CURRICULUM VITAE

DAVID B. COOPER
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EDUCATION

ScB.	Electrical Engineering, MIT, January 1957	
ScM.	Electrical Engineering, MIT, January 1957	
PhD.	Applied Mathematics, Columbia University, June 1966	

PhD. Dissertation topic: On the Existence of Nonsupervised Adaptive Signal Detectors; And Detector Estimation Using Stochastic Approximation Methods

PROFESSIONAL APPOINTMENTS

Jan. 1955-Jan. 1956	Massachusetts Institute of Technology, Teaching Assistant
Jan. 1956-Jan 1957	Massachusetts Institute of Technology, Lincoln Laboratory, Research Assistant
Jan 1957-March 1957	Massachusetts Institute of Technology, Lincoln Laboratory, Staff Member
April 1957-Jan. 1959	Sylvania Electric Products, Mountainview, CA. Title: Engineer
During 1958	Delivered series of lectures on Information Theory as a lecturer in the University of California graduate extension program, Palo Alto, CA
March 1959-Sept. 1966	Raytheon Company, Wayland and Norwood, MA Title: Senior Research Engineer
Sept. 1966-1969	Assistant Professor of Engineering, Brown University
July 1969-July 1978	Associate Professor of Engineering, Brown University
Sept. 1972-Aug. 1973	Visiting Professor, Technical University of Delft, the Netherlands. (Official salaried appointment as scientific staff member)
July 1978-	Professor of Engineering, Brown University
Sept.-Nov. 1987	Visiting Researcher, Institut National de Recherche en Informatique et en Automatique, Rocquencourt, France (Joint NSF-France Cooperative Research Grant Program)
Aug.-Nov. 1989	Staff Member, IBM, T.J. Watson Research Center, Yorktown Heights, NY
Aug.-Sept. 1993	Workshop Participant, Isaac Newton Institute for Mathematical Sciences, Cambridge University, Cambridge, England
1982 - 1997	Associate Director, Laboratory for Engineering Man/Machine Systems, Division of Engineering, Brown

University (Research center in applied artificial intelligence, consisting of 6 faculty, 2 technical staff, about 25 graduate students, about 20 undergraduates)

1996 - 1998   Head of Electrical Engineering (Member of four-faculty Executive Committee, which, with the Dean of Engineering, runs the Division of Engineering)

CONSULTING WHILE AT BROWN

1970-1972   Naval Underwater Systems Center, Newport, RI
1982-1984   Honeywell Co.
June-August 1987   Honeywell Co.
May-June 1989   Analog Devices Co.
October 1994   Schlumberger-Doll

PUBLICATIONS

Chapters in Books

1.   On the Recognition of Highly Variable Line Drawings Through Use of Maximum Likelihood Functions, a chapter in **Pattern Recognition and Artificial Intelligence**, edited by C. H. Chen, Academic Press, 1976, pp. 145-163.

2.   Neurobiology, Rapporteur for this group report in **Biomedical Pattern Recognition and Image Processing**, K. S. Fu and T. Pavlidis, Editors, Verlag Chemie: Weinheim, Deerfield Beach/Florida, Basel: 1979, pp. 365-393.

3.   Stochastic Boundary Estimation and Object Recognition, a chapter in **Image Modeling**, A Rosenfeld, Editor, Academic Press, 1980, pp. 63-94.

4.   Optimal Statistical Techniques for Combining Pieces of Information Applied to 3-D Complex-Object Position Estimation, in **Pattern Recognition in Practice II**: **Proceedings of an International Workshop** Held in Amsterdam, June 19-21, 1985, edited by E. S. Gelsema and L. N. Kanal, North Holland Press, Amsterdam, 1986, pp. 243-253 (with R. Bolle).

5.   Use of Markov Random Fields in Estimating and Recognizing Objects in 3D Space, a chapter in the book **Markov Random Fields: Theory and Application**, Rama Chellapa and Anil Jain, editors, , pp. 335-367, Academic Press, 1992 (with B. Cernuschi-Frias, Y. P. Hung and J. Subrahmonia).

6.   2D and 3D Object Recognition and Positioning System Based on Moment Invariants. A chapter in **Geometric Invariance in Machine Vision**, pp. 375-397, J. Mundy and A. Zisserman editors, MIT Press, 1992 (with G. Taubin).

7.   3D Object Recognition and Positioning with Algebraic Invariants and Covariants. A chapter in **Symbolic and Numerical Computations --**

Towards Integration, pp. 147-182, B. R. Donald, D. Kapur and J. Mundy editors, Academic Press, 1993 (with G. Taubin).

8. Integrating Algebraic Curves and Surfaces, Algebraic Invariants, and Bayesian Methods for 2D and 3D Object Recognition, a chapter in **Application of Invariance in Computer Vision**, pp. 493-510, J. L. Mundy, A. Zisserman, D. Forsyth, editors, Springer-Verlag 1994.

9. An Algebraic and Bayesian Technology for Object Recognition, a chapter in **Statistics and Images**, 2, pp. 165-205, K. V. Mardia editor, Carfax Publishing Co., Abingdon, Oxfordshire, UK, 1994 (with J. Subrahmonia and D. Keren).

10. On Representation and Invariant Recognition of Complex Objects Based on Patches and Parts, a chapter in **Object Representation in Computer Vision**, M. Hebert, J. Ponce, T. Boult, A. Gross Editors, Springer, 1995, pp. 139-153 (with Z. Lei).

11. THE SHAPE Lab – New Technology and Software for Archaeologists, in computing **Archaeology for Understanding the Past** (CAA 2000), BAR International Series 931, Archaeopress, Oxford, UK, pp. 79-89, 2001, (with F. Leymarie, et al).

REFEREED JOURNAL AND PROCEEDINGS PAPERS

1. Nonsupervised Adaptive Signal Detection and Pattern Recognition, Information and Control, Vol. 7, pp. 416-444, September 1964 (with P. W. Cooper).

2. Adaptive Pattern Recognition and Signal Detection Without Supervision, IEEE International Convention Record, Part 1, pp. 246-256, 1964 (with P. W. Cooper).

3. Adaptive Pattern Recognition and Signal Detection Using Stochastic Approximation, IEEE Transactions on Electronic Computers, Vol. EC-13, pp. 306-307, June 1964.

4. Synchronization of Nonsupervised Adaptive Signal Detectors, Proceedings of the IEEE, Vol. 53, p. 187, February 1965.

5. Nonsupervised Estimation of Optimum Pattern Classifiers When Little is Known About Pattern Class Probability Structure, Record of the Colloque Internationale sur la Reconnaissance de Forem, at le Centre d'Estudes Nucleaires de Grenoble, Grenoble, France, September 11-13, 1968, pp. 123-134.

6. On Suitable Conditions for Statistical Pettern Recognition Without Supervision, SIAM Journal on Applied Mathematics, Vol. 17, pp. 872-896, September 1969 (with R. Schwarz).

7.	On the Asymptotic Improvement of the Outcome of Supervised Learning Provided by Additional Nonsupervised Learning, IEEE Transactions on Computers, Vol. C-19, pp. 1055-1063, November 1970 (with J. Freeman).

8.	The Computer at Work in the Neighborhood -- For the Neighborhood Organizations and City, New England J. of the American Institute of Planner, Vol. I, Issue 1, August 1972, pp. 44-54.

9.	When Should a Learning Automaton Ask for Help, Textes de exposes du Seminaire organize par IRIA, 1973; pp. 119-139; Rocquencourt, France.

10.	When Should a Learning Machine Ask for Help, IEEE Transactions on Information Theory, July 1974, pp. 455-471.

11.	Feature Selection and Super Data Compression for Pictures Occurring in Remote Conference and Classroom Communications, Proceedings of the 2nd International Conference on Pattern Recognition, Lyngby-Copenhagen, August 13-15, 1974, pp. 111-115.

12.	On Some Convergence Properties of "Learning with a Probabilistic Teacher", Algorithms, IEEE Transactions on Information Theory, Vol. IT-21, pp. 699-702, November 1975.

13.	On the Cost of Approximating and Recognizing a Noise Perturbed Straight Line or a Quadratic Curve Segment in the plane, IEEE Transactions on Computers, Vol. C-25, No. 10, October 1976; pp. 1020-1032 (with N. Yalabik).

14.	Super High Compression of Line Drawing Data, Proceedings 3rd International Conference on Pattern Recognition, San Diego, November 8-11, 1976; pp. 638-642.

15.	On the Role of Dimensionality and Sample Size for Structured and Unstructured Covariance Matrix Estimation, Ibid; pp. 467-422 (with S. D. Morgera).

16.	Compression of Contour Data Through Exploiting Curve-to-Curve Dependence, Ibid; pp. 350-354 (with N. Yalabik).

17.	Structured Estimation: Sample Size Reduction for Adaptive Pattern Classification, IEEE Trans. on Information Theory, November 1977, pp. 728-741 (with S. Morgera).

18.	A Maximum Likelihood Framework for Boundary Estimation in Noisy Images, Proceedings of the IEEE Computer Society Conference on Pattern Recognition and Image Processing, Chicago, May 31-June 2 1978, pp. 25-31 (with H. Elliott).

19.	Implementation, Interpretation and Analysis of a Suboptimal Boundary Finding Algorithm, Proceedings IEEE Computer Society Conference

Pattern Recognition and Image Processing, Chicago, August 6-8, 1979, pp. 122-130 (with H. Elliott, P. Symosek).

20. The Ripple Filter: An Algorithm for Region Growing in Scene Analysis, Proceedings IEEE Computer Society Conference Computer Software and Applications, Chicago, November 6-8, 1979, pp. 849-853 (with L. Reiss).

21. Maximum Likelihood Estimation of Markov Process Blob Boundaries in Noisy Images, IEEE Transactions on Pattern Recognition and Machine Intelligence, November 1979, pp. 372-384.

22. Two-Dimensional Image Boundary Estimation by Use of Likelihood Maximization and Kalman Filtering, Proceedings 1980 IEEE International Conference on Acoustics, Speech and Signal Processing, Denver, April 9-11, 1980, pp. 410-413 (with H. Elliott, F. Cohen, P. Symosek).

23. Stochastic Boundary Estimation and Object Recognition, Journal on Computer Graphics and Image Processing, Vol. 12, 1980, pp. 326-356 (with H. Elliott, F. Cohen, P. Symosek, L. Reiss).

24. Fast Adaptive Algorithms for Low Level Scene Analysis, Vol. 252: Smart Sensor, Society of Photo Optical Instrumentation Engineers. Presented at the 1980 Annual International SPIE Technical Symposium, San Diego (August), (with P. S. Schenker).

25. A Parallel-Window Estimator for Simple-Object Boundary Finding in Noisy Images, Proceedings 5th International Conference on Pattern Recognition, Miami, December 1-14, 1980, pp. 1308-1313 (with P. S. Schenker, K. Wong).

26. Toward a Theory of Multiple-Window Algorithms for Fast Adaptive Boundary Finding in Computer Vision, ibid, pp. 1278-1284.

27. Implementation, Interpretation and Analysis of a Suboptimal Boundry Finding Algorithm, IEEE Transactions on Pattern Analysis and Machine Intelligence, pp. 167-182, March 1982 (with H. Elliott, F. Cohen, P. Symosek).

28. Three Dimensional Surface Shape Recognition by Approximating Image Intensity Functions with Quadric Polynomials, Proceedings of IEEE Computer Society Conference. on Pattern Recognition and Image Processing, Las Vegas, June 1982, pp. 611-617 (with R. Bolle, B. Cernuschi).

29. Estimation of Location and Orientation of Three-Dimensional Surfaces Using a Single Two-Dimensional Image, Ibid, pp. 605-610 (with B. Cernuschi, R. Bolle).

30. Multiple-Window Parallel Adaptive Boundary Finding in Computer Vision, IEEE Transactions on Pattern Analysis and Machine Intelligence, May 1983, pp. 299-316 (with F. Sung).

31. Fast Parallel Image Processing for Robot Vision for the Purpose of Extracting Information About Objects, Proceeding of IEEE International Conference on Acoustics, Speech and Signal Processing, April 14-16, 1983, Boston, pp. 126-128 (with R. Bolle, B. Cernuschi).

32. A New Conceptually Attractive and Computationally Effective Approach to Shape from Shading, Proceedings of the Eighth International Joint Conference on Artificial Intelligence, August 8-12, 1983, Karlsruhe, West Germany, pp. 965-968 (with R. Bolle, B. Cernuschi).

33. Three-Dimensional Surface Shape Recognition by Approximating Image Intensity Functions with Quadric Polynomials, IEEE Transactions on Pattern Analysis and Machine Intelligence, July 1984, pp. 418-429 (with R. Bolle).

34. 3-D Space Location and Orientation Parameter Estimation of Lambertian Spheres and Cylinders from a Single 2-D Image by Fitting Lines and Ellipses to Thresholded Data, IEEE Transactions on PAMI, July 1984, pp. 430-441 (with B. Cernuschi).

35. Real Time Textured Image Segmentation Based on Noncausal Markovian Random Field Models, Proceedings of the SPIE Third International Conference on Robot Vision and Sensory Controls, November 6-10, 1983, Cambridge, MA, Proceedings SPIE 449, 1984, pp. 17-28 (with F. Cohen).

36. Simple Parallel Hierarchical and Relaxation Algorithms for Segmenting Textured Images Based on Noncausal Markovian Random Field Models, Proceedings of the 7th International Joint Conference on Pattern Recognition, July 1984, Montreal, pp. 1104-1107 (with F. Cohen).

37. Estimating and Recognizing Parameterized 3-D Objects Using a Moving Camera, Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, San Francisco, June 1985, pp. 167-171 (with B. Cernuschi, P. N. Belhumeur).

38. Classification and Ranging of Quadric Surfaces from T.V. Images Obtained by a Moving Camera, Proceedings of 1985 IEEE Intl. Conference on Systems, Man and Cybernetics, Tucson, Arizona, November 12-15, 1985, pp. 943-947 (with B. Cernuschi).

39. On Parallel Bayesian Estimation and Recognition for Large Data Sets, with Application to Estimating 3-D Complex-Object Position from Range Data, Proceedings of the SPIE Conference on Computer Vision for Robots, Vol. 595, Cannes, France, December 2-5, 1985, pp. 90-100 (with R. Bolle).

40. Unsupervised Estimation of Polynomial Approximations to Smooth Surfaces in Images or Range Data, Proceedings of the IEEE International Conference on Robotics and Automation, April 7-10, 1986, pp. 299-304 (with J. F. Silverman).

41. 3-D Object Position Estimation and Recognition Based on Parameterized Surfaces and Multiple Views, ibid. pp. 639-644 (with B. Cernuschi, P. N. Belhumeur).

42. On Optimally Combining Pieces of Information, with Application to Estimating 3-D Complex-Object Position from Range Data, IEEE Transactions on Pattern Analysis and Machine Intelligence, September 1986, pp. 619-638 (with R. M. Bolle).

43. Estimation by Multiple Views of Outdoor Terrain Modelled by Stochastic Processes, Proceedings of SPIE Cambridge Conference on Intelligent Robots and Computer Visiion, Vol. 726, October 1986, pp. 36-45 (with B. Cernuschi, F. G. Amblard).

44. Simple Parallel Hierarchical and Relaxation Algorithms for Segmenting Noncausal Markovian Random Fields, IEEE Trans. on PAMI, March 1987, pp. 195-219 (with F. S. Cohen).

45. Maximum Likelihood Estimation of Parameterized 3-D Surfaces Using a Moving Camera, Proceedings of the JPL Workshop on Space Terobotics, July 1 1987, pp. 71-83 (with Y. P. Hung, B. Cernuschi-Frias).

46. Unsupervised Bayesian Model-Learning with Application to Textured and Polynomial Image Segmentation, Proceedings of the International Conference on Computer Vision, June 1987, pp. 299-304 (with J. F. Silverman).

47. Bayesian Estimation of 3-D Surfaces from a Sequence of Images, Proceedings 1988 IEEE International Conference on Robotics and Automation, April 1988, pp. 906-911 (with Y. P. Hung, B. Cernuschi-Frias).

48. A Decision Theoretic Approach for 3-D Vision, Proceedings, Computer Vision and Pattern Recognition Conference., June 1988, pp. 964-972 (with F. S. Cohen).

49. Bayesian Clustering for Unsupervised Estimation of Surface and Texture Models, IEEE Transactions on Pattern Analysis and Machine Intelligence, July 1988, pp 482-495 (with J. Silverman).

50. A New Model-Based Stereo Approach for 3D Surface Reconstruction Using Contours on the Surface Pattern, Proceedings International Conf. on Computer Vision, December 1988, pp. 74-83 (with Y. P. Hung, G. Taubin).

51. Representing and Comparing Shapes Using Shape Polynomials, Proc. IEEE Conf. on Computer Vision and Pattern Recognition, June 1989, pp. 510-516 (with G. Taubin, R. M. Bolle).

52.   Shape from Egomotion: A Model-Based Probabilistic Approach, Topical Meeting on Image Understanding and Machine Vision, June 1989, 1989 Technical Digest Series, Vol. 14, Optical Society of America, pp. 34-37 (with Y. P. Hung).

53.   Toward a Bayesian Theory for Estimating and Recognizing Parameterized 3-D Objects Using Two or More Images Taken from Different Positions, IEEE Transactions on Pattern Analysis and Machine Intelligence, October 1989, pp. 1028-1052 (with B. Cernuschi, P. N. Belhumeur, Y. P. Hung).

54.   Maximum A Posteriori 3D Surface Reconstruction Using Multiple Intensity Images Directly, Proceedings of SPIE/SPSE Symposium on Electronic Imaging: Science & Technology, Conference on "Sensing and Reconstruction of 3D Objects and Scenes", February 1990, Santa Clara, CA (with Y. P. Hung).

55.   Model-Based Segmentation and Estimation of 3D Surfaces from Two or More Intensity Images Using Markov Random Fields, Proceedings to 10th International Conference on Pattern Recognition, June 1990, Atlantic City, NJ, pp. 390-397 (with J. Subrahmonia, Y.P. Hung).

56.   Asymptotic Bayesian Surface Estimation Using an Image Sequence, Intl. Journal of Computer Vision, Vol. 6, No. 2, 1991, pp. 105-132, (with Y. P. Hung, B. Cernuschi-Frias).

57.   Toward a model-based Bayesian theory for estimating and recognizing parametrized 3-D objects using two or more images taken from different positions, IJCV, 6(2):105-132, 1991 (with Y.P.Hung, B. Cernuschi-Frias).

58.   Use of Markov Random Fields in Estimating and Recognizing Objects in 3D Space. A chapter in the book Markov Random Fields: Theory and Application, Rama Chellapa and Anil Jain, editors, pp. 335-367, Academic Press, 1992 (with J. Subrahmonia, Y.P. Hung, B. Cernuschi-Frias).

59.   Research at Brown University, Proceedings of the DARPA Image Understanding Workshop, San Diego, January 1992, pp. 153-156 (with T. L. Dean, W.A. Wolovich).

60.   Bounded and Unbounded Implicit Polynomial Curves and Surfaces, Mahalanobis Distances and Geometric Invariants for Robust Object Recognition, Proceedings of the DARPA Image Understanding Workshop, San Diego, January 1992, pp. 769-777 (with D. Keren, J. Subrahmonia, G. Taubin).

61.   Robust Object Recognition by Stabilizing Geometric Invariants, Technical Report LEMS-96, Brown University, 1991, Proceedings, IEEE Conference on Computer Vision and Pattern Recognition, pp. 791-794, Illinois, June 1992, pp. 791-794 (with D. Keren, J. Subrahmonia).

62. Object Recognition Based On Moment (Or Algebraic) Invariants, Geometric Invariance in Computer Vision, J.L. Mundy and A. Zisserman editors, MIT Press, Cambridge, MA, pp. 375-397, 1992 (with G. Taubin)

63. Bayesian Methods for the Use of Implicit Polynomials and Algebraic Invariants in Practical Computer Vision, in the Proceedings of the SPIE Conference on Intelligent Robots and Computer Vision, Boston, MA, November 1992, pp. (with J. Subrahmonia, D. Keren).

64. Progress in Image Understanding Research at Brown University, Proceedings ARPA Image Understanding Workshop, Washington, DC, April 1993, pp. 133-137 (with W.A. Wolovich, T.L. Dean).

65. Structure and Motion from Region Correspondences and Affine Invariants, Proceedings ARPA Image Understanding Workshop, Washington, DC, April 1993, pp. 707-711 (with C.Y. Lee).

66. Recognizing Mice, Vegetables and Hand Printed Characters Based on Implicit Polynomials, Invariants and Bayesian Methods, Proceedings IEEE International Conference on Computer Vision, Berlin, May 1993, pp. 320-324 (with J. Subrahmonia, D. Keren).

67. Structure from Motion: A Region Based Approach Using Affine Transformation and Moment Invariants, Proceedings IEEE Conference on Robotics and Automation, Atlanta, GA, 1993, pp.   (with C. Y. Lee).

68. An Integrated Object Recognition System Based on High Degree Implicit Polynomials, Algebraic Invariants, and Bayesian Methods, pp. 861-865 (with J. Subrahmonia, D. Keren).

69. Computing Correspondence Based on Regions and Invariants without Feature Extraction and Segmentation, Proceedings IEEE Conference on Computer Vision and Pattern Recognition, New York City, 1993, pp. 655-656 (with C. Y. Lee, D. Keren).

70. Automatic Finding of Main Roads in Aerial Images by Using Geometric-Stochastic Models and Estimation, ibid, pp. 459-464, (with M. Barzohar).

71. Describing Complicated Objects by Implicit Polynomials, In IEEE Transactions on Pattern Analysis and Machine Intelligence, January 1994, pp. 38-53 (with J. Subrahmonia, D. Keren).

72. Multicovariance Matched Filter for Target Detection and Background Recognition, in Signal and Data Processing of Small Targets 1994, Proceedings SPIE, Vol. 2235, Oliver E. Drummond editor, Orlando, FL, April 5-7, 1994 pp. (with M.M. Scheffe, M.M. Blane).

73. Recognizing Groups of Curves Based on New Affine Mutual Geometric Invariants with Applications to Recognizing Intersecting Roads in Aerial Images, Proceedings 12th International Conference on Pattern Recognition, Jerusalem, Israel, October 1994, Vol. 1, pp. 205-209.

74. Recognition of Objects in 2D Images or 3D Range Data Based on High Degree Implicit Polynomial Curves or Surfaces, Algebraic Invariants, and Asymptotic Bayesian Methods, Proceedings of the 1994 Joint Statistical Meetings (Institute of Mathematical Statistics, American Statistical Association, International Biometric Society, Statistical Society of Canada), Toronto, CA, 13-18 August 1994, Section on Physical and Engineering Sciences, pp. 44-49 (with J. Subrahmonia, D. Keren).

75. Computationally Fast Bayesian Recognition of Complex Objects Based on Mutual Algebraic Invariants, Proceedings IEEE International Conference on Image Processing, Washington, D.C., pp. 635-638, October 1995 (with Z. Lei, D. Keren).

76. Part-Based Bayesian Recognition Using Implicit Polynomial Invariants, Proceedings, 1995 IEEE International Conference on Image Processing, Washington, DC, October 1995, pp. 360-363 (with K. Siddiqi, J. Subrahmonia, B.B. Kimia).

77. Practical Reliable Bayesian Recognition of 2D and 3D Objects Using Implicit Polynomials and Algebraic Invariants, IEEE Transactions on Pattern Analysis and Machine Intelligence, pp 505-519, May 1996 (with J. Subrahmonia, D. Keren).

78. New, Faster, More Controlled Fitting of Implicit Polynomial 2D Curves and 3D Surfaces to Data, Proceedings of 1996 Computer Vision and Pattern Recognition Conference, San Francisco, CA, pp. 514-519, June 1996 (with Z. Lei).

79. Automatic Finding of Main Roads in Aerial Images by Using Geometric-Stochastic Models and Estimation, IEEE PAMI, 18(7):707-721, July 1996 (with M. Barzohar).

80. 3L Fitting of Higher Degree Implicit Polynomials, Proceedings of Third IEEE Workshop on Applications of Computer Vision, Sarasota, FL, pp. 148-153, December 1996 (with Z. Lei, M.M. Blane).

81. Free-form Object Modeling and Inspection, Automated Optical Inspection for Industry, Vol. 2899, Proceedings of SPIE International Symposium on Lasers, Optoelectronics and Microphotonics, Beijing, China, pp. 675-686, November 1996 (with Z. Lei, H. Civi).

82. Implicit Polynomial Based Geometric Shape Modeling and Recognition, a chapter in Advances in Visual Form Analysis, C. Arcelli, L.P. Cordella, G.S. diBaja, editors, World Scientific, New Jersey, 1997, pp. 368-377 (with Z. Lei).

83. Interactive Shape Modeling, Proceedings 1997 IEEE First Workshop on Multimedia Signal Processing, Princeton, June 23-25, 1997, pp. 262-267 (with Z. Lei).

84. Interactive Contour Modeling Applied to Image Querying, Visual Proceedings, The Art and Interdisciplinary Program of SIGGRAPH 1997, Los Ang`eles, CA, August 1997, pp. 163-164 (with Z. Lei).

85. Automatic and Robust Aerial Road Detection Based on Multi-Hypothesis Generalized Kalman Filters Using Fully and Partially Occluded Models, Proceedings IEEE International Conference on Image Processing, Santa Barbara, CA, October 26-29, 1997, Vol. 3, pp. 134-137 (with M. Barzohar, M. Cohen and I. Ziskind).

86. Object Signature Curve and Invariant Shape Patches for Geometric Indexing into Pictorial Databases, Proceedings Multimedia Storage and Archiving Systems II, SPIE's International Symposium and Education Program on Voice, Video, and Data Communications, Dallas, TX, November 1997, pp. 232-243 (with Z. Lei and T. Tasdizen).

87. PIMS and Invariant Parts for Shape Recognition, Proceeding International Conference on Computer Vision, Bombay, India, January 1998, pp. 827-832 (with Z. Lei and T. Tasdizen).

88. Pose Estimation of Free-Form 3D Objects Without Point Matching Using Algebraic Surface Models, Proceeding IEEE International Workshop on Model-Based 3D Image Analysis, January 3 1998, Mumbai, India, pp. 13-21 (with J.-P. Tarel, H. Civi).

89. Linear Programming Fitting of Implicit Polynomials, Z. Lei and D.B. Cooper, IEEE Trans. on Pattern Analysis and Machine Intelligence, pp. 212-217, February 1998.

90. A New Complex Basis for Implicit Polynomial Curves and its Simple Exploitation for Pose Estimation and Invariant Recognition, J.-P. Tarel, D.B. Cooper, Proceedings IEEE Conf. On Computer Vision And Pattern Recognition (CVPR'98), pp. 111-117, Santa Barbara, June 1998.

91. Algebraic Curves That Work Better, T. Tasdizen, J.-P. Tarel, D.B. Cooper, Proceedings IEEE Conf. on Computer Vision and Pattern Recognition (CVPR'99), pp. 35-41, July 1999.

92. A Complex Basis for Implicit Polynomial Curves and its Simple Exploitation for Pose Estimation and Invariant Recognition, J.-P. Tarel, D.B. Cooper, IEEE Trans. on Pattern Analysis And Machine Intelligence, Vol. 22, No. 7, pp. 111-117, 2000.

93. Improving The Stability Of Algebraic Curves For Applications, T. Tasdizen, J-P. Tarel, D.B. Cooper, IEEE Trans. on Image Processing, Vol. 9, No. 3, pp. 405-416, March 2000

94. On Interactive Object Shape Modeling Using Algebraic Curves, Z. Lei and D.B. Cooper, Journal of VLSI Signal Processing Systems: special issue on Multimedia Signal Processing. vol. 20, pp. 151-161, October 1998.

95.   Covariant Conics Decomposition of Quartics for 2D Object Recognition and Affine Alignment, J.-P. Tarel, W.A. Wolovich, D.B. Cooper, Proceedings of IEEE Intl. Conf. On Image Processing (ICIP'98), pp. 818-822, Chicago, October 1998.

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97.   A Linear Dual-Space Approach to 3D Surface Reconstruction from Occluding Contours Using Algegraic Surfaces, in Proceedings ICCV'2001, pp. 198-204, 2001 with K. Kang, J.P. Tarel, R. Fishman.

98.   Assembling Virtual Pots from 3D Measurements of their Fragments, in Proceedings of VAST 2001 (Conference on Virtual Archaeology and Cultural Heritage), Athens, Greece, pp. 241-254, November 2001, (with A. Willis, et al.).

99.   Bayesian Pot Assembly from Fragments as Problems in Perceptual-Grouping and Geometric Learning, in Proceedings ICPR 2002 (Intl. Conf. on Pattern Recognition), Quebec City, Canada, vol. III, pp. 297-302, August 2002, with A. Willis, et al.

100.   Covariant-Conic Decomposition of Quartics for Shape Recognition and Alignment, Journal of Mathematical Imaging and Vision, vol. 19, no. 3, pp. 255-273, Nov. 2003, with J-P. Tarel and W. Wolovich.

101.   Accurately estimating sherd 3D surface geometry with application to pot reconstruction, in proceedings IEEE Workshop on Computer Vision in Archaeology, Madison, Wisconsin, pp. 5, June 17, 2003, with A. Willis and X. Orriols.

102.   A Unified Linear Fitting Approach for Singular and Non-Singular 3D Quadrics from Occluding Contours, Proceedings First IEEE International Workshop on Higher-Level Knowledge in 3D Modeling and Motion Analysis, Cannes, France, pp. 48, October 2003, with J-P. Tarel and K. Kang.

103.   Surface Sculpting with Stochastic Deformable 3D Surfaces, Proceedings of International Conference on Pattern Recognition (ICPR), Vol. II, pp. 249--252, Sept. 2004; with Willis, A. and Speicher, J.

104.   Alignment of Multiple Non-Overlapping Axially Symmetric 3D Datasets, ibid, pp. 96-99; with Willis, A., Willis.

105.   Bayesian Assembly of 3D Axially Symmetric Shapes from Fragments, Proceedings IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Vol. I, pp. 82--89, June 2004; with Willis, A.,

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109. Computational Schemes for Biomimetic Sculpture, Proceedings of the ACM (Association for Computing Machinery), 5th Intl. Conference on Creativity and Cognition (C&C), April 12--14, 2005, London, pp. 22-31; with Willis, A., Aspelund, K., Hatcher, B., and Speicher, J.

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112. Rapid prototyping 3D objects from scanned measurement data, in *Journal of Image and Vision Computing,* pp. 1174-1184, vol. 25, (2007). With Andrew Willis, Jasper Speicher.

113. Free-form Object Reconstruction from Silhouettes, Occluding Edges and Texture Edges: A Unified and Robust Operator based on Duality, IEEE Transactions on Pattern Recognition and Machine Intelligence, pp. 131-146, vol. 20, (2008). With S. Liu, K. Kang, J.P. Tarel.

114. . From Ruins to Relics: Computational Reconstruction of Ancient Artifacts, IEEE Signal Processing Magazine, July 2008, pp.65-83. With Andrew Willis

115. Using 3D Line Segments for Robust and Efficient Change Detection from Multiple Noisy Images, Proc. ECCV (European Conf. on Computer Vision), vol 4, pp172-185, October 2008. With I Eden

116. NorMal: Non-Compact Markovian Likelihood for Change Detection, Proc. ICPR (Intl. Conf. on Pattern Recog.), Dec. 2008, pp. . With O. Sezer, J. Mundy, A. Yucel.

117. A Volumetric Approach to Change Detection in Satellite Images. (Accepted to Appear in) Photogrammetric Engineering & Remote Sensing (PE&RS), 2010. With T. Pollard, I. Eden, J. Mundy.

118. "Semi-Automated Data Capture and Image Processing: new routes to interactive 3D models", in Proceedings III International Conference on Remote Sensing in Archaeology, Tamil Nadu, Tiruchirappalli, India, August 2009 2010. With K. Galor, D. Sanders, B. Kimia, O. Tal, G. Taubin and A. Willis.

119. Volumetric Scene Geometry Reconstruction With a Network of Distributed Smart Cameras, in Proc CVPR2009 (IEEE Conf. on Computer Vision and Pattern Recognition), June 2009. With S. Liu and K. Kong.

EXTERNAL MEDIA EXPOSURE OF OUR WORK

"Piecing the Past", by Lisa DeKeukelaere, Scientific American, Sept. 2004, p. 30. This is a one page Scientific American article written by their staff, motivated by an IEEE conference publication, of ours and is devoted to discussing our work on 3D pot shape estimation from dense data laser scans of fragments found at archaeological sites.

Oct 2004. A 1.5 minute TV Channel 10 segment, on the 6:00 PM news, devoted to our work on archaeological- site pot estimation and reconstruction of other structures. This was motivated by the Scientific American article, and in preparation they spent two hours shooting material in our lab.

UNSOLICITED PUBLIC EXPOSURE OF OUR RESEARCH

11"x12" article "University Archaeologists Really Starting to Dig Technology" in Investor's Business Daily", June 14, 2005, page A4, consisting of results of their interview primarily of me on digital archaeology research at Brown and elsewhere. (They say that this news letter is the 2nd largest-circulation business news letter in the US.)

INVITED LECTURES

Oct. 1975	Invited participant at NSF Workshop on Advanced Automation, Purdue
June 1976	Session Chairman and Speaker at IEEE Computer Society Workshop on Pattern Recognition and Artificial Intelligence, Hyannis, MA
March 1978	Session Chairman at New England Bioengineering Conference, University of RI
Nov. 1978	Speaker at Army Research Office Workshop on Stochastic Models, Ft. Belvoir, VA
May 1979	Rapporteur (editor for report on workshop sessions on neurobiology) at Dahlem Workshop on Biomedical Pattern Recognition, Berlin, Germany
April 1980	Invited speaker at Army Research Office Workshop on Fast Algorithms, Dover, NJ

	Session Chairman at IEEE Intl. Conference on Robotics, Speech and Signal Processing, Denver
Dec. 1980	Session Chairman at 5th Intl. Conf. on Pattern Recognition, Miami
Oct. 1981	Invited panelist at the 2nd Workshop on 2-D Image Processing sponsored by the IEEE Society on Acoustics, Speech and Signal Processing
1981	MIT Electrical Engineering (Seminar)
	Lehigh Electrical Engineering (Seminar)
1982	Columbia University Electrical Engineering (Seminar)
June 1982	IEEE Intl. Symposium on Information Theory, Les Arcs, France (Present Paper)
April 1983	Organized and ran (with a colleague) a three day workshop on Unsupervised Image Analysis for the Army Research Office. (About 70 attendees from government, industry and academe)
1984	MIT Artificial Intelligence (Seminar)
1985	University of Massachusetts, Computer and Information Sciences (Seminar)
	University of Rhode Island, Electrical Engineering (Seminar)
Oct. 8, 1985	International Geoscience and Remote Sensing Symposium (Invited Paper)
Jan. 1987	Invited paper at Jet Propulsion Laboratory Workshop on Telerobotics
1987	INRIA, Rocquencourt, France (Three Computer Vision Center Seminars)
	INRIA, Sophia Antipoli, France (Two Computer Vision Center Seminars)
	CNRS, Toulouse, France, Robotics Center (Seminar)
	Universite de Paris d'Orsay, (Mathematics Seminar)
1988	State University of New York at Stoney Brook (Computer Science Seminar)
June 1989	Invited paper at NSF Workshop on Markov Random Fields, San Diego, CA
Feb. 1990	Invited participant First DARPA Image Understanding Working Group Meeting
Sept. 1990	DARPA Image Understanding Workshop Speaker
May 1991	Rikjavik, Iceland. Invited Speaker at DARPA-ESPIRIT Workshop on Geometric Invariants
Jan. 1992	ARPA Image Understanding Workshop, San Diego, CA (Talk)
	Stanford Research Institute International, Menlo Park, CA (Seminar)
	University of California, Irvine. Department of Electrical Engineering (Seminar)
Feb. 1992	University of Massachusetts, Amherst. Department of Computer and Information Sciences (Seminar)
June 1992	Xerox Co., Palo Alto, CA (Seminar)
April 1993	ARPA Image Understanding Workshop, Washington, DC (Talk)
August 1993	Isaac Newton Institute for the Mathematical Sciences, Cambridge University, England (Seminar)
Nov. 1993	ARPA ATR Meeting, Boston, MA (Talk with Molly Scheffe)

March 1994	MIT, Electrical Engineering
June 1994	Bogaczici University, Istanbul, Turkey (Two Lectures)
August 1994	University of Toronto, Computer Science, Toronto, CA
August 1994	ARPA, University ATR Workshop, Washington, DC
Sept. 1994	Xerox Research Center, Rochester, NY
April 1995	Yale University, Engineering
Sept. 1995	ARPA (Department of Defense Advanced Projects Research Agency)
	University Automatic Target Recognition Workshop, Washington, DC
Sept. 1996	DARPA, University ATR Workshop, Ft. Belvoir, VA
June 1998	Lockheed Martin Co., Sunnyvale, CA
July 1998	Boeing Co., Seattle, WA
April 2003	Invited seminar: Center for Imaging Sciences, Johns Hopkins University
November 2003	"Applications of 3D shape in archaeology", NSF Workshop on Digital Libraries and Museums, Washington, DC
April 2006	Distinguished Speaker Series, for 2 days, University of Maryland, Center for Automation Research
May 2007	Extracting 3D Structure and Appearance from Multiple Images with Applications to Change Detection, ASPRS 2007, annual conference, Tampa, FL., with I. Eden and J. Mundy.
May 2007	Toward Paradigm Shifts in Sensors, Data Capture and Storage; and Information Extraction at Archaeological Excavation Sites. Talk series of the Northeastern Section of the American Institute of Archaeology
Oct. 2007	Toward Reliable Recognition of Vehicle Class From One or More Video Clips Under General View Conditions, Laboratoire Central des Ponts et Chaussees (French government research lab), Paris
February, 2008	Digital Archaeology, Cogut Center, Brown Univ
Dec. 3, 2009	Talk: Acquiring, archiving, searching, disseminating, and extracting information suitable for making complex inferences, from Imagery; and panelist at Brown University Conference: "Animating Archives: Making New Media Matter", Brown University.

SERVICE TO THE PROFESSION

1983	Army Research Office Workshop on Unsupervised Image Analysis, Brown University, April 15-18, 1983. Organized and ran this workshop (with Professor D. McClure) for 70 attendees, at the request of ARO
1984	Concordia University, Montreal. Was the external faculty member brought in to be a Ph.D. thesis reader and examiner for an Electrical Engineering thesis. Also, see Conference Session Chairmanships in (5), over the years
Dec. 1990	National Science Foundation Panel for Women Faculty

	Developments Awards
April 1991	National Science Foundation Panel for Faculty Research Initiation Grants
	Drexel University, Philadelphia. Was the external faculty member brought in to be a Ph.D. thesis reader and examiner for an Electrical Engineering thesis
Nov. 1992	Member of Conference Program Committee. Society for Photo-Optical Instrumentation Engineers Conference on Intelligent Robots and Computer Vision, Boston, MA
June 1993	Member of Conference Program Committee. IEEE Computer Society Conference on Computer Vision and Pattern Recognition, New York City
	Gave 4 hour tutorial on "Object Recognition with Algebraic Geometry, Invariants and Bayesian Methods", IEEE Conference on Computer Vision and Pattern Recognition, New York City
Aug.-Sept. 1993	Invited Guest for six months, but had time for only one month, at Sir Isaac Newton Institute for the Mathematical Sciences, Cambridge University, England, for a 6 month program on computer vision
June 1994	Invited Guest for eight days at Bogaczici University, Istanbul, Turkey for the purpose of establishing a Brown University-Bogazici University collaboration in computer vision research
Oct. 1994	Member of Conference Program Committee: International Conference on Pattern Recognition, Jerusalem, Israel
	Member of Conference Program Committee SPIE (Society for Photo-Optical Instrumentation Engineers) OE/Technology Symposium on Sensor Fusion, Boston
June 1998	Conference Program Committee Member, Workshop on Content-Based Access of Image and Video Libraries (with CVPR)
Jan. 1999	Conference Program Committee Member, Asian Conference on Computer Vision
1999	National Science Foundation Panel for Research Grants
2003	General chairman and co-organizer of first IEEE Computer Vision and Pattern Recognition Workshop on Applications of Computer Vision in Archaeology, Madison, Wisconsin, June 17, 2003
2003	Member program committee for 3D Image Data and Image Modeling Conference, Banff, Canada, November 2003
2004	Member of program committee for 3DPTV'04
2005	Member of program committee for CAIP (Computer Analysis and Image Processing)
2006	Conference Program Committee Member 3DPVT 2006 (Third International Symposium on 3D Data Processing Visualization, and Transmission), June 14-6, 2006, Vienna
2006	Conference Program Committee Member EVA2006, August 22-25, 2006, Vienna
2007	Program Committee Member ICCV07 (IEEE International Conference on Computer Vision), Rio de Janeiro, Oct. 2007

| 2009 | On program committees for two workshops at: CVPR2010 and ECCV2010, respectively**. |

SERVICE TO THE UNIVERSITY

2003	Chairman of Faculty Search Committee that hired Professor Gabriel Taubin
2003	Chairman of Faculty Promotion Committee for Benjamin Kimia
2003	Freshman advisor
2003	Read Freshman Admission folders
2003	Brown Engineering Alumni Medal Committee
2004	Freshman advisor
2004	Brown Engineering Alumni Medal Committee
2005	Freshman advisor
2005	Read Freshman Admission folders
2005	Brown Engineering Alumni Medal Committee
2006	Served on BEAM Committee
2006	Read Freshman Applications
2007	Served on BEAM Committee
2008	Served on BEAM Committee
2009	Served on BEAM Committee

GRANTS
2005

1. ***PI., with COPIs B. Kimia, M. Joukowsky, D. Mumford, R. Fishman***. NSF (ITR): 3D Shape Representation, Manipulation and Recovery, with Applications to Archaeology and Virtual   Sculpting, $2,018,000, 9/1/03-8/31/07.

2. ***COPI, with J. Mundy as PI.***
Lockheed Martin: *529913, "MODELING AND CHANGE DETECTION", $100,000, 12/1/04-12/31/05.

3. *529029, "NEXT-GENERATION CHANGE DETECTION ALGORITHM PROJECT", $100,000,12/9/05-12/31/06.

4. *NGA 524655 "AUTOMATED CHANGE DETECTION BASED ON MULTI-MODAL FUSION", $326,963 7/20/05-7/19/08.

5. *COPI with J. Mundy as PI and B. Kimia as COPI.* *524625-DARPA: "ACTIVE MODELS FOR GENERIC OBJECT RECOGNITION", $799,600, 3/4/03-8/30/06.

6. Lockheed Martin Co.: *529914, "VEHICLE TRACKING AND RECOGNITION PROJECT", $200,000, 12/1/04-12/31/05.

7. *529028, "LOW NIIRS VIDEO TARGET RECOGNITION PROJECT", $200,000, 12/9/05-   12/31/06.

2006

A COPI with Joseph Mundy as PI on the following grants:
1. DARPA 5-24664 9/18/06-9/17/07, $100,000
2. Lockheed Martin 5-29029 Gaithersburg 12/9/05-12/31/07, $200,000
3. Lockheed Martin 5-29038 Lenniger 12/9/05-12/31/06, $125,000
4. Lockheed Martin 5-29139 Phoenix 12/9/06-12/31/07, $195,000

5. **PI with 4 COPI's**
    NSF ITR.   3D FREE FORM MODELS FOR THE REPRESENTATION MANIPULATION AND RECOVERY OF SHAPE WITH APPLICATIONS TO ARCHAEOLOGY AND VIRTUAL SCULPTING, 9/1/02-8/31/07, $2,050,000.

2007

A COPI with Joseph Mundy as PI on the following grants:
1. DARPA 5-24664 9/18/06-9/17/08, $100,000, with G. Taubin.
2. Lockheed Martin 5-29029 Gaithersburg 12/9/05-12/31/07, $200,000
3. NGA 5-24655 7/20/05-7/19/08, $470,000
4. Lockheed Martin 5-29139 Phoenix 12/9/06-12/31/07, $195,000, with B. Kimia

5. **PI with 4 COPI's**
    NSF ITR.   3D FREE FORM MODELS FOR THE REPRESENTATION MANIPULATION AND RECOVERY OF SHAPE WITH APPLICATIONS TO ARCHAEOLOGY AND VIRTUAL SCULPTING, 9/1/02-8/31/08, $2,050,000.

2008
A COPI with Joseph Mundy as PI on the following grants:
1. DARPA 5-24664 9/18/06-9/17/09, $550,000, with G. Taubin.
2. Lockheed Martin Gaithersburg 5-29029, 12/9/05-12/31/07, $200,000
3. NGA 5-24655, 7/20/05-7/18/09, $620,000
4. Lockheed Martin Phoenix 5-29139, 10/1/08-6/30/09, $695,000, with B. Kimia

PI with 4 COPI's
5. NSF ITR. 3D FREE FORM MODELS FOR THE REPRESENTATION MANIPULATION AND RECOVERY OF SHAPE WITH APPLICATIONS TO

ARCHAEOLOGY AND VIRTUAL SCULPTING, 9/1/02-8/31/08, $2,050,000.

PI with 3 COPIs

6. NSF IIS.   III-CXT-Core Computer Vision Research Promoting Paradigm Shifts in Archaeology,
     9/1/08 - 8/31/12, $2,638, 964 Plus $100,000 matching from Brown University.

2009

A COPI with Joseph Mundy as PI on the following grants:

1. NGA 5-24655, 7/20/05-7/18/10, $620,000
2. Lockheed Martin Phoenix 5-29139, 12/6/06 - 3/31/10, $195,000 per year, with B. Kimia

PI with 3 COPIs

3. NSF IIS **5-26735,** III-CXT-Core Computer Vision Research Promoting Paradigm Shifts in Archaeology, 9/1/08 - 8/31/12, $2,638, 964 Plus $100,000 matching from Brown University, with 3 COPIs.
4. NSF 5-26819, REU grant as an ad-on to grant 3 above.   09/01/08 - 8/31/12, $58,005, with 3 COPIs.

5. Brown University Curriculum development grant with Professor Katharina Galor: $4,000

Grant Proposal Under Review

 6. NSF. "CIF: Analysis and Design of Computer Vision and Scene Understanding
 Task-Solutions Using Random Networks of '1000' Smart Wireless Battery
 Powered Cameras", : 6/1/10 - 5/31/13, $ 481,321

TEACHING

2004 COURSES TAUGHT

Spring: EN252, 6 students

Fall: EN157, 11 students

EN195, 1 student. EN196, 1 student

EN297, 4 students. EN298, 5 students

2005 COURSES TAUGHT

Spring: EN257, 8 students

Fall: EN161, 8 students

EN195, 1 student. EN196, 1 student

EN297, 4 students. EN298, 3 students

2006 COURSES TAUGHT

Spring: EN252, 8 Students

Fall: EN161, 7 Students

EN298, 4 students. EN297, 3 students

2007 COURSES TAUGHT

Spring: EN257 Applied Stochastic Processes, 7 students

Fall: Sabbatical Leave

EN298, 2 students. EN297, 3 students

2008 COURSES TAUGHT

Spring: EN252 Pattern Recognition and Computer Vision, 10 students

Fall 2008: No course because of half-time appointment.

EN297,298, 4 each semester

2009 COURSES TAUGHT

Spring: No course because of half- time appointment

Fall: No course because wife died in September. Will make up for the course by
    teaching Fall 2010.
EN297,298, 4 each semester

2004 PH.D.S GRADUATED
Andrew Willis, Kongbin Kang

2004 M.A. THESES COSUPERVISED AND GRADUATED
John Speicher

2004 POST DOCTORAL FELLOWS SUPERVISED: 1 Researcher
Andrew Willis since June 2004

2005 POST DOCTORAL FELLOW SUPERVISED: 1

2004 GRADUATE RESEARCH ASSISTANTS SUPERVISED
7 (3 graduated in June, 2 started in September, 2 continued through the year)

2005 GRADUATE RESEARCH STUDENTS SUPERVISED: 5 students
Dongjin Han, Anat Kaspi, Ibrahim Eden, Shubao Liu, Osman Sezer
(4 working for Ph.D., 1 for M.S. thesis.)

2005 UNDERGRADUATE HONORS THESES SUPERVISED:
Sye-Min Chan who graduated with the Best Computer Engineering Student Award.

2006 GRADUATE STUDENTS SUPERVISED: 6

M.Sc. Awarded: Anat Kaspi

2006 Ph.D. PROGRAM STUDENTS SUPPORTED AND SUPERVISED: 5
Osman Sezer, Dongjin Han, Ibrahim Eden, Shubao Liu, Eduardo Almeida (Fellowship)

2007 Ph.D. PROGRAM STUDENTS SUPPORTED AND SUPERVISED: 4
Ibrahim Eden, Shubao Liu, Eduardo Almeida, Dongjin Han

2008 Ph.D. PROGRAM STUDENTS SUPPORTED AND SUPERVISED: 5
I. Eden, S. Liu, E. Almeida, O. Ulosoy, D. Han

2009 Ph.D. PROGRAM STUDENTS SUPPORTED AND SUPERVISED: 4
I. Eden, S. Liu, E. Almeida, O. Ulosoy

BRIEF SUMMARY OF CURRENT RESEARCH TOPICS

1. Vehicle classification from a video clip taken by a calibrated camera.

2. Change Detection:
   Surveillance problem for detecting a potential threat by detecting and analyzing change in the appearance of a scene. Data used is LADAR or video. This work involves estimating 3D geometry such as lines, planes, surfaces, and semantically meaningful geometry such as walls, windows, doors, etc., in buildings.

3. Pot Assembly:
   Completing a 2nd generation pot assembly-from-fragments algorithm and software system.

4. Solid object 3D model estimation and assembly based on dense-data laser scans or on multiview digital images or video:
   Semiautomatic system for matching and aligning broken pieces from a solid object in order to recreate the object. This is based on 3D laser scans of the pieces or on multiview digital images or video, and is applicable to sculpture, column capitals, and arbitrary large structures.

5. Virtual worlds based on "1000" cameras:
   Detecting, recognizing and reconstructing 3D models of significant geometric structures in a scene for the purpose of collaborative work, from remote locations, relevant to the real 3D scene. Also, applications to disaster relief and to urban warfare.

6. 3D reconstruction from image silhouettes, self occluding edges seen in an image, and image intensities taken by a moving camera: