

CURRICULUM VITAE

William A. Hoff

Division of Engineering
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EDUCATION

Ph.D. Computer Science, University of Illinois (Urbana), January 1987.

Thesis title: "Surfaces from Stereo: An Integrated Approach"

M.S. Physics, University of Illinois (Urbana), August 1981.

B.S. Physics, Illinois Institute of Technology, May 1978.

RESEARCH INTERESTS

Development of intelligent sensing systems within integrated man-machine or robotic systems. Specifically, these interests include computer vision and image understanding, three dimensional object recognition, robotics, medical imaging, human-computer interfaces, virtual and augmented reality. I am particularly interested in the role of perception in robotics, and in the interaction between humans and intelligent machines, such as a human assisting or being assisted by computer vision in performing a task.

RESEARCH AND PROFESSIONAL EXPERIENCE

Associate Professor, Colorado School of Mines *August 2001 - present*
Research in medical imaging, activity recognition, and vision-based navigation. Taught undergraduate courses in digital electronics and microcontrollers, and graduate courses on computer vision and image processing. Served as assistant director of the Engineering Division since 2006.

Assistant Professor, Colorado School of Mines *August 1994 – August 2001*
Founded a research lab focusing on 3-D computer vision, specializing in the area of augmented reality and interactive computer vision systems. Developed a funded research program in augmented reality, focusing on registration using computer vision techniques and inertial sensors. Developed a funded research program in medical imaging, focusing on algorithms to analyze the kinematics of joints from x-ray fluoroscopy image sequences. Started a collaboration with a local medical research center, which developed into a NSF I/UCRC program in biomedical devices. Developed undergraduate courses in digital electronics and microcontrollers, focusing on data acquisition and control systems. Developed graduate courses on computer vision, image processing, and stochastic processes.

Visiting Scientist, Rocky Mountain Musculoskeletal Research Lab *2002 –2003*
While on sabbatical, performed research in medical imaging, including fluoroscopy, ultrasound, and computed tomography.

Staff Engineer, Martin Marietta Astronautics Group *September 1988 - August 1994*
Lead of target recognition algorithm development and integration team for DARPA's unmanned ground vehicle program, and successfully conducted two annual demonstrations. Developed the navigation and inspection systems of a robotic vehicle system for the Department of Energy that demonstrated autonomous monitoring and inspection of hazardous waste storage facilities. As principal investigator of an independent research and development project on Computer Vision, directed the development and integration of vision technology into several robot testbeds, including a multi-arm supervisory controlled system and a free-flying vehicle simulator.

Staff Engineer, Martin Marietta Aero & Naval Systems *January 1987 - September 1988*
Performed research in computer vision for robotics and autonomous underwater vehicles. Served as a research associate at the National Institute of Standards and Technology (NIST), and implemented some of the first algorithms on the prototype PIPE image processing computer, including a real-time stereo vision algorithm and a moving edge detection algorithm.

Research Assistant, University of Illinois *January 1983 - December 1986*
Performed research in the area of computer vision. Ph.D thesis was on a new vision algorithm to compute the surface map of a scene from a stereo pair of images, that integrated feature matching, surface fitting, and contour detection. Developed tools and software for the vision research group, including display, graphics, and analysis tools.

COURSE DEVELOPMENT

EGGN 384 - Digital Logic

Improved and updated this course by increasing the use of computers in simulation and design. Initiated the use of schematic entry and simulation software (e.g., Altera), which allowed students to quickly design complex combinational and sequential logic circuits, then build them in hardware. Introduced programmable logic devices (CPLDs and FPGAs) and hardware description languages (VHDL), and created new lab projects. Increased the amount of design in the course through the use of projects. Example projects have included: infrared communications system, digital security system, mobile robots, and processor design. Put course materials on web, including homeworks and sample problems.

EGGN 482 – Microcontroller Architecture and Interfacing

Improved and updated this course by increasing the sophistication of programming projects, increasing the amount of design, and upgrading the target processor. Created many new lab projects based on interfacing to sensors and actuators (e.g., sonar, temperature, light, step and DC motors). Put course materials on web, including homeworks and sample problems.

EGES 510 – Multidimensional Signal and Image Processing

Developed new examples and assignments using Matlab.

EGES 512 – Computer Vision

Developed a new course, covering all aspects of computer vision, from image formation and early processing, through feature extraction and object recognition. Developed examples and assignments using commercial tools such as Khoros, Matlab, and OpenCV.

EGES 598 – Introduction to Stochastic Processes

Developed a new course, covering the topic of probability and random processes, with applications to signal processing and estimation.

EGGN 491/492 – Senior Design

Regularly sponsored and advised student teams in senior design project. Projects included: augmented reality, magnetic head tracking sensor, and mobile robots.

Introduction to Electrical Engineering and Robotics at CSM

This is a half day course that is part of a high school summer camp (“Engineering and Science Week at CSM”). Developed two modules (digital electronics and robotics), which are hands-on in nature and designed to give the students a taste of electrical engineering.

UNDERGRADUATE RESEARCH PROJECTS

I regularly sponsor and advise student teams in senior design projects, both in Engineering (EGGN 491/492) and Physics (PHGN 471/472), as well as field session in the Mathematical and Computer Sciences department. Example projects have included:

- Augmented reality
- Mobile robots
- Medical imaging

EDUCATION RESOURCES ACQUIRED

CSM Technology Fee Committee, 8 computers for Electronics Lab (\$19K), 1998.

Alumni donation of new logic analyzer (\$2000), 1999.

Altera Corp., PLD prototyping boards (\$1K), 1999.

CSM Technology Fee Committee, 4 digital oscilloscopes (\$16K), 2000.

Agilent Corp, 4 digital oscilloscopes (\$16K), 2000.

Altera Corp., PLD prototyping boards (\$1K), 2003.

CSM Technology Fee Committee, PLD programmer (\$1000), Spring 2004.

CSM Technology Fee Committee, electronics lab equipment (\$6868), Fall 2004.

CSM Technology Fee Committee, microcontroller equipment (\$864), Spring 2005.

CSM Technology Fee Committee, LCD Tablet for Lecture Presentations (\$2000), Spring 2007

CSM Technology Fee Committee, FPGA Boards for Digital Logic Laboratory (\$4035), Spring 2009

PROFESSIONAL ACTIVITIES

- (2009) Program committee, for IFAC Workshop on Networked Robotics, Oct 6-8, 2009, Golden, Colorado
- (2003 – 2006) Director of campus research center – Center for Automation, Robotics and Distributed Intelligence (CARDI)
- (2000) NSF Proposal Panel
- (2000, 2001, 2002) Program Committee, IEEE/ACM International Symposium on Augmented Reality
- (1999) Demos and exhibits chair at IEEE Computer Vision and Pattern Recognition Conference
- (1997) Session chair at IEEE International Conference on Robotics and Automation
- (1996 – 2000) Member of Operating Board and also Executive Board for the Colorado Advanced Software Institute
- (1995) Gave short course on Computer Vision to the Idaho National Engineering Lab
- (1995) Session co-chair at SPIE conference on Mobile Robots
- (1992 – present) Associate editor for the journal, *Pattern Recognition*, and member of Pattern Recognition Society
- (1983 – present) Member of IEEE (Computer Society; Robotics & Automation),
- (1984 to present) Reviewer for many conferences and journals, including:
 - IEEE Transactions on Pattern Analysis and Machine Intelligence
 - IEEE Transactions on Medical Imaging
 - National Science Foundation proposals
 - IEEE International Conference on Computer Vision
 - IEEE Computer Vision and Pattern Recognition Conference
 - IEEE and ACM International Symposium on Mixed and Augmented Reality (ISMAR)
 - ASME Journal of Biomechanics
 - EURASIP Journal on Advances in Signal Processing
 - Image and Vision Computing Journal

CSM COMMITTEES AND OTHER SERVICE

CSM Faculty Compensation Committee	2009-present
Engineering Division website development Committee	2008
Engineering Division assistant director	2006-present
CSM Student Scholastic Awards Committee	2005-present
CSM ad-hoc committee on future of bioscience and bioengineering	2006
CSM Faculty Oversight Committee on Sports and Athletics	2003-2005
CSM Curriculum Committee	2001-2002
Advisor for IEEE Student Chapter	1999-2005
Engineering Division admissions committee	2000-2002
CSM Readmissions Committee	1996-2000
Engineering Division ABET preparation committee	1999-2000
Judge for CSM Research Fair	March 1995
Chaperone/faculty advisor for a 3-day student trip to Phelps Dodge Co.	October 1997
Undergraduate advisees: approximately 20	

ENGINEERING DIVISION SEARCH COMMITTEES

Chair of Engineering Division lecturer search committee (EE)	2009
Engineering Division faculty search committee (comp eng)	2009
Engineering Division faculty search committee (signals)	2008
Engineering Division faculty search committee (power)	2007
Engineering Division faculty search committee (division director)	2006
Engineering Division faculty search committee (Dobelman chair)	2005
Chair of Engineering Division faculty search committee (Dobelman chair)	2004
Engineering Division faculty search committee (telecommunications)	2003
Chair of Engineering Division faculty search committee (Paden chair)	2002
Chair of Engineering Division faculty search committee (bioengineering)	2000
Engineering Division faculty search committee (Paden chair)	1999
Engineering Division faculty search committee (signal processing)	1998
Engineering Division faculty search committee (controls)	1997
Engineering Division faculty search committee (power)	1996

PAST AND CURRENT RESEARCH PROJECTS

William Hoff, Michael Colagrosso, “Activity Mathematics”, Lockheed Martin, \$120,000, January 2008 – December 2008.

Kevin Moore , William Hoff, “Fast Rope Video Analysis”, Kuchera Defense Systems, \$11,626 , May 2007 – July 2007

William Hoff, Tyrone Vincent, “Tracking support for Loadmaster Training System”, Pathfinder Systems, Inc, \$54,138, Feb 2007 – Aug 2007

William Hoff, “Biplanar Registration Algorithm”, University of Tennessee, \$48,000, August 2005 – December 2007.

William Hoff, Jae Young Lee, “Activity Mathematics”, Lockheed Martin, \$99,994, January 2007 – December 2007.

William Hoff, Jae Young Lee, “Activity Notation Transformations”, Lockheed Martin, \$29,482, August 2006 – December 2006.

William Hoff, Tyrone Vincent, “Video Aided Navigation, SBIR Phase 2” PercepTek Inc., \$130,000, June 2006 – April 2008.

William Hoff, “Moving Target Reconstruction,” PercepTek Inc., \$34,978, July 2005 – April 2006.

William Hoff, “Video Aided Navigation,” PercepTek Inc., \$32,994, July 2005 – March 2006.

William Hoff, Tyrone Vincent, “Dismounted Augmented Reality Training System”, Pathfinder Systems Inc., \$15,939, July 2005 – September 2005.

William Hoff, Jae Young Lee, “Universal Activity Theory”, Lockheed Martin, \$60,000. December 2004 – December 2005.

William Hoff, Alan Norton, “Activity Identification and Visualization”, Lockheed Martin, \$120,000. December 2003 – December 2004.

Chris Debrunner, William Hoff, "Tomographic Imaging from Fluoroscopic Video", Colorado Alliance for Bioengineering, \$57,700. January 2002 – June 2002.

Chris Debrunner, William Hoff, "Markerless Human Motion Tracking", Colorado Advanced Software Institute, \$40,000. July 2001 – August 2002.

William A. Hoff, "Real-Time 3D Modeling Development", \$29,500, Sandia National Laboratory, December 1999 – May 2002.

William Hoff, Tracy Camp, Xindong Wu, "Mentored Internships," Colorado Advanced Software Institute, \$12,500. February 2001 - June 2001.

William A. Hoff, "Registration of Range Data", \$8,245, Sandia National Laboratory, November 1998 – May 1999.

William A. Hoff, "Tactical Mobile Robots Support", \$107,238, SAIC Corporation, July 1998 - April 2000.

William A. Hoff, "Measurement of Normal Knee Kinematics from X-ray Images," \$39,900, Colorado Advanced Software Institute, July 1998 - August 1999.

William A. Hoff, "InImEx Interactive SAR Object Recognition," \$58,859, Lockheed-Martin Astronautics, February 1998 - June 2001.

Rahmat Shoureshi, William Hoff, Richard Komistek, "NSF Industry/University Cooperative Research Center for Intelligent Biomedical Devices and Musculoskeletal Systems," \$550,000, January 1998 - August 2002

William A. Hoff, "Measurement of Implant Component Position and Orientation from X-ray Images," \$40,651, Colorado Advanced Software Institute, July 1997 - August 1998.

William A. Hoff, "Vision-based tracking system for an augmented reality-based surgical aid," \$24,996, Johnson & Johnson Professional Inc., July 1996 - August 1997.

Richard Komistek, William Hoff, "Planning Meeting for an Industry/University Cooperative Research Center for Musculoskeletal System Analysis", NSF Grant EEC-9616415, \$10,000, July 1996 - July 1997.

William A. Hoff, "Measurement of Joint Kinematics from Fluoroscopy Images", \$1700, NSF Coalition to Increase Minority Degrees, Grant KMD-2414-3-7/SUB, June 1996 - August 1996.

William A. Hoff, Robert King, "Evaluation of Interactive Techniques for the Creation and Updating of Site Models for Remote Operations and Inspection", \$160,546, Lockheed Martin INEL - Department of Energy, Contract PO CC-S-596129, June 1995 - Sept 1996.

OTHER RESEARCH RESOURCES ACQUIRED

Odetics Laser Range Scanner, on loan from Lockheed-Martin (value ~\$100K)
Northern Digital Optotrak sensor system, on loan from Johnson & Johnson (value ~ \$60K).
Head mounted displays, monitors, cameras from Medtronic (value \$220K).

CONSULTING ACTIVITY

Rocky Mountain Musculoskeletal Research Laboratory, August 2002 – May 2003. Bioimaging research.

Peak Performance, Inc., August 2004 – June 2005. Project: “Objective Radiographic Oropharyngeal Swallowing Analysis”, SBIR from NIH.

PAST AND CURRENT GRADUATE STUDENTS

Torsten Lyon (M.S. 1995). Thesis title: “Three-dimensional Pose Estimation from Noisy Two-Dimensional Image Observations Using Multiple Cameras”

Fred Hood (M.S. 1997). Thesis title: “Evaluation of an Interactive Site Modeling System”

Khoi Nguyen (M.S. 1998). Thesis title: “Inertial Data Fusion Using Kalman Filter Methods for Augmented Reality”

Mark Sarojak (M.S. 1998). Thesis title: “Interactive pose estimation of total joint arthroplasty via x-ray fluoroscopy”

Jason Luck (M.S. 1999). Thesis title: “Registration of Range Images Through the Use of a Hybrid Simulated Annealing and Iterative Closest Point Algorithm”

Lin Chai (M.S. 2000). Thesis title: “3-D Motion and Structure Estimation Using Inertial Sensors and Computer Vision for Augmented Reality”

Josh Lisle (MS 2002). Thesis title: “Design and Evaluation of a Virtual Reality Interface for Mobile Robot Control Using a Small Display”

Mohamed Mahfouz (PhD 2002). Thesis title: “A New Registration Method for Implanted and Non Implanted Knee Joints Using Single Plane X-ray Fluoroscopy”

Jason Luck (PhD 2003). Thesis title: “Real-time markerless human motion tracking using linked kinematic chains”

Josh King (MS 2007). Thesis title: “Bi-Planar Image Registration and Modeling of Bones”

Marc Wennogle (MS 2007). Thesis title: “Three Dimensional Segmentation of Intravascular Ultrasound Data”

Stuart Guarnieri (MS 2008). Thesis title: “3D Object Segmentation Using Correspondence Space Grouping and Propagation”

John Steinbis, (MS 2008). Thesis title: “A New Vision and Inertial Pose Estimation System for Handheld Augmented Reality”

HONORS AND AWARDS

Third place at National Security Innovation Competition, 2009

Outstanding faculty member award (from CSM graduate student ballots), 2006

Winner of the "Exemplary Project" award from CASI, for the project "Measurement of Implant Component Position and Orientation from X-ray Images", October 1999

Best paper of session award at the Rocky Mountain Bioengineering Symposium, April 1999

Winner of the "Clinical Biomechanics" award, European Society of Biomechanics, August 1996.

JOURNAL PUBLICATIONS

1. Hoff, W. and Ahuja, N., "Surfaces from Stereo: Integrating Feature Matching, Disparity Estimation, and Contour Detection," *IEEE Trans. Pattern Analysis and Machine Intelligence*, Vol. 11, No. 2, pp. 121-136, 1989.
2. Magee, M., Hoff, W., Gatrell, L., Sklair, C., and Wolfe, W., "Employing Sensor Repositioning to Refine Spatial Reasoning in an Industrial Robotic Environment," *International Journal of Applied Intelligence*, Vol. 1, No. 1, pp. 69-85, 1991.
3. Hoff, W., Gatrell, L., and Spofford, J., "Machine Vision Based Teleoperation Aid," *Telematics and Informatics*, Vol. 8, No. 4, pp. 403-423, 1991.
4. Byler, E., Chun, W., Hoff, W., and Layne, D., "Autonomous hazardous waste inspection vehicle," *IEEE Robotics and Automation Magazine*, Vol. 2, No. 1, pp. 6-17, 1995.
5. Dennis, D. A., Komistek, R. D., Hoff, W. A., and Gabriel, S. M., "In-Vivo Knee Kinematics Derived Using an Inverse Perspective Technique," *Clinical Orthopaedics and Related Research*, Vol. 331, pp. 107-117, 1996.
6. Stiehl, J. B., Komistek, R. D., Dennis, D. A., Paxson, R. D., and Hoff, W. A., "Fluoroscopic analysis of kinematics after posterior-cruciate retaining knee arthroplasty," *Journal of Bone and Joint Surgery-British*, Vol. 77-B, No. 6, pp. 884-889, 1996.
7. Stiehl, J. B., Komistek, R. D., Dennis, D. A., Paxson, R. D., and Hoff, W. A., "Comparison of Biomechanical Aspects of Posterior Cruciate Retaining vs. Posterior Cruciate Sparing Total Knee Arthroplasty," *Journal of Contemporary Orthopaedics*, 1996.
8. Walker, S. A., Hoff, W. A., Komistek, R. D., and Dennis, D. A., "In Vivo Pose Estimation of Artificial Knee Implants Using Computer Vision," *Biomed Sciences Instrumentation*, Vol. 32, No. 1996.
9. Hoff, W. A., R. D. Komistek, D. A. Dennis, S. M. Gabriel, and S. A. Walker, "Three-dimensional determination of femoral-tibial contact positions under "in-vivo" conditions using fluoroscopy," *Clinical Biomechanics*, Vol. 13, No. 7, pp. 455-472, 1998.
10. Hoff, W. A. and T. Vincent, "Analysis of Head Pose Accuracy in Augmented Reality," *IEEE Trans. Visualization and Computer Graphics*, Vol 6., No. 4, pp. 319-334, 2000.
11. Bertin, K., Komistek, R., Dennis, D., Hoff, W., Anderson, D., Langer, T., "In vivo determination of posterior femoral rollback for subjects having a NexGen posterior cruciate retaining total knee arthroplasty," *J Arthroplasty*, vol. 17, no. 8, pp. 1040-1048, 2002.
12. Chai, L., W. A. Hoff, and T. Vincent, "Three-dimensional motion and structure estimation using inertial sensors and computer vision for augmented reality," *Presence: Teleoperators and Virtual Environments*, vol. 11, no. 5, pp. 474-492, 2002.
13. Mahfouz, M., W. Hoff, R. Komistek, and D. Dennis, "A Robust Method for Registration of Three-Dimensional Knee Implant Models to Two-Dimensional Fluoroscopy Images," *IEEE Trans. Medical Imaging*, vol. 22, no. 12, pp. 1561-74, 2003.
14. Mahfouz, M., R. Komistek, D. Dennis, and W. Hoff, "In vivo assessment of the kinematics in normal and anterior cruciate ligament-deficient knees," *J Bone Joint Surg Am.*, vol. 86, pp. 56-61, 2004.

15. Dennis, D., M. Mahfouz, R. Komistek, and W. Hoff, "In vivo determination of normal and anterior cruciate ligament-deficient knee kinematics," *J Biomech.*, vol. 38, no. 2, pp. 241-53, 2005.
16. Mahfouz, M., W. Hoff, R. Komistek, and D. Dennis, "Effect of segmentation errors on 3D-to-2D registration of implant models in X-ray images," *J Biomech.*, vol. 38, no. 2, pp. 229-39, 2005.

BOOK CHAPTERS

1. Magee, M., Hoff, W., Gatrell, L., and Wolfe, W., "Intelligent Control of a Vision-Based Spatial Reasoning System Integrated with a Robot Manipulator," in *Progress in Robotics and Intelligent Systems*, Vol. 3, G. Zobrist and C. Y. Ho, Ed., Norwood, New Jersey, Ablex Publishing Corp., pp. 261-286, 1995.
2. E. Berg, M. Mahfouz, C. Debrunner, B. Merkl, and W. Hoff., "Fourier descriptor-based deformable models for segmentation of the distal femur in CT," to appear in *Advanced Computer Information Systems*, K. Saeed and J. Pejas, Ed.: Springer Verlag, 2005.

REFEREED CONFERENCE PROCEEDINGS

1. Ahuja, N. and Hoff, W., "Augmented Medial Axis Transform," *Proc. of IEEE Workshop on Computer Vision: Representation and Control*, April, pp. 251-256, 1984.
2. Ahuja, N. and Hoff, W., "Depth from Stereo," *Proc. of 4th Scandinavian Conference on Image Analysis*, Trondheim, Norway, June, pp. 761-768, 1985.
3. Hoff, W. and Ahuja, N., "Extracting Surfaces from Stereo Images: An Integrated Approach," *Proc. of First Int'l Conf. on Computer Vision*, IEEE, London, June, pp. 284-294, 1987.
4. Hoff, W. and Sklair, C., "Planetary Terminal Descent Hazard Avoidance Using Optical Flow," *Proc. of IEEE Conf. Robotics and Automation*, pp. 238-243, 1990.
5. Magee, M., Hoff, W., Gatrell, L., and Wolfe, W., "Adaptive Camera Calibration in an Industrial Robotic Environment," *Proc. of 3rd Int'l Conf. on Industrial and Engineering Applications of AI*, ACM, July, 1990.
6. Magee, M., Hoff, W., Gatrell, L., and Wolfe, W., "Integrated Planning of Robotic and Computer Vision Based Spatial Reasoning," *Proc. of 3rd Int'l Conf. on Industrial and Engineering Applications of AI*, ACM, July, 1990.
7. Cuseo, J., Fleming, P., Hoff, W., Sklair, C., Eshera, M., and Whitten, G., "Machine Vision Techniques for Planetary Terminal Descent Hazard Avoidance and Landmark Tracking," *Proc. of American Control Conference*, June, 1991.
8. Hoff, W., Komistek, R., Dennis, D., Walker, S., Northcut, E., and Spargo, K., "Pose Estimation of Artificial Knee Implants in Fluoroscopy Images Using a Template Matching Technique," *Proc. of 3rd Workshop on Applications of Computer Vision*, IEEE, Sarasota, FL, Dec. 2-4, pp. 181-186, 1996.

9. Hoff, W. A., Hood, F. W., and King, R. H., "An Interactive System for Creating Object Models from Range Data Based on Simulated Annealing," *Proc. of Int'l Conference on Robotics and Automation*, IEEE, Albuquerque, NM, April 21-27, 1997.
10. W. A. Hoff, "Fusion of Data from Head-Mounted and Fixed Sensors," *Proc. of First International Workshop on Augmented Reality*, IEEE, San Francisco, California, November 1, 1998.
11. M. E. Sarojak, W. A. Hoff, R. D. Komistek, and D. A. Dennis, "Utilization of an automated model fitting process to determine kinematics of TKA," *Proc. of Orthopaedic Research Society*, Anaheim, California, February 1-5, 1999.
12. L. Chai, K. Nguyen, W. Hoff, and T. Vincent, "An adaptive estimator for registration in augmented reality," *Proc. of 2nd IEEE/ACM Int'l Workshop on Augmented Reality*, San Francisco, Oct. 20-21, 1999.
13. J. Luck, C. Little, and W. Hoff, "Registration of range data using a hybrid simulated annealing and iterative closest point algorithm," *Proc. of IEEE International Conference on Robotics and Automation*, San Francisco, April 24-28, 2000.
14. D. A. Dennis, R. Komistek, M. Mahfouz, W. Hoff, J. Stiehl, "In vivo determination of three dimensional normal knee motion during five weight-bearing activities," *Proc. of Annual Meeting of the American Academy of Orthopaedic Surgeons*, San Francisco, CA, 2001, San Francisco, CA, Feb. 28 - Mar. 4.
15. M. Mahfouz, W. A. Hoff, R. Komistek, and D. A. Dennis, "Post-Operative Analysis Of Non-Implanted Knee Joint Kinematics Using Fluoroscopy," *Proc. of Fifth Annual North American Program on Computer Assisted Orthopaedic Surgery*, Pittsburgh, Pennsylvania, 2001, Pittsburgh, Pennsylvania, July 6-8.
16. M. Mahfouz, W. Hoff, D. Anderson, E. Northcut, R. Komistek, "Verification Of Three-Dimensional Joint Kinematics Determined Using Fluoroscopy: An Error Analysis," *Proc. of 48th Annual Meeting Orthopaedic Research Society - Poster*, Dallas, TX, 2002, Dallas, TX, February.
17. J. P. Luck, C. Debrunner, W. Hoff, Q. He, D. Small, "Development and Analysis of a Real-Time Human Motion Tracking System," *Proc. of Workshop on Applications of Computer Vision*, Orlando, FL, 2002, Orlando, FL, Dec 3-4, pp. 196-202.
18. J. Argenson, R. Komistek, D. Dennis, W. Hoff, T. Langer, "In Vivo Determination Of Knee Kinematics During Gait For Subjects Implanted with A Unicompartmental Arthroplasty," *Proc. of AAOS 2003 Annual Meeting*, New Orleans, Louisiana, 2003, New Orleans, Louisiana.
19. J. Goffin, R. Komistek, M. Mahfouz, D. Wong, D. Macht, W. Hoff, "In vivo kinematics of normal, degenerative, fused and disk-replaced cervical spines," *Proc. of AAOS 2003 Annual Meeting*, New Orleans, Louisiana, 2003, New Orleans, Louisiana.
20. W. Hoff and J. Lisle, "Mobile Robot Control Using a Small Display," *Proc. of International Conference on Intelligent Robots and Systems (IROS)*, Las Vegas, Nevada, 2003, Las Vegas, Nevada, October 27-31. Acceptance rate = 60%.
21. E. Berg, M. Mahfouz, C. Debrunner, and W. Hoff, "A 2D Fourier Approach To Deformable Model Segmentation Of 3D Medical Images," *Proc. of International Symposium on Biomedical Imaging*, Arlington, VA, 2004, Arlington, VA, 15-18 April.

22. C. Baker, Debrunner, C., Mahfouz, M., Hoff, W., Bowen, J, "CT from an Unmodified Standard Fluoroscopy Machine using a Non-Reproducible Path," *Proc. of Computer Vision Approaches to Medical Image Analysis (CVAMIA)*, Prague, 2004, May 15, 11-23.
23. C. Debrunner, Baker C., Hoff, W., Bowen, J., Mahfouz, M., "Tomographic Reconstruction From an Uncontrolled Sensor Trajectory," *Proceedings of the 2004 IEEE International Symposium on Biomedical Imaging: From Nano to Macro*, 2004, Arlington, VA, USA, 15-18 April, 1416-1419.
24. E. Berg, M. Mahfouz, C. Debrunner, and W. Hoff, "A 2D Fourier Approach to Deformable Model Segmentation of 3D Medical Images," *Proc. of Computer Vision and Mathematical Methods in Medical and Biomedical Image Analysis*, Prague, Czech Republic, 2004, May 15, pp. 181-192.
25. E. Berg, C. Debrunner, W. Hoff, and M. Mahfouz, "Automatic Segmentation of 3D Medical Images Using Fourier Descriptor-Based Deformable Models," *Proc. of Advanced Computer Systems-Computer Information Systems and Industrial Management Applications (ACS-CISIM)*, Elk, Poland, 2004, June 14-16.
26. R. Parker, W. Hoff, A. Norton, J. Lee, and M. Colagrosso, "Activity Identification and Visualization," *Proc. of Pattern Recognition in Information Systems – PRIS 2005*, Miami, FL, 2005, May 24-25, pp. 124 – 133. (acceptance rate 50%)
27. C. Baker, C. Debrunner, S. Gooding, W. Hoff, and W. Severson, "Autonomous Vehicle Video Aided Navigation - Coupling INS and Video Approaches," *Proc. of 2nd International Symposium on Visual Computing*, Lake Tahoe, NV, 2006, Nov. 6-8, pp. 534-543. (acceptance rate 44%)
28. J. Lee, W. Hoff, "Activity Identification Utilizing Data Mining Techniques," *Proc. of IEEE Workshop on Motion and Video Computing*, Austin, TX, 2007, Feb. 23-24.
29. R. Rimey, W. Hoff, J. Lee, "Recognizing wide-area and process-type activities," *Proc. of 10th International Conference on Information Fusion*, Quebec City, QC, Canada, 2007, Jul. 9-12, pp. 1-8.
30. J. Steinbis, W. Hoff, T. Vincent, "3D Fiducials for Scalable AR Visual Tracking," *Proc. of 7th IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, Cambridge, UK, 2008, Sept 15-18, pp. 183-184. (acceptance rate 20%)
31. J. Steinbis, T. Vincent, W. Hoff, "New Extensions of the 3-Simplex for Exterior Orientation," *Proc. of 19th Int'l Conf. on Pattern Recognition (ICPR)*, Tampa, FL, 2008, Dec 8-11.
32. M. Wennogle, W. Hoff, "Three Dimensional Segmentation of Intravascular Ultrasound Data," *Proc. of Int'l Conf. on Image Analysis and Recognition (ICIAR 2009)*, Halifax, Canada, 2009, July 6-8, pp. 772-781.

INVITED TALKS AND PRESENTATIONS

1. "Multi-Resolution Techniques in Stereo Vision," *Workshop in Computational Vision on Multi-Resolution Representation of Images*. Copenhagen, Denmark, Invited presentation, 1987.

2. "Research in Augmented Reality," invited presentation to Center for LifeLong Learning and Design (L3D) group at University of Colorado – Boulder, March 1997.
3. "The Use of Optimization in Solving Registration Problems in Biomedical Imaging and Robot Vision," invited presentation to the Optimization and Bio-Mathematics/Statistics research groups at CU-Denver, 9/22/98.
4. "Automation and Robotics Research and Education at the Colorado School of Mines," invited presentation to Sigma Xi chapter at Mesa State College, 4/24/00.
5. "Projection on Convex Sets", presentation to U. Tennessee Biomedical Engineering Dept, August 2007.

NON-REFEREED CONFERENCES, PRESENTATIONS, AND TECH REPORTS

1. Hoff, W. and Mathis, D., "Connectionist Model-Based Stereo Vision for Telerobotics," *Proc. of Visual Information Processing for Television and Telerobotics*, Vol. NASA CP-3053, Williamsburg, Virginia, May, pp. 261-270, 1989.
2. Magee, M., Hoff, W., Gatrell, L., and Wolfe, W., "Task Panel Sensing with a Movable Camera," *Proc. of Advances in Intelligent Robotics Systems*, Vol. 1193, SPIE, Philadelphia, Pennsylvania, November, 1989.
3. Sklair, C., Gatrell, L., and Hoff, W., "Optical Target Location Using Machine Vision in Space Robotics Tasks," *Proc. of Advances in Intelligent Systems*, Vol. 1387, SPIE, November, pp. 380-391, 1990.
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