ‘Teleporting’”. NPR. Inside Indiana Business. Sept. 28, 2015.
- “Purdue researchers working on new technology to save lives on battlefield”. WLFI.com TV news. 2015
- “Surgeons could use his hand-gesture system to control robots” Profile. *Spectrum Magazine*. Magazine, 19 Aug 2013. <http://spectrum.ieee.org/geek-life/profiles/profile-juan-wachs>
- CBN News. (TV Show). Rise of the Machines: Robots Man's Best Friend?
- <http://www.cbn.com/cbnnews/us/2014/June/Rise-of-the-Machines-Robots-Mans-Best-Friend/>
- “Robots and people can all get along” NPR Marketplace, Radio broadcast, and online:
- <http://www.marketplace.org/topics/tech/robots-ate-my-job/robots-and-people-can-all-get-along>
- “Surgeons could use his hand-gesture system to control robots” Profile. *Spectrum Magazine*, 19 Aug 2013.
- “Robotic Nurse in Development at Purdue” FOX NEWS , News, March 18, 2011.
- “Robots may assist surgeons in the future” The Exponent , Newspaper, February 22, 2011.
- “Future surgeons may use robotic nurse, 'gesture recognition'” Purdue Featured News, February 3, 2011.
- “Camera ensures control of robotic nurse is all in hand” the Engineer, News February 4, 2011.
- “Prototype Robotic Scrub Nurse Recognizes Surgeons' Gestures” Outpatient Surgery, News, February 4, 2011.
- “Future Technology in the OR Could Decrease Surgery Times, Risk of Infection” Infection Control Today, News, February 4, 2011.

- “Surgeons may get Minority Report-style display” New Scientist Magazine, 16 June, 2008.
- “Gesture Computer Interface Device Developed For Surgeons” ScienceDaily, June 19, 2008
- “Gesturing Interface Developed for Doctors” Dr. Dobb’s, June 16, 2008.
- “Gesturing Medical Procedures” NASA Tech Briefs INSIDER 06/27/2008
- “How to choose grad school?” Resources, IEEE Spectrum Magazine, Sept. 2005, pp: 59-62.
- ‘Gestix’ in Beyond Tomorrow”. Beyond Tomorrow (Australian TV Show). Stories, Episode 15, e-medicine, 2006. www.beyondtomorrow.com

FUNDING

- Agency/Title of Grant: Naval Postgraduate School
Title: “An efficient real-time method for detection and characterization of UAVs”
Duration of Funding (Dates): 03/31/2015 - 3/30/2016
Total amount of award: \$90,00.00
co-PI (Purdue PI) – 0.23
- Agency/Title of Grant: Purdue PRF
Title: “The Algorithmic Gardener – Tales of Nature and Code: Creating New Metaphors for Future Natures through Critical Gardening”
Duration of Funding (Dates): 01/01/2015 - 12/31/2015
Total amount of award: \$20,00.00
co-PI (Purdue PI) – 0.18
- Agency/Title of Grant: NSF
Collaborative Research: Title: “I/UCRC for Robots and Sensors for the Human Wellbeing
Duration of Funding (Dates): 09/15/2014 - 08/31/2019
Total amount of award: \$65,000
- Agency/Title of Grant: NSF
Title: “MRI Development: Human Avatars: Enabling Research in Natural Communication with Virtual Tutors, Therapists, and Robotic Companions”
Duration of Funding (Dates): 09/01/2014 - 08/31/2017
Total amount of award: \$1,200,00.00
co-PI (Purdue PI) - \$150,000
- Agency/Title of Grant: USAMRAA/ TATRC
“See-what-I-do: Increasing mentor and trainee sense of co-presence in trauma surgeries with the STAR platform” (PI)
Duration of Funding (Dates): 2/20/2014-2/20/2019
Total amount of award : \$1,750,000 (Phase 1 awarded, \$750,000)
- Agency/Title of Grant: QNRF
“Robotic Assistants in Operating Rooms in Qatar “Theory, Development and Integration” (PI)
Duration of Funding (Dates): 11/20/2013-11/20/2015
Total amount of award: \$1,000,050
- Agency/Title of Grant: 2013 AFOSR Young Investigator Research Program (PI)
“Embodied Interactions in Human-Machine Decision Making for Situation Awareness Enhancement Systems”
Duration of Funding (Dates): 08/20/2013 - 08/19/2016
Total amount of award: \$358,857.48

- Agency/Title of Grant: OVPR Laboratory Equipment Program “A Dual Robotic Arm to Enhance Cross-disciplinary Capabilities and Exploration” (PI)
Duration of Funding (Dates): N/A
Total amount of award: \$100,000
- Agency/Title of Grant: Indiana Clinical and Translational Sciences Institute
“Gestonurse: A Robotic Scrub Nurse That Understands Hand Gestures” (PI)
Duration of Funding (Dates): One (1) year 08/01/2012-07/31/2013
Total amount of award: \$75,000
- Agency/Title of Grant: Endologix “Challenges of Selective Catheterization across the Aortic Bifurcation with different Endografts” (co-PI)
Duration of Funding (Dates): One (1) year 04/10/2012-05/15/2012
Total amount of award: \$14,265
- Agency/Title of Grant: Discovery Park Seed Grant (co-PI)
“Collaborative Assistive Robotics”
Duration of Funding (Dates): One (1) year 09/01/2010-08/31/2011
Total amount of award: \$36,795
- Agency/Title of Grant: Purdue Research Foundation
Title: “Distributed Sensor Fusion Methodology In "intelligent Rooms" For Assisted Living Facilities” (PI)
Duration of Funding (Dates): One (1) year 06/01/2010-05/31/2011
Total amount of award: \$16,795
- Agency/Title of Grant: AHRQ R03 HS019837-01 (PI)
Title: “Context-Based Hand-Gesture Recognition for the Operating Room”
Duration of Funding: Two (2) years 09/30/2010-09/29/2012
Total amount of award: \$100,000
- Agency: Indiana Clinical and Translational Sciences Institute (PI)
Title: “A Window on Tissue” - Tissue Depth Visualization using Face Orientation for Laparoscope Control
Duration: One (1) year 11/19/2009-11/10/2011; Total amount of award: \$9,685