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Department of Computer Science
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February 2, 2007

EDUCATION

Ph.D. in Computer Science, University of Pennsylvania, 1988
Dissertation: Active Reduction of Uncertainty in Multi-Sensor Systems
Advisor: Dr. Max Mintz

M.S.E. in Computer Science, University of Pennsylvania, 1985
Thesis: Computational Aspects of Proofs in Modal Logic
Advisor: Dr. Dale Miller

B.A. *Summa Cum Laude*, Luther College, Decorah, Iowa, 1983
Thesis: Heuristic Programming

POSITIONS HELD

Professor of Computer Science with secondary appointment in **Mechanical Engineering**
Johns Hopkins University, 1999-present.

Associate Professor of Computer Science and Electrical Engineering
Yale University, 1996-1999.

Assistant Professor of Computer Science
Yale University, 1991-1996.

Post-doctoral Research Fellow
University of Pennsylvania, 1990.

Fulbright Fellow
Fraunhofer Inst., IITB & University of Karlsruhe, 1988-1990.

Summer Research Staff
SRI International, 1984.

Summer Research Staff
IBM T.J. Watson Research Center, 1983.

PROFESSIONAL AWARDS

Fellow of the IEEE, 2006

Best Paper Awards:

MICCAI 2005
MICCAI 2005 (Best Student Paper)
SPIE 2006

Best Paper Nominations:

Intelligent Robots and Systems, 2004
IEEE Trans. on Robotics and Automation, 1996.
International Symposium on Robotics Research, 1989.

Yale Junior Faculty Fellowship, 1995.

Fulbright Post-doctoral Junior Research Fellowship, 1988.

Rubinoff Dissertation Prize, University of Pennsylvania, 1988.

IBM Graduate Fellowship in Manufacturing and Automation, 1986.

National Science Foundation Graduate Fellowship, 1983.

PROFESSIONAL ACTIVITIES

Editorial Boards:

International Journal of Computer Vision, 2004-present
IEEE Transactions on Robotics and Automation, 1997-2000.
Pattern Analysis and Applications, 1997-present.

Chair:

Computer and Robot Vision Technical Committee of the
IEEE Robotics and Automation Society, 1996-2000.

Organizer:

Workshop on Programming Methods in Robotics, CIRA 2001.
Tutorial in Vision-Based Robotics, CIRA 2001.
Dagstuhl Workshop on Sensor-Based Robotics, 2000.
Tutorial on Dynamic Vision, AAAI 2000.
Workshop and Tutorials Chair, CVPR 2000.
Workshop on Robust Vision for Control of Motion, 1998.
Block Island Workshop on Vision and Control, 1997.
Tutorial on Visual Control of Motion, 1996.
Workshop on Visual Servoing, 1994.

Editor:

Special Joint Issue of IJRR and IJCV on Vision and Robotics, 2006
Special Issue of the IEEE Transactions on Robotics and Automation on Visual Servoing, 1996.

Area Chair:

Computer Vision and Pattern Recognition, 2005, 2006
Medical Image Computing and Computer Assisted Intervention, 2005

Program Committees:

Computer Vision and Pattern Recognition, 2003, 2004
Medical Image Computing and Computer Assisted Intervention, 2002, 2003,2006
Vision Interfaces, 2002, 2003
International Conference on Computational Intelligence in Robotics and Automation, 2001
International Symposium on Robotics with Applications 2000.
Vision Algorithms Workshop (with ICCV'99), 1999.
Third Haskell Workshop (with ICFP'99), 1999.

IEEE International Conference on Computer Vision and Pattern Recognition 1996-1999.
International Conference on Computer Vision 1999.
International Conference on Robotics and Automation 1997,1999-2002,2005.
World Manufacturing Congress, 1997.
AAAI Conference 1996.
International Symposium on Robotics and Manufacturing 1996.
Multisensor Fusion and Integration for Intelligent Systems, 1994, 1996.
IEEE International Conference on Intelligent Robotics Systems, 1994, 1996, 2001.
SPIE Sensor Fusion Workshop 1991-1997.

Invited Speaker:

2000 Keynote Speaker: Multimedia Computing and Networking 2000.
1999 DIMACS Workshop on Computer Vision and Robotics, Rutgers University.
1999 Workshop on Automated Control of Distributed Instrumentation, University of Illinois.
1999 First Annual Computational Neuroscience Symposium, University of Minnesota
1997 Workshop on Control Problems in Robotics and Automation, CDC 1997.
1995 Joint Slovenia/Austrian Workshop on Computer Vision, Marberg, Slovenia.
1994 Dagstuhl Workshop on the Mathematical Foundations of Vision, Dagstuhl, Germany.
1992 AAAI Spring Symposium, Stanford University.
1992 Allerton Conference, University of Illinois.
1991 Conference on Mathematical Methods of Robotics, Freiberg Germany.
1989 Annual Stockholm Vision Workshop, Stockholm, Sweden.
1989 German Special Committee Meeting on Robotic Control, Dortmund, Germany.

NSF Panels:

RHA program panel
CISE Postdoctoral Research Associates in Experimental Computer Science
Career Awards
Challenges in CISE
Computer Vision
“Future Directions in Robotics,” 1991.

Consulting:

Strider Labs, Inc.
Smart Systems Technology
ABB Inc.
Siemens
United Technologies Research Center
Microsoft Inc.

PATENTS

A Vision-based Six-degree-of-freedom Computer Input Device (with K. Toyama), U.S. Patent 60/012,761 issued November, 1998.
Method and System for Cooperative Control of Manipulator Systems, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen), preliminary patent filed, 2001.
Method for Robot Assisted Puncture of a Blood Vessel, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen and E. deJuan), preliminary patent filed, 2001.
Method for Creating High Resolution Composite Images, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen), preliminary patent filed, 2001.

Method for Manipulating Cells of a Cell Culture (with R. Kumar and R. Taylor), preliminary patent filed, 2001.

PUBLICATIONS

Journal Articles:

1. Henry C. Lin, Izhak Shafran, David Yuh, Gregory D. Hager. Towards Automatic Skill Evaluation: Detection and Segmentation of Robot-Assisted Surgical Motions. *Computer Aided Surgery*, 11(5):220-230, September 2006.
2. Le Lu and Xiang-tian Dai and Gregory D. Hager. Efficient particle filtering using RANSAC with application to 3D face tracking. *Image Vision Computing*, 24(6):581-592, June 2006.
3. Darius Burschka and Ming Li and Russell Taylor and Gregory D. Hager and Masaru Ishii. Scale-Invariant Registration of Monocular Endoscopic Images to CT-Scans for Sinus Surgery. *Medical Image Analysis*, 9(5):413-439, October 2005.
4. Jason J. Corso and Guangqi Ye and Gregory D. Hager. Analysis of Multi-Modal Gestures with a Coherent Probabilistic Graphical Model. *Virtual Reality*, 8(4):242-252, September 2005.
5. Darius Burschka, Jason J. Corso, Maneesh Dewan, William W. Lau, Ming Li, Henry Lin, Panadda Marayong, Nicholas A. Ramey, Gregory D. Hager, Brian Hoffman, David Larkin, and Christopher J. Hasser. Navigating inner space: 3-D assistance for minimally invasive surgery . *Robotics and Autonomous System*, 52(1):5-26, 2005.
6. D. Kragic, P. Marayong, M. Li, A.M. Okamura, and G.D. Hager. Human-Machine Collaborative Systems for Microsurgical Applications. *The International Journal of Robotics Research*, 24(9):731-741, 2005.
7. Guangqi Ye, Jason J. Corso, Darius Burschka, and Gregory D. Hager. Vics: A modular hci framework using spatio-temporal dynamics. *Machine Vision and Applications*, 16(1):13-20, 2004.
8. A. Bettini, P. Marayong, S. Lang, A. M. Okamura, and G. D. Hager, "Vision Assisted Control for Manipulation Using Virtual Fixtures," *IEEE Transactions on Robotics*, Vol. 20, No. 6, pp. 953-966, 2004.
9. D. Rothbaum, J. Roy, G. Hager, R. Taylor, L. Whitcomb, H. Francis, and J. Niparko. Task performance in stapedotomy: Comparison between surgeons of different experience levels. *Otolaryngology - Head and Neck Surgery*, 2003.
10. Myron Z. Brown, Darius Burschka, and Gregory D. Hager. Advances in Computational Stereo. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(8):993-1008, 2003.
11. Joint Probabilistic Techniques for Tracking Multi-Part Objects (with C. Rasmussen). *IEEE PAMI*, 23(6): pp. 560-576, 2001.
12. Object Pose from Video Images (with C-P. Lu and E. Mjolsness). *PAMI* 22(6): pp. 610-622, 2000
13. What Tasks Can Be Performed with an Uncalibrated Stereo Vision System? (with J. Hespanha, Z. Dodds, and A.S. Morse). *The International Journal of Computer Vision*, 35(1): pp. 65-85, Nov. 1999.
14. Incremental Focus of Attention for Robust Visual Tracking (with K. Toyama). *The International Journal of Computer Vision*, 35(1): pp. 45-63, Nov. 1999.

15. Tracking in 3D: Image Variability Decomposition for Recovering Object Pose and Illumination (with P. Belhumeur). Accepted to appear in the *Pattern Analysis and Applications*, March, 1999.
16. Efficient Region Tracking with Parametric Models of Geometry and Illumination (with P. Belhumeur). *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 20(10), pp. 1125-1139, 1998.
17. The XVision System: A General-Purpose Substrate for Portable Real-Time Vision Applications (with K. Toyama). *Computer Vision and Image Understanding*, 69(1), pp. 23-37, 1998.
18. A Modular System for Robust Hand-Eye Coordination Using Feedback from Stereo Vision. *IEEE Transactions on Robotics and Automation*, 13(4) pp. 582-595, 1997.
19. A Tutorial Introduction to Visual Servo Control (with S. Hutchinson and P. Corke). *IEEE Transactions on Robotics and Automation*, 12(5) pp. 651-670, 1996 (**one of five nominated for best transactions article of 1996**).
20. Online Computation of Exterior Orientation with Application to Hand-Eye Calibration (with C.P. Lu and E. J. Mjolsness). *Mathematical and Computer Modeling*, 24(5), pp. 121-143, 1996.
21. Robot Feedback Control Based on Stereo Vision: Towards Calibration-Free Hand-Eye Coordination (with W. Chang and A.S. Morse). *IEEE Control Systems Magazine*, 15(1), pp. 30-39, 1995.
22. Task-Directed Computation of Qualitative Decisions from Sensor Data. *IEEE Transactions on Robotics and Automation*, 10(4), pp. 415-429, 1994.
23. Solving Large Systems of Non-Linear Constraints with Application to Data Modeling. *Interval Computations*, 2, pp. 169-200, 1994.
24. Real-Time Vision-Based Robot Localization (with S. Atiya). *IEEE Transactions on Robotics and Automation*, 9(6), pp. 785-800, 1993.
25. Computational Methods for Task-Directed Sensor Data Fusion and Sensor Planning (with M. Mintz). *International Journal of Robotics Research*, 10(4), pp. 285-313, 1991.

Books:

26. *Task-Directed Sensor Fusion and Planning*. Kluwer, Boston, 1990.
27. *The Confluence of Vision and Control* (with D. Kriegman, and A.S. Morse, Editors) LNCIS series, Springer-Verlag, 1998.
28. *Robust Vision for Vision-Based Control of Motion* (with M. Vincze, Editor) IEEE Computer Society Press, 1999.
29. *Sensor-Based Robots* (with H. Christensen, Editor) LNCS series, Springer-Verlag, 2001 (expected).

Book Chapters:

30. Guangqi Ye and Jason J. Corso Gregory D. Hager. Real-Time Vision for Human-Computer Interaction, chapter 7: Visual Modeling of Dynamic Gestures Using 3D Appearance and Motion Features. Springer-Verlag, 2005. to appear.
31. Research Issues in Vision and Control (with D. Kriegman and A.S. Morse) in *The Confluence of Vision and Control* (G. Hager D. Kriegman, and A.S. Morse, Editors) LNCIS series, Springer-Verlag, 1998.

32. Feature-Based Visual Servoing and its Application to Telerobotics (with G. Grunwald and K. Toyama). In V. Graefe, editor, *Intelligent Robotic Systems*, Elsevier, Amsterdam, 1995.
33. Robust Linear Rules for Nonlinear Systems. In J.K. Aggarwal, editor, *Multisensor Fusion for Computer Vision*, Springer-Verlag, 1993.
34. Automatic Sensor Search and Positioning for Geometric Tasks (with M. Mintz). In S. Chen, editor, *Recent Advances in Spatial Reasoning*, Ablex, 1990.

Reviews, Editorials:

35. Computational Vision at Yale (with Peter N. Belhumeur, James S. Duncan, Drew V. McDermott, A. Stephen Morse, Steven W. Zucker) *International Journal of Computer Vision* 35(1): 5-12, November 1999
36. Introduction to the Special Section on Vision-Based Control of Robot Manipulators (with S. Hutchinson). *IEEE Transactions on Robotics and Automation*, 12(5) pp. 649-650, 1996.
37. A Review of *Active Vision*. *IEEE Expert*, 8(4), 1993.

Invited Papers:

38. Darius Burschka and Gregory D. Hager. Principles and Practice of Real Time Tracking on Consumer Hardware . In Tututial 1 at IEEE VR2003: Recent Methods for Image-Based Modeling and Rendering, pages 55-66, March 2003.
39. Human-Machine Cooperative Manipulation With Vision-Based Motion Constraints, Workshop on Visual Servoing, (with IROS 2002).
40. FROB: A Transformational Approach to the Design of Robot Software (with J. Peterson), *Proceedings of the Ninth International Symposium on Robotics Research*, Springer Verlag, 2000, pages 257-264.
41. Tracking in 3D: Image Variability Decomposition for Recovering Object Pose and Illumination (with P. Belhumeur). In the *Proceedings of the International Conference on Pattern Analysis and Applications*, pp. 93-102.
42. Toward Domain-Independent Navigation: Dynamic Vision and Control, (with D. Kriegman, A. Georgiades and O. Ben-Shahar). In the *proceedings of the IEEE Conference on Decision and Control*, special session on active vision, 1998.
43. Vision-Based Robot Control (with P. Corke). In *Control Problems in Robotics and Automation*, Springer Verlag Lecture Notes in Control and Information Sciences 230, pp. 177-190, 1997.
44. Modeling and Control for Mobile Manipulation in Everyday Environments (with W. Feiten, W. Magnussen and K. Toyama). In the *Proceedings of the 1997 International Symposium on Robotics Research*.
45. A Projective Framework for Constructing Accurate Hand-Eye Systems (with Z. Dodds). In the *Proceedings of the IEEE/RSJ/INRIA Workshop On New Trends in Image-Based Robot Servoing*, pp. 71-82, 1997.
46. The XVision System: A Paradigm for Real-Time Vision. In *Visual Modules: Proceedings of the 19th ÖAGM and 1st SDVR Workshop*, pp. 11-28, 1995.

47. Sensor planning for reactive robot programs (with G. Grunwald). In *Proceedings of the Allerton Conference on Communications, Computing and Control*, Oct., 1992.

Peer-Reviewed Conferences:

48. Maneesh Dewan and Gregory D. Hager and Christine H. Lorenz. Robust Image-Based Motion Tracking for Coronary MR Angiography. In the 1st International Workshop on Computer Vision for Intravascular and Intracardiac Imaging (CVII), in conjunction with MICCAI 2006, pages 171-78, Oct 2006.
49. Maneesh Dewan and Gregory D. Hager. Toward Optimal Kernel-based Tracking. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 1:618-625, June 2006.
50. Maneesh Dewan and Gregory D. Hager and Steven M. Shea and Christine H. Lorenz. Compensating for Beat-to-Beat Variation in Coronary Motion Improves Image Quality in Coronary MR. In Proceedings of the International Society for Magnetic Resonance Medicine (ISMRM), 14th Scientific Meeting in Seattle, Washington, USA, page 2159, May 2006.
51. Maneesh Dewan and Gregory D. Hager and Christine H. Lorenz. Image-Based Tracking and Prediction of Coronary Motion for Coronary MR Angiography. In Proceedings of the 9th Annual Meeting of the Society for Cardiovascular Magnetic Resonance (SCMR), January 2006.
52. E.M. Boctor, I. Iordachita, G.D. Hager and G. Fichtinger. Bootstrapped Ultrasound Calibration . Medicine Meets Virtual Reality, 2006.
53. Henry Lin, Izhak Shafran, David D. Yuh and Gregory D. Hager. Vision-Assisted Automatic Detection and Segmentation of Robot-Assisted Surgical Motions. Medicine Meets Virtual Reality, 2006.
54. Henry Lin, Maneesh Dewan, Panadda Marayong, James Handa and Gregory D. Hager. Vision-Based Human-Machine Collaborative System for Ophthalmic Micro-Surgery. Medicine Meets Virtual Reality, 2006.
55. P. Marayong, G.D. Hager and A.M. Okamura. Effect of Hand Dynamics on Virtual Fixtures for Compliant Human-Machine Interfaces. 14th Symposium on Haptic Interfaces for Virtual Environments and Teleoperator Systems, pages 109-115, 2006.
56. Henry C. Lin, Panadda Marayong, Keith Mills, Ray Karam, Peter Kazanzides, Allison Okamura, Gregory D. Hager. Portability and Applicability of Virtual Fixtures Across Medical and Manufacturing Tasks. In Proc. of International Conference on Robotics and Automation (ICRA), pages 225-230, 2006.
57. Sharmishtaa Seshamani, William Lau, Gregory D. Hager. Real-time Endoscopic Mosaicking. In MICCAI, pages 355-363, 2006.
58. Sharmishtaa Seshamani, Cameron Riviere, James T. Handa, Louis Lobes, Gregory D. Hager. Visual Measurement of Microsurgical Motion with Application to Robotic Augmentation. In Northeast Bioengineering Conference, pages 39-40, 2006.
59. E.M. Boctor, M. DeOliviera, M. Choti, R. Ghanem, R.H. Taylor, G. Hager, G. Fichtinger. Ultrasound Monitoring of Tissue Ablation via Deformation Model and Shape Priors. In Ninth International Conference on Medical Image Computing and Computer-Assisted Intervention, volume 4191, pages 405-412. Springer, 2006.

60. E.M. Boctor, I. Iordachita, G. Fichtinger, G.D. Hager. Ultrasound Self-Calibration. In *Medical Imaging 2006: Visualization, Image-Guided Procedures, and Display*; Kevin R. Cleary, Robert L. Galloway, Jr.; Eds., volume 6141, pages 784-795, 2006.
61. Le Lu and Gregory Hager. Dynamic Foreground/Background Extraction from Images and Video using Random Patches. In *Proc. NIPS, 2006*. In press.
62. I. Iordachita, A. Kapoor, B. Mitchell, P. Kazanzides, G. Hager, J. Handa, R. Taylor. Steady-Hand Manipulator for Retinal Surgery. In *MICCAI Workshop on Medical Robotics*, Edited by K. Cleary, N. Hata, P. Kazanzides, pages 66-73, 2006.
63. Le Lu and Gregory D. Hager and Laurent Younes. A Three Tiered Approach for Articulated Object Action Modeling and Recognition. *Advances in Neural Information Processing Systems*, 17:841-848, July 2005.
64. Guangqi Ye, Jason J. Corso, and Gregory D. Hager. Real-Time Vision for Human-Computer Interaction, chapter 7: Visual Modeling of Dynamic Gestures Using 3D Appearance and Motion Features, pages 103-120. Springer-Verlag, 2005.
65. Le Lu and Kentaro Toyama and Gregory D. Hager. A Two Level Approach for Scene Recognition. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2005)*, 1:688-695, 2005.
66. Jason J. Corso and Gregory D. Hager. Coherent Regions for Concise and Stable Image Description. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2005)*, 2:184-190, 2005.
67. Henry C. Lin, Izhak Shafran, Todd E. Murphy, Allison M. Okamura, David D. Yuh, and Gregory D. Hager. Automatic Detection and Segmentation of Robot-Assisted Surgical Motions. In *MICCAI 2005, LNCS 3749*, pages 802-810, 2005. Best Paper Award at MICCAI 2005.
68. D. Burschka and G.D. Hager. Vision-Based 3D Scene Analysis for Driver Assistance. *ICRA*, 2005.
69. Joshua Leven and Darius Burschka and Rajesh Kumar and Gary Zhang and Steve Blumenkranz and Xiangtian (Donald) Dai and Mike Awad and Gregory D. Hager and Mike Marohn and Mike Choti and Christopher J. Hasser and Russell H. Taylor. DaVinci Canvas: A Telerobotic Surgical System with Integrated, Robot-Assisted, Laparoscopic Ultrasound Capability. In *MICCAI*, pages 811-818, 2005.
70. D. Burschka and G.D. Hager. Vision-based Inspection of Structural Changes respective to Pre-operative CT-Scans with Monocular Endoscope Cameras. *CURAC*, 2005.
71. E.M. Boctor, I. Iordachita, G. Fichtinger and G. Hager. Ultrasound Self-Calibration and Real-Time Quality Control for Interventions. *IEEE International Ultrasonics Symposium*, 2005.
72. E.M. Boctor, I. Iordachita, G. Fichtinger and G. Hager. Real-Time Quality Control of Tracked Ultrasound. In *MICCAI 2005, LNCS 3749*, pages 621-630, 2005.
73. R. Kon, J. Leven, K. Kothapalli, E.M. Boctor, G. Fichtinger, G.D. Hager and R.H. Taylor. CIS-UltraCal: An Open-Source Ultrasound Calibration Toolkit. In William F. Walker, Stanislav Y. Emelianov, editor, *SPIE Medical Imaging 2005: Ultrasonic Imaging and Signal Processing*, volume 5750, pages 516-523, 2005.
74. E.M. Boctor, I. Iordachita, G. Fichtinger, G.D. Hager. Bootstrapped Ultrasound Calibration. In *Stud Health Technol Inform.*, volume 119, pages 61-6, 2005.

75. Darius Burschka and Gregory D. Hager. V-GPS(SLAM): - Vision-Based Inertial System for Mobile Robots. In Proc. of ICRA, pages 409-415, April 2004.
76. Guangqi Ye, Jason J. Corso, and Gregory D. Hager. Gesture Recognition Using 3D Appearance and Motion Features. In Proceedings of CVPRHCI, 2004.
77. Jason J. Corso, Maneesh Dewan, and Gregory D. Hager. Image Segmentation Through Energy Minimization Based Subspace Fusion. In Proceedings of 17th International Conference on Pattern Recognition (ICPR 2004), 2004.
78. Nicholas A. Ramey, Jason J. Corso, William W. Lau, Darius Burschka, and Gregory D. Hager. Real Time 3D Surface Tracking and Its Applications. In Proceedings of Workshop on Real-time 3D Sensors and Their Use (at CVPR 2004), 2004.
79. Darius Burschka and Gregory D. Hager. Principle and Practice of Real-Time Visual Tracking for Navigation and Mapping. In IEEE Workshop on Robotic Sensing: Robotics in the Automotive Industry, ROSE, 2004. (to appear).
80. Gregory D. Hager, Maneesh Dewan, and Charles V. Stewart. Multiple Kernel Tracking with SSD. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2004), 2004.
81. Giambattista Gennari and Gregory D. Hager. Probabilistic data association methods in visual tracking of groups. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2004), 2004.
82. William W. Lau, Nicholas A. Ramey, Jason J. Corso, Nitish Thakor, and Gregory D. Hager. Stereo-Based Endoscopic Tracking of Cardiac Surface Deformation. In Proceedings of Seventh International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), volume 2, pages 494-501, 2004.
83. Maneesh Dewan, Panadda Marayong, Allison Okamura, and Gregory D. Hager. Vision-Based Assistance for Ophthalmic Micro-Surgery. In Proceedings of Seventh International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), volume 2, pages 49-57, 2004.
84. D. Burschka, M. Li, R.H. Taylor, and G.D. Hager. Scale-Invariant Registration of Monocular Endoscope Images to CT-Scans For Sinus Surgery. In Proceedings of Seventh International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), volume 2, pages 413-421, 2004.
85. A. Viswanathan, E.M. Boctor, R.H. Taylor, G.D. Hager, and G. Fichtinger. Immediate Ultrasound Calibration from Two Poses and Minimal Image Processing. In Proceedings of Seventh International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2004. (to appear).
86. E. Boctor, A. Viswanathan, M. Choti, R.H. Taylor, G. Fichtinger, and G.D. Hager. A Novel Closed Form Solution For Ultrasound Calibration. In Proceedings of ISBI, 2004.
87. Darius Burschka, Ming Li, Russell Taylor, and Gregory D. Hager. Scale-Invariant Registration of Monocular Stereo Images to 3D Surface Models. In Proceedings of IROS, pages 2581-2586, 2004.
88. D. Kragic, P. Marayong, M. Li, A. M. Okamura, and G. D. Hager. Human-Machine Collaborative Systems for Microsurgical Applications. In B. Siciliano, O. Khatib, and F.C.A. Groen, editors, In International Symposium on Robotics Research, October 2003.

89. D. Kragic and G. D. Hager. Task modeling and specification for modular sensory based human-machine cooperative systems. In Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems, volume 4, pages 3192-3197, October 2003.
90. Darius Burschka and Gregory D. Hager. V-GPS - Image-Based Control for 3D Guidance Systems. In Proc. of IROS, pages 1789-1795, October 2003.
91. Darius Burschka, Jeremy Geiman, and Gregory D. Hager. Optimal Landmark Configuration for Vision-Based Control of Mobile Robots. In Proc. of International Conference on Robotics and Automation (ICRA), pages 3917-3922, September 2003.
92. Jason Corso, Darius Burschka, and Gregory D. Hager. The 4DT: Unencumbered HCI With VICs. In Proceedings of CVPRHCI, 2003.
93. Jason Corso, Darius Burschka, and Gregory D. Hager. Direct Plane Tracking in Stereo Image for Mobile Navigation. In Proceedings of International Conference on Robotics and Automation, pages 875-880, 2003.
94. Guangqi Ye, Jason Corso, Darius Burschka, and Gregory D. Hager. VICs: A Modular Vision-Based HCI Framework. In Proceedings of 3rd International Conference on Computer Vision Systems, pages 257-267, 2003.
95. Izzet Pemececi and Gregory D. Hager. Functional reactive programming as a hybrid systems framework. In Proc. ICRA, volume 1, pages 727-734, 2003.
96. P. Marayong, M. Li, A. Okamura, and G. Hager. Spatial motion constraints: Theory and demonstrations for robot guidance using virtual fixtures. In Proc. ICRA, 2003.
97. Guangqi Ye, Jason J. Corso, Gregory D. Hager, and Allison M. Okamura. VisHap: Augmented Reality Combining Haptics and Vision. In Proceedings of IEEE International Conference on Systems, Man and Cybernetics, pages 3425-3431, 2003.
2003
98. Scene Classification from Dense Disparity Maps in Indoor Environments (with D. Burschka) In Proc. ICPR, 2002. to appear.
99. Functional Reactive Robotics: An Exercise in Principled Integration of Domain-Specific Languages (with I. Pemececi, H. Nilsson, J. Peterson, and D. Burschka), to appear in Principles and Practice of Declarative Programming, 2002.
100. Stereo-Based Obstacle Avoidance in Indoor Environments with Active Sensor Re-Calibration (with D. Burschka and S. Lee), Proc. International Conference on Robotics and Automation, 2002 (to appear).
101. Specifying Behavior in C++ (with X. Dai), Proc. International Conference on Robotics and Automation, 2002 (to appear).
102. Vision Assisted Control for Manipulation Using Virtual Fixtures: Experiments at Macro and Micro Scales (with A. Bettini and A. Okamura), Proc. International Conference on Robotics and Automation, pp 3354-3361, 2002
103. Dynamic composition of tracking primitives for interactive vision-guided navigation (with D. Burschka). In SPIE's Intelligent Systems for Advanced Manufacturing, Boston, November 2001.
104. Building a Task Language for Segmentation and Recognition of User Input to Cooperative Manipulation Systems (with C.S.Hundtofte and A.M. Okamura, 10th International Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems, pp. 225-230, 2002

105. Vision Assisted Control for Manipulation Using Virtual Fixtures (with A. Bettini and A. Okamura), in Proc. IROS, pp. 1171-1176, 2001.
106. Applications of Task-Level Augmentation For Cooperative Fine Manipulation Tasks in Surgery (with R. Kumar, A.C. Barnes, P.S. Jensen and R.H. Taylor), *Proceedings of Medical Image Computing and Computer Assisted Intervention*, 2001.
107. Performance Evaluation of a Cooperative Manipulation Microsurgical Assistant Robot Applied to Stapedotomy (with P. Berkelman, D. Rothbaum, J. Roy, S. Lang, L. Whitcomb, P.S. Jensen, E. de Juan, R. Taylor and J. Niparko), *Proceedings of Medical Image Computing and Computer Assisted Intervention*, 2001.
108. Composable Robot Controllers (with J. Peterson and A. Serjentov), Proc. CIRA, 2001.
109. FVision: A Declarative Language for Visual Tracking (with John Peterson, Paul Hudak, Alastair Reid, and Greg Hager), Proc PADL, 2001.
110. Vision-Based Control of Mobile Robots (with D. Burschka), In Proc. International Conference on Robotics and Automation, pages 1707-1713, 2001
111. An Augmentation System for Fine Manipulation, (with Rajesh Kumar and Aaron Barnes and Patrick Jensen and Russell H. Taylor), In the Proceedings of Medical Image Computing and Computer Assisted Intervention, 2000, pp. 956–965.
112. Laser-based Position Tracking and Map Generation (with D. Burschka), Laser-based Position Tracking and Map Generation. In Proceedings of RA 2000, August 2000, Hawaii, pp. 149-155
113. On Specifying and Performing Visual Tasks with Qualitative Object Models, In the International Conference on Robotics and Automation, 2000.
114. Model-based 3-D Object Tracking using Projective Invariance (with S-W Lee and B-J You). Proceedings of the International Conference on Robotics and Automation , 1999.
115. Fast 3D Boundary Computation from Occluding Contour Motion (with A. Bendiksen). Proceedings of the International Conference on Robotics and Automation, 1999.
116. Task Specification and Monitoring for Uncalibrated Hand/Eye Coordination (with Z. Dodds, J. Hespanha, and A.S. Morse). Proceedings of the International Conference on Robotics and Automation, pp. 1607-1613, 1999.
117. A Language for Declarative Robotic Programming (with J. Peterson, and P. Hudak). Proceedings of the International Conference on Robotics and Automation, pp. 1144-1151, 1999.
118. Prototyping Real-Time Vision Systems: An Experiment in DSL Design (with A. Reid, J. Peterson, and P. Hudak). Proceedings of the International Conference on Software Engineering, pp. 484-493, 1999.
119. A Hierarchical Architecture for Vision-Based Robotic Manipulation Tasks (with Z. Dodds, M. Jagersand and K. Toyama). In Proceedings of the International Conference on Vision Systems, pp. 312-330, 1999.
120. Decidability of Robot Positioning Tasks Using Stereo Vision Systems, (with J. Hespanha, Z. Dodds and A.S. Morse). In the Proceedings of the IEEE Conference on Decision and Control, 1998.
121. Joint Probabilistic Techniques for Tracking Objects Using Multiple Visual Cues (with C. Rasmussen). In the proceedings of the IEEE International Conference on Intelligent Robots and Systems, 1998.

122. Joint Probabilistic Techniques for Tracking Multi-Part Objects (with C. Rasmussen). In the proceedings of the IEEE International Conference on Computer Vision, 1998.
123. Dynamic Sensor Planning in Visual Servoing (with E. Marchand). In the proceedings of the 1998 IEEE International Conference on Robotics and Automation.
124. What Can be Done With an Uncalibrated Stereo System? (with J. Hespanha and Z. Dodds). In the proceedings of the IEEE International Conference on Robotics and Automation, 1998.
125. Task Re-Encoding in Vision-Based Control Systems (with W-C. Chang, J. P. Hespanha and A.S. Morse). In the *Proceedings of the IEEE Conference on Decision and Control*, 1997.
126. If At First You Don't Succeed (with K. Toyama). In the *Proceedings of the AAAI Conference on Artificial Intelligence*, pp. 3-9, 1997.
127. A Color Interest Operator for Landmark-based Navigation (with Z. Dodds). *Proceedings of the AAAI Conference on Artificial Intelligence*, pp. 655-660, 1997.
128. Image-based Prediction of Landmark Features for Mobile Navigation (with D. Kriegman, E. Yeh and C. Rasmussen). In the *Proceedings of the International Conference on Robotics and Automation*, pp. 1040-1046, IEEE Computer Society Press, 1997.
129. Preliminary Results on Grasping With Vision and Touch (with J. Son, R. Howe, and J. Wang). In the *Proceedings of the 1996 IEEE/RSJ International Conference on Intelligent Robots and Systems*, Nov. 1996.
130. Robot Navigation Using Image Sequences (with C. Rasmussen). In the *Proceedings of the AAAI Conference on Artificial Intelligence*, pp. 938-943, 1996.
131. Incremental Focus of Attention for Robust Visual Tracking (with K. Toyama). In the *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pp. 189-195, 1996.
132. Real-Time Tracking of Image Regions With Changes in Geometry and Illumination (with P. Belhumeur). In the *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pp. 403-410, 1996.
133. A Calibration-Free, Self-Adjusting Stereo Visual Control System (with W.C. Chang and A.S. Morse). In the *Proceedings of the 13th IFAC World Congress*, pp. 343-348, 1996.
134. SERVOMATIC: A Modular System for Robust Positioning Using Stereo Visual Servoing (with K. Toyama and J. Wang). In the *Proceedings of the International Conference on Robotics and Automation*, pp. 2636-2643, IEEE Computer Society Press, 1996.
135. XVision: Combining Image Warping and Geometric Constraints for Fast Visual Tracking (with K. Toyama). In the *Proceedings of the Fourth European Conference on Computer Vision (ECCV '96)*, pp. 507-517, Springer Verlag, 1996.
136. A "Robust" Convergent Visual Servoing System (with D. Kim, A. Rizzi, D. Koditschek). In *Proceedings of the International Conference on Intelligent Robots and Systems*, Vol. I, pp. 348-353. 1995.
137. The "XVision" System: A General Purpose Substrate for Real-Time Vision-Based Robotics. In *Proceedings of the Workshop on Vision for Robotics*, pp. 56-63, 1995.
138. Distraction-Proof Tracking: Keeping One's Eye on the Ball (with K. Toyama). In *Proceedings of the International Conference on Intelligent Robots and Systems*, Vol. I, pp. 354-359. 1995.

139. Calibration-Free Visual Control Using Projective Invariance. In *Proceedings of the International Conference on Computer Vision*, pp. 1009-1015, 1995.
140. Flexible Tools for Hand-Eye Coordination (with K. Toyama). Video segment appearing in the proceedings of the International Conference on Robotics and Automation, 1995.
141. Feature-Based Visual Servoing and its Application to Telerobotics (with G. Grunwald and G. Hirzinger). In *Proceedings of the 1994 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 164–171. IEEE Computer Society Press, Sept. 1994.
142. Real-Time Feature Tracking and Projective Invariance as a Basis for Hand-Eye Coordination. In *Proc. IEEE Conference on Computer Vision and Image Processing (CVPR)*, pages 533–539. IEEE Computer Society Press, June 1994.
143. Robot Feedback Control Based on Stereo Vision: Towards Calibration-Free Hand-Eye Coordination (with W. Chang and A.S. Morse). In *Proc. IEEE Int. Conference on Robotics and Automation*, pages 2850–2856. IEEE Computer Society Press, May 1994.
144. A Vision-Based Grasping System for Unfamiliar Planar Objects (with A. Bendiksen). In *Proc. IEEE Int. Conference on Robotics and Automation*, pages 2844–2849. IEEE Computer Society Press, May 1994.
145. On Comparing Statistical and Set-Based Methods in Sensor Data Fusion (with S. Engelson and S. Atiya). In *Proceedings of the 1993 IEEE International Conference on Robotics and Automation*, pp. 1662–1667, 1993.
146. Constraint Solving Methods and Sensor-Based Decision Making. In *Proceedings of the 1992 IEEE International Conference on Robotics and Automation*, pp. 1662–1667, 1992.
147. Towards Geometric Decision Making in Unstructured Environments. *Proceedings of the International Workshop on Intelligent Robots and Systems*, pp. 1412–1417. A revised version appears in the proceedings of SPIE, Sensor Fusion IV, 1991.
148. Using Resource-Bounded Sensing in Telerobotics. In *Proceedings of the Fifth International Conference on Advanced Robotics*, pp. 199–204, 1991.
149. Real-Time Vision-Based Robot Localization (with S. Atiya). In *Proceedings of the IEEE International Conference on Robotics and Automation*, pp. 639–643, 1991.
150. A Comparison of Information-Gathering Approaches. In *Proceedings of the Symposium on Advances in Intelligent Systems*, SPIE, Boston, MA. Also appears in *Proceedings of the first International IARP Workshop on Sensor Fusion*, Toulouse, France, 1989.
151. Estimation Procedures for Robust Sensor Control (with M. Mintz). In L. Kanal, T. Levitt, and J. Lemmer, editors, *Uncertainty in Artificial Intelligence 3*, pp. 285–301, North-Holland, New York, NY, 1989.
152. Sensor Modeling and Robust Sensor Fusion (with M. Mintz). In *Proceedings of the Fifth International Symposium on Robotics Research*, MIT Press, Cambridge, MA, 1989.
153. Task-Directed Multi-Sensor Fusion (with M. Mintz). In *Proceedings of IEEE Conference on Robotics and Automation*, pp. 662–667, 1989.
154. Egomotion and the Stabilized World (with D. Heeger). In *Proceedings of the Second International Conference on Computer Vision*, 1988.

- 155. Information and Multi-Sensor Coordination, (with H. Durrant-Whyte). In J. Lemmer and L. Kanal, editors, *Uncertainty in Artificial Intelligence 2*, pp. 381–394, North-Holland, New York, NY, 1988.
- 156. Explaining Modal Logic Proofs (with A. Felty). In *Proceedings of IEEE Systems, Man, and Cybernetics Conference on Human Computer Interaction*, 1988.
- 157. Searching for Information (with M. Mintz). In *Proceedings of Workshop on Spatial Reasoning and Multi-Sensor Fusion*, pp. 313–322, Morgan Kaufmann, 1987.
- 158. Tactile Information Processing— The Bottom Up Approach (with R. Bajcsy). In *Proceedings of the International Conference on Pattern Recognition* pp. 809-811, 1984.

Other Conferences:

- 159. Tracker fusion for robustness in visual feature tracking (with K. Toyama). In *SPIE Int'l Sym. Intel. Sys. and Adv. Manufacturing*, volume 2589, Philadelphia, PA, October 1995.
- 160. Towards task-directed planning of cooperating sensors (with G. Grunwald). In *SPIE Sensor Fusion V*, pages 214-225, Nov., 1992.
- 161. A constraint-based view of selective perception. In *AAAI Spring Symposium on Selective Perception*, pp. 61–65, 1992.
- 162. Set-based estimation: Towards task-directed sensing. In *Proceedings of Melecon Conference*, pp. 1205–1209, 1991.
- 163. Deciding not to decide using resource-bounded sensing. In *Proceedings of the Symposium on Advances in Intelligent Systems*, SPIE, Boston, MA, 1990.

Other Publications:

- 164. Jason J. Corso, Maneesh Dewan, and Gregory D. Hager. Image Segmentation Through Energy Minimization Based Subspace Fusion. Technical Report CIRL-TR-04-01, The Johns Hopkins University, 2004.
- 165. Guangqi Ye, Jason J. Corso, Gregory D. Hager, and Allison M. Okamura. Augmented Reality Combining Haptics and Vision. Technical Report 03, The Johns Hopkins University, 2003. CIRL Technical Report.
- 166. Jason J. Corso, Nicholas Ramey, and Gregory D. Hager. Stereo-Based Direct Surface Tracking with Deformable Parametric Models. Technical Report 02, The Johns Hopkins University, 2003. CIRL Technical Report.
- 167. Le Lu, Xiangtian Dai, and Gregory D. Hager. Real Time Video Mosaicing - Technical Report. Technical report, The Johns Hopkins University, 2003. CIRL Technical Report.
- 168. Myron Z. Brown, Darius Burschka, and Gregory D. Hager. Shape and appearance in object recognition. 2003.
- 169. Tracking Objects by Color Alone (with Christopher Rasmussen), DCS-RR-1114, Yale University, New Haven, CT, 1997.
- 170. Tracking Tools for Vision-Based Navigation, DCS-RR-1060, Yale University, New Haven, CT, 1994.

171. Six DOF Visual Control of Relative Position, DCS-RR-1038, Yale University, New Haven, CT, 1994
172. A Framework for Real-Time Vision-Based Tracking Using Off-the-Shelf Hardware (with S. Puri and K. Toyama), DCS-RR-988, Yale University, New Haven, CT, 1993.
173. A C++ Interval and Constraint Solving Package, DCS-RR-953, Yale University, New Haven, CT, 1993.
174. Some Problems in Adaptive Visual Servoing, DCS-RR-948, Yale University, New Haven, CT, 1993.
175. Active Reduction of Uncertainty in Multi-Sensor Systems. Ph.D. thesis, University of Pennsylvania, 1988.
176. An Agent Specification Language, MS-CIS-87-08, The University of Pennsylvania, Philadelphia, PA, 1987.
177. Information Maps for Active Sensor Control, MS-CIS-87-07, The University of Pennsylvania, Philadelphia, PA, 1987.
178. Commonsense Summer: The Final Report (with J. Hobbs *et al.*), CSLI-85-35, SRI International, Palo Alto, CA, 1985.
179. Computational aspects of proof theory in modal logic. Masters thesis, University of Pennsylvania, 1985

Software Packages:

1. The XVision Tracking Toolkit, 1995, 1996, 1997.
2. A System for Solution of High-Dimensional Nonlinear Constraints, 1993.

INVITED LECTURES

Robust Mean Square Estimation

Fraunhofer Institute, Karlsruhe, FRG. June, 1987.

University of Pisa, Pisa, Italy. June, 1987.

Active Reduction of Uncertainty in Multi-Sensor Systems

IBM Thomas J. Watson Research Center, Yorktown Heights, NY. August 1988.

MIT, Boston MA. September 1988.

Stanford University, Stanford, CA. September 1988.

University of Karlsruhe, Karlsruhe, FRG. October 1988.

INRIA, Sophia Antipolis, France. April, 1989.

The University of Lille, Lille, France. April 1989.

The University of Delft, Delft, The Netherlands. April 1989.

Oxford University, Oxford, England. May 1989.

Workshop on Human and Computer Vision, Stockholm, Sweden. August 1989

DLR, Oberpfaffenhoffen, October 1989.

Task-Oriented Sensor Programming

German Workshop on Robot Control, Dortmund, FRG. November 1989.

Interval Based Methods for Sensor-Based Decision Making

Yale University, New Haven, CT. October 1990.

Techniques for Sensor Data Fusion and Sensor Planning

ASTEM Research, Kyoto, Japan. November, 1991.

University of Connecticut, Storrs, CT. December 1991.

Carnegie Mellon University, Pittsburg, PA. October 1992.

Columbia University, New York, NY. October 1992.

Research in Sensor Data Fusion and Sensor Planning

Red Stone Arsenal, Huntsville, Alabama. April, 1992.

Qualitative Decision-Making

DLR, Oberpfaffenhoffen, FRG. June 1992.

Robot Feedback Control Based on Stereo Vision: Toward Calibration Free Hand-Eye Coordination

RPI, Troy NY, Nov. 1993.

A Skill-Based Approach to Hand-Eye Coordination

University of Rochester, Rochester NY, Jan. 1995.

The XVision System: An Approach to Real-Time Vision

Joint Slovenian-Austrian Workshop on Computer Vision, Maribor Slovenia, May 1995.

Cheap, Fast, and Firmly in Control: Lightweight Systems for Real-Time Vision and Robotics.

University of Michigan, Ann Arbor MI, Oct. 1995

University of Minnesota, Minneapolis MN, Nov. 1995

University of Chicago, Chicago IL, Nov. 1995

Purdue University, West Lafayette IN, Nov. 1995

University of Illinois, Champaign IL, Nov. 1995

Stanford University, Palo Alto CA, Jan. 1996

University of California, Berkeley CA, Jan. 1996
Max Plank Institute, Tuebingen, Germany, Jul. 1996
Siemens Central Research, Munich, Germany, Jul. 1996

Lightweight Systems for Real-Time Vision

Xerox Parc, Palo Alto CA, Jan. 1996
SGI Inc., Mt. View CA, Jan. 1996
Columbia University, Feb. 1996
MIT Media Lab, Apr. 1996
Cognex Corp, May 1996
University of Connecticut, Oct. 1996
Rutgers University, Oct. 1996
The University of Pennsylvania, Nov. 1996
Brown University, Nov. 1996

Vision as Feedback

Harvard University, Cambridge MA, Mar. 1997

Real-Time Vision on Your Desktop: Principles, Programming and Practice

University of Utah, Salt Lake City UT, Mar. 1998
Microsoft Corp, Redmond WA, Mar. 1998
Johns Hopkins University, Baltimore MA, Apr. 1998

How to Get What You See: Software Systems for Real-Time Vision

Johns Hopkins University, Baltimore MA, Apr. 1998

TEACHING:**Postdoctoral Associates:**

Darius Burschka, 1999-present.

Martin Jägersand, 1998-2000

Eric Marchand, 1996-1997.

Markus Vincze, 1996.

Graduate Students:

Nicholas Ramey, M.S. expected, 2003.

Jeremy Mullendore, Ph.D. expected 2005.

Le Lu, Ph.D. expected 2005.

Guangqi Yeh, Ph.D. expected 2005.

Myron Brown, Ph.D. expected 2004.

Jason Corso, Ph.D. expected 2004.

Izzet Pembeci, Ph.D. expected 2003.

Xangtian Dai, Ph.D. expected 2003.

Zachary Dodds, Ph.D. 2000.

Christopher Rasmussen, Ph.D. 2000.

Aage Bendiksen, M.S. degree received 1995.

Jesse Reklaw, M.S. received 1998.

Kentaro Toyama, Ph.D received 1997.

Jonathan Wang, M.S. degree received 1996.

Sami Atiya, Ph.D. received 1995.

Listed Courses Taught or Co-Taught:

Vision-Based Interaction in Man and Machine, 2000

Computer Vision, 1991 - present.

Artificial Intelligence, 1992-1993, 1996, 1997, 1999, 2000.

Analytical Introduction to Engineering Issues in Robotics, 1994-present.

Autonomous Systems (new course), 1993, 1995, 1997, 1999.

A Second Course in Programming (new course), 1993, 1994, 1997.

Programming in Fortran, 1992-1993.

Seminar Courses:

Topics in Intelligent Autonomous Systems, 1992

Topics in Sensing for Artificial Intelligence and Robotics Applications, 1991

GRANTS

Awarded:

1. NSF: "ITR:Modeling, Synthesis and Analysis of Human-Machine Collaborative Systems," (G. Hager (PI), A. Okamura, R. Taylor and B. Hannaford) for 1,100,000 from 8/1/02-7/31/07.
2. NSF: "ITR/SY:Software Systems for Vision-based Spatial Interaction," for 450,000 from 8/1/01-7/31/04.
3. NSF: "ERC PER: A Quantitive Eye Atlas," (G. Hager (PI), B. Roysam (RPI)) for 150,000 from 8/1/01-7/31/03.
4. NSF: "Scale-Invariant Skill Augmentation for cooperative Human-Machine Micromanipulation Systems,"(G. Hager (PI), A. Okamura and R. Taylor) for 380,000 from 8/1/01-7/31/04.
5. DARPA: "Composition and Adaptation of Goal-Oriented Robotic Systems" (G. Hager (PI), P. Hudak and D. McDermott) for \$2,304,083 from 4/1/00-4/1/04.
6. DARPA: "Environment-Independent Perception and Navigation for Tactical Mobile Robots: A Diktiometric Approach" (G. Hager (PI), D. Kriegman and D. McDermott) for \$750,000 from 6/98-6/00.
7. NSF: "A Compositional Approach to Vision-Based Manipulation" (G. Hager (PI) and M. Jägersand) for \$66,000 from 6/98-6/00 (CISE Postdoctoral Research Award)
8. ARO: "Visual Tracking as Stabilization" (G. Hager (PI) and D. Kriegman) for \$270,000 from 3/1/98-3/1/01.
9. ARO: "Next Generation Vision-Based Control Systems" (G. Hager (PI), A.S. Morse and D. Kriegman) for \$129,945 from 3/1/97-3/1/98 (DURIP equipment grant).
10. NSF: "Domain-Independent Vision-Based Navigation" (D. Kriegman (PI) and G. Hager) for \$419,184 from 9/1/97–10/31/00 .
11. NSF: "The Block Island Workshop on Vision and Control" (G. Hager, PI) for \$14,500 from 6/1/97–5/30/98.
12. NSF: " A Modular Toolkit for Vision and Robotics – An Experiment in Domain-Specific Software Architectures" (G. Hager (PI) and P. Hudak) for \$1,223,090 over 4 years from 6/1/97-6/1/01.
13. DARPA: "Point-Man Robot" (STTR subcontract through Nomadics Inc.) for \$45,000, over 1 year from 6/1/97 - 6/1/98.
14. Siemens Corp: "Light-Weight Vision for Enhanced Mobility" (G. Hager, PI)for \$40,000, over 1 year from 1/1/97 - 9/30/97.
15. NSF: "Calibration Insensitive Hand-Eye Coordination for Robotic Systems Based on Stereo Vision" (G. Hager, PI) for \$240,000 over 3 years from 8/95-8/98.
16. DARPA: "Equipment for Sensor-Based Navigation and Control of Autonomous Agents" (D. McDermott (PI) and G. Hager) for \$75,000 from 1/23/95–1/23/96.
17. DARPA: "Sensor-based and Geometry-based Planning for Autonomous Agents" (with D. McDermott (PI) and G. Hager) for \$971,489 from 10/1/93–5/31/96.
18. NSF: "Resource-Bounded Sensor-Based Decision Making in Unconstrained Environments" (G. Hager, PI) for \$170,245 from 9/1/91–2/28/94

19. NSF: “A Range Finder & Manipulator for Empirical Verification of Sensor-Based Decision Making” (D. Kriegman (PI) and G. Hager) for \$40,000 from 5/1/91–2/28/93 .
20. NATO: “NATO Collaborative Research Grant Between Yale University and the DLR” (G. Hirzinger, PI) for \$5000 from 9/1/92—9/1/94.
21. NATO: “NATO Collaborative Research Grant Between Yale University and the DLR” (G. Hirzinger, PI) for \$5000 from 9/1/91—9/1/92.