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RESEARCH
INTERESTS

My research is in using machine vision as an input modality. That means using natural means of communication to control devices such robots and computers. For this purpose, my interest is in the use of hand gestures, face expressions, body movements and gaze to facilitate this interaction. I have a special interest in research on intelligent interfaces for activity recognition and surveillance tasks.

EDUCATION

Ben Gurion University of the Negev, Israel

Ph.D., Industrial Engineering and Management, Oct. 2007

Dissertation: Optimal Hand Gesture Vocabulary Design Methodology for Virtual Robotic Control

Advisors: Helman Stern and Yael Edan

Ben Gurion University of the Negev, Israel

M. Sc., Magna Cum Laude, Industrial Engineering and Management, 2003

Advisors: Helman Stern and Yael Edan

ORT Academic College, Hebrew University Campus, Israel

B.Ed.Tech, Cum Laude, Electronics Department, 1995

RESEARCH
EXPERIENCE

**Naval Postgraduate School, MOVES Institute,
Monterey, US**

Postdoctoral Researcher

Jan. 2008-Now

Efficient detection boosting procedures for marine's posture recognition. Activity detection for surveillance tasks.

Inst. of Agricultural Engineering Volcani Center, Israel

Ben Gurion University of the Negev, Israel

Postdoctoral Researcher

Oct. 2006-2007

Enhancement of Sensing Technologies for Selective Tree Fruit Identification and Targeting in Robotic Harvesting Systems

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. Use of this interface eliminates surgeon's focus shift and location change. 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. Dynamic navigation gestures are translated to commands based on their relative positions on the screen. The gesture system relies on tracking of the user's hand based on color-motion cues.

	<p>Ben Gurion University of the Negev, Israel Intelligent Systems Lab <i>Laboratory Engineer</i> <i>Oct. 2000- Jun. 2004</i> Responsible for the design of research projects. Machine learning design of classifiers, image and video processing, background subtraction, face segmentation, hand gesture recognition, and telerobotics control using closed-form inverse kinematics.</p>
INDUSTRY EXPERIENCE	<p>Dalet Digital Media Systems, Israel Gefen - Dekel Technologies Ltd <i>Quality Assurance Engineer</i> <i>Set. 1999- Set. 2000</i> Performed quality assurance testing of new product features and new software releases. Built installation images for production environment deployment.</p>
TEACHING	<p>Ben Gurion University of the Negev, Israel <i>Teaching Assistant</i> <i>Oct. 2000-Jul. 2004</i> <i>Oct. 2005-Jul. 2006</i></p> <ul style="list-style-type: none"> • “Machine Vision” • “Mathematical Methods in AI” • “Applications in AI” • “Human Computer Interfaces” • “Development and Application of Databases” <p>Collaborated on curriculum and exam development, met with students upon request, and graded all written work, including final exam papers.</p> <p>Erez College, Shlomi, Israel <i>Lecturer</i> <i>Oct. 1998-Jul. 2000</i></p> <ul style="list-style-type: none"> • “Fundamentals of Programming with Visual Basic” • “Introduction to Web Programming” • “Development of Server Applications” <p>Taught and developed syllabus and overall course structure, and administered all grades</p> <p>ORT Academic College, Hebrew University Campus, Israel <i>Lecturer</i> <i>Oct. 1996-Jul. 1998</i></p> <ul style="list-style-type: none"> • “Digital Electronics” • “Digital Electronics Laboratory” <p>Taught and developed syllabus and overall course structure, including weekly lab practicum, and administered all grades.</p>
PROFESSIONAL ACTIVITIES & AFFILIATIONS	<ul style="list-style-type: none"> • <i>Member</i>, IEEE Society <i>2003-present</i> • <i>Member</i> of the Israeli Society for Operations Research <i>2005-present</i>
AWARDS & HONORS	<ul style="list-style-type: none"> • National Research Associateship Program award <i>2007</i> • Excellence Scholarship, Ben Gurion University of the Negev <i>2004-2006</i> <i>Feb. 2004</i> • X ELAVIO Latin American Association of Operations Research Summer School; Best paper selected by EURO <i>2002</i> • The 12th Annual Conference of Industrial Engineering and Management. Student Paper Award.
INVITED TALKS	<ul style="list-style-type: none"> • Computational Interaction and Robotics Lab Seminar, <i>Johns Hopkins University</i>, Baltimore, MD, US. <i>Jul.26, 2006</i> • Imaging Science and Information Systems (ISIS) Seminar, <i>Georgetown University Medical Center</i>, DC, US. <i>Jul. 18, 2006</i>

- 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*

JOURNAL
PUBLICATIONS

- “Designing Hand Gesture Vocabularies for Natural Interaction by Combining Psycho-Physiological and Recognition Factors”. H. Stern, J.P. Wachs. Y. Edan. 2008. *Int. Journal of Semantic Computing. Special Issue on Gesture in Multimodal Systems. 2008. Vol. 2, No. 1*, pp. 137-160.
- “A hand gesture sterile tool for browsing MRI images in the OR”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler. 2008. *Journal of the American Medical Informatics Association. Volume 15, Issue 3*.
- “A Real-Time Hand Gesture Interface for a Medical Image Guided System”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler. *International Journal of Intelligent Computing in Medical Sciences and Image Processing. 2008 .Vol. 1, No. 3, Issue 1*, pp. 175-185.
- “Gestix: A Doctor-Computer Sterile Gesture Interface for Dynamic Environments”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler. *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.) 2007, pp. 30-39.
- “A Real-Time Hand Gesture System Based on Evolutionary Search”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, and J. Handler. *Vision. vol. 22, no. 3, Oct. 2006*, Dearborn, Mich.: Society of Manufacturing Engineers.
- “A Real-Time Hand Gesture Interface for Medical Visualization Applications”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler. 2006. *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.
- “Cluster Labeling and Parameter Estimation for the Automated Setup of a Hand-Gesture Recognition System”. J. Wachs, H. Stern, Y. Edan. *IEEE Transactions on Systems, Man and Cybernetics. Part A. vol. 35, no. 6, Nov. 2005*, pp. 932-944.
- “A Method to Enhance the ‘Possibilistic C-Means with Repulsion’ Algorithm based on Cluster Validity Index”. J. Wachs, O. Shapira, and H. Stern. 2005. *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.
- “Segmentation of Faces Using Fuzzy Min-Max Neural Network”. J. Wachs, H. Stern, M. Last. *International Journal of Image and Graphics. vol. 2, no. 4, 2002*, pp: 587-601.

CONFERENCES
AND
PROCEEDINGS

- “Optimal Consensus Intuitive Hand Gesture Vocabulary Design.” H. Stern, J. Wachs and Y. Edan. In *Proc. of IEEE International Conference on Semantic Computing, 2008*. pp. 96-103,
- “A Holistic Framework for Hand Gestures Design.” J. Wachs, H. Stern, Y. Edan. In *Proceedings of 2nd Annual Visual and Iconic Language Conference. July 21-22, San Diego, CA, 2008*, pp. 24-34.
- “Multi-modal Registration Using a Combined Similarity Measure”. J. Wachs, H. Stern, T. Burks, and V..Alchanatis. *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. 38, pp. 170-180 (to appear).
- “An Analytic Approach for Optimal Hand Gestures”, H. Stern, J. Wachs, Y. Edan. In Proc. of the 7th Intl Workshop on Gesture in Human-Computer Interaction and Simulation, GW 2007. 23-25 May 2007, Lisbon, Portugal.
 - “Doctor-Computer Interface using Gestures”, J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler, In Workshop on Gesture in Human-Computer Interaction and Simulation, GW 2007. 23-25 May 2007, Lisbon, Portugal.
 - “A Real-Time Gesture Interface for Hands-Free Control of Electronic Medical Records”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith, J. Handler. 2006 Annual Symposium of the American Medical Informatics Association (AMIA 2006), November 11-15, Washington DC.
 - “Human factors for design of hand gesture Human - Machine Interaction”. H. Stern, J. Wachs, Y. Edan. Proceedings of 2006 IEEE International Conference on Systems, Man, and Cybernetics, Oct. 8 -11, Taipei, Taiwan, 2006, pp. 4052-4056.
 - “Optimal Hand Gesture Vocabulary Design Using Psycho-Physiological and Technical Factors”. H. Stern, J. Wachs, Y. Edan. Proceedings of 7th International Conference on Automatic Face and Gesture Recognition, FG2006, Southampton, UK, April 10-12 2006, pp. 257-262.
 - “A Real-Time Hand Gesture Interface for a Medical Image Guided System”. J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith and J. Handler. In the Ninth Israeli Symposium on Computer-Aided Surgery, Medical Robotics, and Medical Imaging, ISRACAS 2006, May 11, 2006, Petach Tikva, Israel.
 - “KISS Human-Robot Interfaces”. A. Eliav, T. Lavie, Y. Parmet, H. Stern, J. Wachs, Y. Edan. In the 18th International Conference on Production Research (ICPR), July, 2005, Salerno, Italy.
 - "A Real-Time Hand Gesture System based on Evolutionary Search". J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, M. Smith and J. Handler, In Genetic and Evolutionary Computation Conference (GECCO '05), June, 2005, Washington DC, USA.
 - “Hand Gesture Vocabulary Design: A Multicriteria Optimization”. H. Stern, J. Wachs, Y. Edan. In Proceedings of the IEEE International Conference on Systems, Man & Cybernetics. The Hague, Netherlands, 2004.
 - “A Graphical method based on the Xie-Beni Validity index to improve the ‘Possibilistic C-Means with Repulsion’ Algorithm”. O. Shapira and J. Wachs. In Proceedings of the 4th International Symposium on Intelligent Manufacturing Systems, Sakarya, Turkey, 2004, pp. 958 – 967.
 - “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.
 - “Parameter Calibration for Reconfiguration of a Hand Gesture Tele-Robotic Control System”. H. Stern, J. Wachs, Y. Edan. In Proceedings of the U.S.A.-Japan Symposium on Flexible Automation, Denver, Colorado, 2004.
 - “Parameter search for an image processing fuzzy C-means hand gesture recognition system”. J. Wachs, H. Stern, Y. Edan. In Proc. of IEEE Intl Conference on Image Processing ICIP, 2003, Spain, vol 3, pp. 341.
 - “Real-Time Hand Gesture Telerobotic System Using the Fuzzy C-Means Clustering Algorithm”. J. Wachs, U. Kartoun, Y. Edan, H. Stern. In IE&M 2002, Proc. 2th annual conference of Industrial Engineering and

Management, Tel-Aviv, Israel, pp. 94-98. Received Student Paper Award.

- “Real-Time Hand Gesture Telerobotic System Using the Fuzzy C-Means Clustering Algorithm”. J. Wachs, U. Kartoun, Y. Edan, H. Stern. In Proceedings of the 5th Biannual World Automation Congress, WAC 2002, Orlando, Florida, USA, vol. 13, pp. 403 – 409.

PRESS

- “Surgeons may get Minority Report-style display” NewScientist Magazine, 16 June, 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

COMPUTER SKILLS

- Programming in Matlab.
- Programming in MFC, C++, C, OpenGL, Scheme and Visual Basic.
- Experience with OpenCV Machine Vision and other scientific libraries.
- Programming in Perl, for utilities, libraries, desktop applications and CGI.

REFERENCES

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