

George Bebis

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Research Interests

Computer Vision
Image Processing
Pattern Recognition
Machine Learning
Genetic Algorithms

Education

Ph.D. in Electrical & Computer Engineering
University of Central Florida, Orlando, FL 32816
Dissertation Topic: *Indexing-Based Object Recognition.*
Graduation: August 1996

Master of Science in Computer Science
University of Crete, Heraklion, Crete, Greece
Thesis topic: *Model Based Object Recognition using
Multi-resolution Segmentation and Neural Network Models.*
Graduation: July 1991

Bachelor of Science in Mathematics
University of Crete, Heraklion, Crete, Greece
Major Areas: *Numerical Analysis, Probability Theory and Statistics*
Graduation: September 1987

Academic Experience

July 2008 - present, Professor
Department of Computer Science and Engineering, UNR

July 2002 - June 2008, Associate Professor
Department of Computer Science and Engineering, UNR

January 1998 - present, Founder and Director
Computer Vision Laboratory (CVL), UNR

January 1998 - June 2002, *Assistant Professor*
Department of Computer Science and Engineering, UNR

August 1997 - December 1997, *Visiting Assistant Professor*
Department of Computer Science and Engineering, UNR

July 1998 - August 1998, *Summer Faculty*
Center for Applied Scientific Computing (CASC), Lawrence Livermore National Laboratory

August 1996 - August 1997, *Visiting Assistant Professor*
Department of Mathematics and Computer Science, University of Missouri-St. Louis (UMSL)

Teaching

CS201 Computer Science I, CS302 Data Structures, CS365 Mathematics of Computer Science, CS477/677 Analysis of Algorithms, CS474/674 Image Processing and Interpretation, CS479/679 Pattern Recognition, CS480/680 Computer Graphics, CS491E/791E Computer Vision, CS791Y Topics in Computer Vision, CS773C Machine Intelligence Advanced Applications, CS791S Neural Networks, CS491Q/790Q SEM: Machine Learning (Biometrics), CS491Y/791Y Mathematical Methods for Computer Vision

Ph.D. Dissertations

On-Road Vehicle Detection, Zehang Sun, Fall 2003.

Perceptual Grouping Using Tensor Voting, Leandro Loss, May 2009.

Hand-Based Biometrics, Gholmareza Amayeh (expected), May 2010.

Note: The Computer Science and Engineering Department only recently obtained a Ph.D program. I have graduated the first Ph.D. student in my Department (Zehang Sun, Fall 2003).

Master Theses

Computational Models for Regional and Mesoscale Air Quality Modeling in the United States, Julide Koracin, Spring 2009.

Gender Classification, Zhiming Liu, Spring 2007.

Fingerprint Template Synthesis, Tamer Uz, Spring 2006.

Improving the Performance of Fingerprint Classification, Uday Rajanna, Spring 2006.

Shape Metamorphism Using p -Laplacian Equation, Mehmet Eser, Spring 2005.

Geometric Approach to Segmentation and Protein Localization in Cell Cultured Assays, Sreevatsan Raman, Fall 2005.

Automatic Recognition of a Baby Gesture, Jigna Bhatt, Spring 2005.

Global Hand Pose Estimation by Multiple Camera Ellipse Tracking, Jorge Usabiaga, Spring 2005.

Rendering Optimizations Guided by Head-Pose Estimates and their Uncertainty, Javier Martinez, Summer 2005.

Face Recognition Experiments Using Random Projection, Navin Goel, Spring 2004.

Infrared and Visible Image Fusion for Face Recognition, Saurabh Singh, Spring 2004.

Heliothis-Zea Classification Using Image Analysis, Tom Patten, Spring 2004.

Face Detection Using Multi-Band Fusion, Jonathan Dowdall, Spring 2003.

Multiresolution Image Retrieval Through Fusion, Vladimir Nikulin, Fall 2003.

Face Recognition Using Image Fusion, Aglika Gyaourova, Spring 2003.

Fingerprint Minutiae Extraction, Chris Smith, Fall 2002.

Computational Analysis of Functionally Unknown Proteins from Expressed Sequence Tags (EST) Datasets, Elham Alavi, Fall 2002.

Improving Fingerprint Recognition, Xiaosheng Tu, Summer 2000.

Genetic Search for Face Recognition, Satish Uthiram, Summer 1999.

Face Detection using Convex Grouping, Alexey Kryuchkov, Fall 1998.

Fingerprint Recognition using Delaunay Triangulation, Taisa Deaconu, Fall 1998.

Honors

Lemelson Award for Innovation and Entrepreneurship, May 2002

Patents

- "Hand-based Verification Using Palm-Finger Segmentation", full patent, filed in June 2007.
- "Hand-Based Gender Classification", provisional patent application, filed in June 2009.
- "Minutiae-based Template Synthesis and Matching", provisional patent application, filed in

August 2009.

Departmental and College Committee Services

2005 - present, Graduate Director

2008 - present, Assessment Committee (Member)

2002 - 2003, Strategic Planning Committee (Chair)

2003 - 2004, Evaluation Committee (Member)

2003-2005, 2006-2007, Search Committee (Member)

2006 - present, College Personnel Committee (Member)

2007 - present, College Dean Search Committee (Member)

State, National, and International Committee Services

2002 - present, IAPR Education Committee

2001 - present, Nevada NASA Space Grant Consortium

Professional Activities

Panelist

NSF, 2002-2005

Nevada NSF-EPSCoR, 2007

Nevada NASA-EPSCoR, 2006-2008

Nevada DoD-EPSCoR, 2004

Nevada Space Grant, 2005-2008

Associate Editor

- *Machine Vision and Applications Journal* (2003-present)

Editorial Board Member

- *Pattern Recognition Journal* (2004-2007)
- *International Journal on Artificial Intelligence Tools* (2003-present)

Guest Editor

- *IEEE Multimedia Magazine* (special issue on Digital Multimedia on Demand, January-March 2004).
- *International Journal on Artificial Intelligence Tools* (special issue on Applications of Computer Vision, June 2000).

Reviewer

- *Computer Vision and Image Understanding* (CVIU)
- *Pattern Recognition* (PR)
- *Image and Vision Computing* (IVC)
- *IEEE Transactions on Pattern Analysis and Machine Intelligence* (PAMI)
- *Machine Vision and Applications* (MVA)
- *International Conference on Computer Vision* (ICCV)
- *Computer Vision and Pattern Recognition Conference* (CVPR)

Program Chair/co-Chair

- *First International Symposium on Visual Computing* (ISVC05), December 5-7, 2005, Lake Tahoe, Nevada (program chair - LNCS, Springer Verlag).
- *IEEE International Symposium on Bio-Informatics & Biomedical Engineering*, November 2000, Washington DC (program co-chair).
- *IEEE Symposium on Image, Speech, and Natural Language Systems*, November 1999, Maryland (program co-chair).

Area Chair

- *9th SIAM International Conference on Data Mining*, Reno, NV, April 30 - May 2, 2009.
- *IEEE International Conference on Advanced Video and Signal Based Surveillance* (AVSS08), September 1-3, 2008, Santa Fe, New Mexico.
- *Visual Information Engineering*, (N. America Area Chair) July 25-27, 2007, London, UK.

Organizer/co-Organizer

- *ACM SIG 2003 Multimedia Biometrics Methods and Applications Workshop*, (in conjunction with ACM Multimedia 03), Berkeley, November 8, 2003 (co-organizer).
- *IEEE Workshop on Combined Research-Curriculum Development in Computer Vision*, (in conjunction with CVPR01), Kauai, Hawaii, December 11-13, 2001 (organizer).

Steering Committee Chair

- *5th International Symposium on Visual Computing (ISVC09)*, November 30 - December 2, 2009, Las Vegas, Nevada.
- *4th International Symposium on Visual Computing (ISVC08)*, December 1-3, 2008, Las Vegas, Nevada.
- *3rd International Symposium on Visual Computing (ISVC07)*, November 26-28, 2007, Lake Tahoe, Nevada.
- *2nd International Symposium on Visual Computing (ISVC06)*, November 6-8, 2006, Lake Tahoe, Nevada.

Program Committee Member

- *Computational Modeling of Objects Represented in Images: Fundamentals, Methods and Applications (CompIMAGE'2010)*, Buffalo, NY, May 5-7, 2010.
- *3rd IEEE International Conference on Biometrics: Theory, Applications and Systems*, Washington DC, Sept 28 - 30, 2009.
- *6th IEEE Workshop on Object Tracking and Classification in and Beyond the Visible Spectrum*, Miami, Florida, June 20, 2009
- *16th International Conference on Digital Signal Processing*, Santorini, Greece, July 5-7, 2009.
- *International Conference on Imaging Theory and Applications*, Lisboa, Portugal, February 5-8, 2009.
- *IEEE International Conference on Information Reuse and Integration*, Las Vegas, August 10-12, 2009.
- *Joint IAPR International Workshops on Structural and Syntactic Pattern Recognition (SSPR 2008) and Statistical Techniques in Pattern Recognition (SPR 2008)*, Orlando, Florida, December 4-6, 2008.
- *SPIE Defense and Security Symposium (DS108: Biometric Technology for Human Identification VI)*, April 13-17, 2009, Orlando, Florida.
- *IEEE Symposium on Computational Intelligence in Vehicles and Vehicular Systems*, Nashville, Tennessee, Mar 30-Apr 2, 2009.
- *IEEE/IAPR International Conference on Biometrics*, Alghero in Sardinia Island, Italy, June 2-5, 2009.
- *International Conference on Pattern Recognition (ICPR08) (Biometrics)*, Tampa, FL, December 8-11, 2008.
- *16th European Signal Processing Conference (EUSIPCO 2008)*, Lausanne, Switzerland, August 25-29, 2008.
- *IEEE Workshop on Online Learning for Classification*, Anchorage, Alaska, June 27, 2008

- *2nd IEEE International Conference on Biometrics: Theory, Applications and Systems*, Washington DC, Sept 29 - Oct 1, 2008.
- *5th IEEE Workshop on Object Tracking and Classification in and Beyond the Visible Spectrum*, Anchorage, Alaska, June 27, 2008
- *IEEE International Conference on Information Reuse and Integration, Las Vegas, July 13-15, 2008.*
- *International Conference on Cyberwolds*, Hangzhou, China, September 22-24 2008.
- *SPIE Defense and Security Symposium (DS26: Biometric Technology for Human Identification V)*, March 16-20, 2008, Orlando, Florida.
- *IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS07)*, September 5-7, 2007, London, UK.
- *International Workshop on Combinatorial Image Analysis (IWCA08)*, April 7-9, 2008, Buffalo, NY, USA.
- *International Conference on Signal-Image Technology and Internet-Based Systems (SITIS07)*, December 16-19, 2007, China.
- *IEEE International Conference on Information Reuse and Integration* August 13-15, 2007, Las Vegas, Nevada.
- *4th IEEE Workshop on Object Tracking and Classification in and Beyond the Visible Spectrum*, Minneapolis, MN, USA, Friday, June 22, 2007.
- *5th International Conference on New Horizons in Industry, Business and Education*, August 30-31, 2007, Rhodes island, Greece.
- *International Conference on Cyberwolds*, Hannover, Germany, Oct 24-26, 2007.
- *Visual Information Engineering*, July 25-27, 2007, London, UK.
- *International Conference on Sciences of Electronic, Technology of Information and Telecommunications (SETIT07)*, March 25-29, 2007, Hammamet, Tunisia.
- *IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS06)*, November 22-24, 2006, Sydney, Australia.
- *International Conference on Cyberwolds*, Ecole Polytechnique Fdrale de Lausanne (EPFL), Switzerland, Nov 28-30, 2006.
- *IEE Conference on Crime and Security: Imaging for Crime Detection and Prevention*, London, UK, 13-15 June 2006.
- *18th IEEE International Conference on Tools with Artificial Intelligence*, 2006.
- *Third IEEE Workshop on Object Tracking and Classification in and Beyond the Visible Spectrum*, (in conjunction with CVPR06), New York, NY, June 22, 2006.
- *International Conference on Computer Games Development*, Las Vegas, NV, June

26-29, 2006.

- *IEEE International Conference on Information Reuse and Integration*, Sep 16-18, 2006, Waikoloa, Hawaii.
- *International Conference on Sciences of Electronic, Technology of Information and Telecommunications (SETIT 2007)*, March 25-29, 2007, Hammamet, Tunisia.
- *International Conference on Computer Vision Theory and Applications (VISAPP)*, February 22-25, 2006, Setubal, Portugal.
- *IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS05)*, September 15-16, 2005, Como, Italy.
- *IEEE International Conference on Image Processing (ICIP05)*, September 11-14, 2005, Genova, Italy.
- *Second IEEE Workshop on Object Tracking and Classification in and Beyond the Visible Spectrum*, (in conjunction with CVPR05), San Diego, CA, June 20, 2005.
- *IEEE Workshop on Machine Vision for Intelligent Vehicles*, (in conjunction with CVPR05), San Diego, CA, June 21, 2005.
- *IEEE International Conference on Information Reuse and Integration*, Las Vegas, August 15-17, 2005.
- *17th IEEE International Conference on Tools with Artificial Intelligence*, 2005.
- *Genetic and Evolutionary Computing Conference (GECCO 2005)*, Washington, DC, June 25-29, 2005.
- *Fourth International Conference on New Horizons in Industry, Business and Education*, 25-26 August 2005, Corfu, Greece.
- *Signal, Image Technology and Internet-Based Systems (SITIS2005)*, November 27 - December 2, 2005, Cameroon.
- *International Conference on Cyberworlds (CW2005)*, November 23-25, 2005, Singapore.
- *Third International Conference on Sciences of Electronic, Technology of Information and Telecommunications*, March 27-31, 2005, Susa, Tunisia.
- *IEEE Workshop on Object Tracking and Classification Beyond the Visible Spectrum*, (in conjunction with CVPR04), Washington, DC, June 28, 2004.
- *International Joint Conference on Neural Networks (IJCNN04)*, Budapest, Hungary, July 25-29, 2004.
- *15th IEEE International Conference on Tools with Artificial Intelligence*, Sacramento, November 3-5, 2003.
- *IEEE International Symposium on Bio-Informatics and Biomedical Engineering*, Bethesda, March 10-12, 2003.

- *IEEE International Conference on Advanced Video and Signal Based Surveillance*, July 21-22, 2003 Miami, FL.
- *Third International Conference on New Horizons in Industry and Education*, 28-29 August 2003, Santorini, Greece.
- *14th IEEE International Conference on Tools with Artificial Intelligence*, November 4-6, 2002, Washington D.C.
- *INNS-IEEE International Joint Conference on Neural Networks (IJCNN02)*, Honolulu, Hawaii, May 12-17 2002.
- *IEEE International Symposium on Bio-Informatics and Biomedical Engineering*, November 2001, Washington DC.
- *IEEE Workshop on Models versus Exemplars in Computer Vision*, (in conjunction with CVPR01), Kauai, Hawaii, December 11-13, 2001.
- *IEEE Workshop on Computer Vision Beyond the Visible Spectrum: Methods and Applications*, (in conjunction with CVPR01), Kauai, Hawaii, December 14, 2001.
- *INNS-IEEE International Joint Conference on Neural Networks (IJCNN01)*, Washington DC, July 14-19, 2001.
- *Neural Networks and Expert Systems in Medicine and Health Care*, Milos Island, Greece, 20-22 June 2001.
- *IEEE Workshop on Computer Vision Beyond the Visible Spectrum: Methods and Applications* (in conjunction with CVPR00), June 2000, Hilton Head Island, SC.
- *IEEE International Conference on Information, Intelligence, and Systems*, November 1999, Maryland.
- *International Conference on Imaging Science, Systems, and Technology*, July 6-9, 1998, Las Vegas, Nevada, USA.
- *11th International Conference on Computer Applications in Industry and Engineering*, November 11-13, 1998, Las Vegas, Nevada, USA.

Session Chair

- *13th International Conference on Parallel and Distributed Computing Systems* Las Vegas, August 8-10, 2000 (Digital Video II).
- *Signal and Image Processing Conference*, Las Vegas, Nevada, October, 1998 (Object Recognition).
- *IEEE International Conference on Systems, Man, and Cybernetics*, Orlando, Florida, October, 1997 (Applications of Neural Networks in Computer Vision).

Editorials

- [1] N. Bourbakis and G. Bebis, "Digital Multimedia on Demand", **IEEE Multimedia**, January-March 2004.

Books Edited

- [7] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol 5359, 4th International Symposium, ISVC 2008, Lake Tahoe, NV, USA, December 1-3, 2008.
- [6] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol 5358, 4th International Symposium, ISVC 2008, Las Vegas, NV, USA, December 1-3, 2008.
- [5] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol 4842, 3rd International Symposium, ISVC 2007, Lake Tahoe, NV, USA, November 26-28, 2007.
- [4] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol 4841, 3rd International Symposium, ISVC 2007, Lake Tahoe, NV, USA, November 26-28, 2007.
- [3] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol 4292, 2nd International Symposium, ISVC 2006, Lake Tahoe, NV, USA, November 6-8, 2006.
- [2] G. Bebis et. al (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol. 4291 2nd International Symposium, ISVC 2006, Lake Tahoe, NV, USA, November 6-8, 2006.
- [1] G. Bebis, R. Boyle, B. Parvin, and D. Koracin (eds) *Advances in Visual Computing*, Lecture Notes in Computer Science (LNCS), Vol. 3804, 1st International Symposium, ISVC 2005, Lake Tahoe, NV, USA, December 5-7, 2005.

Book Chapters

- [2] G. Bebis, "Fingerprint Indexing", **Biometrics Encyclopedia**, Springer-Verlag, (to appear) 2009.
- [1] G. Bebis, "Face Recognition in the Thermal Spectrum", **Biometrics Encyclopedia**, Springer-Verlag, (to appear) 2009.

Journal Publications

- [36] J. Wang, G. Bebis, Mircea Nicolescu, Monica Nicolescu, and R. Miller, "Improving Target Detection by Coupling It with Tracking", **Machine Vision and Applications**, vol. 20,

no. 4, pp. 205-223, 2009.

- [35] T. Uz, G. Bebis, A. Erol, and S. Prabhakar, "Minutiae-Based Template Synthesis and Matching for Fingerprint Authentication", **Computer Vision and Image Understanding (CVIU)**, vol 113, pp. 979-992, 2009.
- [34] A. Amayeh, G. Bebis, and M. Nicolescu, "Hand-based Verification and Identification Using Palm-Finger Segmentation and Fusion", **Computer Vision and Image Understanding Journal (CVIU)**, vol 113, pp. 477-501, 2009.
- [33] J. Martinez, A. Erol, G. Bebis, R. Boyle, and X. Twombly, "Integrating Perceptual Level of Detail with Head Pose Estimates and their Uncertainty", **Machine Vision and Applications** (to appear) 2009.
- [32] L. Loss, G. Bebis, M. Nicolescu, and A. Skurikhin, "An Iterative Multi-Scale Tensor Voting Scheme for Perceptual Grouping of Natural Shapes in Cluttered Backgrounds", **Computer Vision and Image Understanding (CVIU)**, vol. 113, no. 1, pp. 126-149, 2009.
- [31] J. Usabiaga, A. Erol, G. Bebis, R. Boyle, and X. Towmbly, "Global Hand-Pose Estimation by Multiple Camera Ellipse Tracking", **Machine Vision and Applications** (to appear), 2009.
- [30] A. Tavakkoli, Mircea Nicolescu, G. Bebis, and Monica Nicolescu, "Non-parametric Statistical Background Modeling for Efficient Foreground Region Detection", **Machine Vision and Applications** (to appear), 2009.
- [29] U. Rajanna, A. Erol, and G. Bebis, "A Comparative Study on Feature Extraction for Fingerprint Classification and Performance Improvements Using Rank-Level Fusion", **Pattern Analysis and Applications**, (to appear) 2009.
- [28] R. Kelley, C. King, A. Tavakkoli, Mircea Nicolescu, Monica Nicolescu, and G. Bebis, "An architecture for understanding intent using novel hidden Markov formulation", **International Journal of Humanoid Robotics**, (special issue on "Cognitive Humanoid Robots"), vol. 5, no. 2, pp. 243-264, 2008.
- [27] W. Li, G. Bebis, and N. Bourbakis, "3D Object Recognition Using 2D Views", **IEEE Transactions on Image Processing**, vol. 17, no. 11, pp. 2236-2255, 2008.
- [26] A. Tavakkoli, Mircea Nicolescu, G. Bebis, and Monica Nicolescu, "A Support Vector Data Description Approach for Background Modeling in Videos with Quasi-Stationary Backgrounds", **International Journal of Artificial Intelligence Tools**, vol. 17, no. 4, pp. 635-658, 2008.
- [25] A. Erol, G. Bebis, M. Nicolescu, R. Boyle, X. Twombly, "Vision-Based Hand Pose Estimation: A Review", **Computer Vision and Image Understanding** (special issue on Vision for Human-Computer Interaction), October/November 2007.
- [24] G. Bebis, A. Gyaourova, S. Singh, and I. Pavlidis, "Face Recognition by Fusing Thermal Infrared and Visible Imagery", **Image and Vision Computing**, vol. 24, no. 7, pp. 727-742, 2006.

- [23] Z. Sun, G. Bebis, and R. Miller, "On-road Vehicle Detection: A review", **IEEE Transactions on Pattern Analysis and Machine Intelligence**, vol. 28, no. 5, pp. 694-711, 2006.
- [22] Z. Sun, G. Bebis, and R. Miller, "Monocular Pre-crash Vehicle Detection: Features and Classifiers", **IEEE Transactions on Image Processing**, vol. 15, no. 7, pp. 2019-2034, July 2006.
- [21] Z. Sun, G. Bebis, and R. Miller, "On-Road Vehicle Detection Using Evolutionary Gabor Filter Optimization", **IEEE Transactions on Intelligent Transportation Systems**, vol. 6, no. 2, pp. 125-137, 2005.
- [20] Z. Sun, G. Bebis, and R. Miller, "Boosting Object Detection Using Feature Selection", **Pattern Recognition**, vol. 37, pp. 2165-2176, 2004.
- [19] N. Bourbakis, J. Gattiker, and G. Bebis "A Synergistic Model for Interpreting Human Activities and Events from Video", **International Journal on Artificial Intelligence Tools** , vol. 12, no. 1, 2003.
- [18] J. Dowdall, I. Pavlidis, and G. Bebis, "Face Detection Using Multi-Band Fusion", **Image and Vision Computing**, vol 21, no. 7, pp. 565-578, 2003.
- [17] G. Bebis. D. Egbert, and M. Shah, "Review of Computer Vision Education", **IEEE Transactions on Education**, vol. 46, no. 1, pp. 2-21, 2003.
- [16] G. Bebis, S. Louis, Y. Varol, and A. Yfantis, "Genetic Object Recognition Using Combinations of Views", **IEEE Transactions on Evolutionary Computing**, vol 6, no. 2, pp. 132-146, April 2002.
- [15] G. Bebis, S. Uthiram, and M. Georgiopoulos, "Face Detection and Verification Using Genetic Search", **International Journal on Artificial Intelligence Tools**, vol 9, no 2, pp. 225-246, 2000.
- [14] E.Yfantis, T. Lazarakis, G. Bebis, and M. Gallitano, " An Algorithm for Cancer Recognition of Ultrasound Images", **International Journal on Artificial Intelligence Tools**, vol 9, no 2, pp. 265-276, 2000.
- [13] M. Georgiopoulos, I. Dagher, G. Heilman, and G. Bebis, "Properties of Learning of a Fuzzy ART Variant", **Neural Networks**, vol. 12, No. 6, pp. 837-850, 1999.
- [12] G. Bebis, M. Georgiopoulos, N. La Vitoria Lobo, and M. Shah, "Recognition by Learning Affine Transformations", **Pattern Recognition**, Vol. 32, No. 10, pp. 1783-1799, 1999.
- [11] G. Bebis, G. Papadourakis and S. Orphanoudakis, "Curvature Scale Space Driven Object Recognition with an Indexing Scheme based on Artificial Neural Networks", **Pattern Recognition**, Vol. 32, No. 7, pp. 1175-1201, 1999.
- [10] I. Dagher, M. Georgiopoulos, G. Heilman, and G. Bebis, "An Ordering Algorithm for Pattern Presentation in Fuzzy ARTMAP That Tends to Improve Generalization Performance", **IEEE Transactions on Neural Networks**, Vol. 10, No. 4, pp. 768-778, 1999.

- [9] G. Bebis, M. Georgiopoulos, M. Shah, and N. La Vitoria Lobo, "Indexing based on algebraic functions of views", **Computer Vision and Image Understanding**, vol. 72, no. 3, pp. 360-378, 1998.
- [8] G. Bebis, M. Georgiopoulos and N. La Vitoria Lobo, "Using Self-Organizing Maps to Learn Geometric Hashing Functions for Model-Based Object Recognition", **IEEE Transactions on Neural Networks**, Vol 9, No. 3, pp. 560-570, 1998.
- [7] G. Bebis, M. Georgiopoulos, and T. Kasparis "Coupling weight elimination with genetic algorithms to reduce network size and preserve generalization" **Neurocomputing**, Vol. 17, No. 3&4, pp. 167-194, 1997.
- [6] M. Georgiopoulos, H. Fernlund, G. Bebis, and G. Heileman, "Order of Search in Fuzzy ART and Fuzzy ARTMAP: Effect of the Choice Parameter", **Neural Networks**, vol. 9, no. 9, pp. 1541-1559, 1996.
- [5] G. Bebis and M. Georgiopoulos, "Feed-forward neural networks: why network size is so important", **IEEE Potentials**, pp. 27-31, October/November 1994.
- [4] G. Bebis and G. Papadourakis, "Object Recognition Using Invariant Object Boundary Contour Representations and Neural Network Models", **Pattern Recognition**, Vol. 25, No. 1, pp. 25-44, January 1992.
- [3] G. Papadourakis and G. Bebis, "Artificial Neural Networks I", **Scientific Journal of the Technical Chamber of Greece**, Vol. 11, No. 3, pp. 57-73, 1991.
- [2] G. Papadourakis and G. Bebis, "Artificial Neural Networks II", **Scientific Journal of the Technical Chamber of Greece**, Vol. 12, No. 1, pp. 107-131, 1992.
- [1] G. Bebis, G. Papadourakis and M. Georgiopoulos, "Back Propagation: Increasing Rate of Convergence by Predictable Pattern Loading", **Intelligent Systems Review**, Vol. 1, No. 3, pp. 14-30, 1989.

Conference Publications

- [96] G. Amayeh, G. Bebis, and M. Nicolescu, "Improving Hand-Based Verification Through Online Finger Template Update Based on Fused Confidences", **IEEE International Conference on Biometrics: Theory, Applications and Systems (BTAS09)**, September 28-30, 2009, Washington DC.
- [95] L. Loss, G. Bebis, and B. Parvin, "Tunable Tensor Voting Improves Grouping of Membrane-Bound Macromolecules", **IEEE Workshop on Mathematical Methods in Biomedical Image Analysis**, (in conjunction with CVPR09), Miami, USA, June 20, 2009.
- [94] L. Loss, G. Bebis, and B. Parvin, "Tunable Tensor Voting for Rregularizing Punctate Patterns of Membrane-Bound Protein Signals", **IEEE International Symposium on Biomedical Imaging**, Boston, USA, June 28 - July 1, 2009.

- [93] F. Scalzo, G. Bebis, Mircea Nicolescu, L. Loss, and A. Tavakkoli, "Feature Fusion Hierarchies for Gender Classification", **International Conference on Pattern Recognition (ICPR08)**, December 2008.
- [92] A. Tavakkoli, Mircea Nicolescu, G. Bebis and Monica Nicolescu, "Efficient Background Modeling through Incremental Support Vector Data Description", **International Conference on Pattern Recognition (ICPR08)**, December 2008.
- [91] L. Loss, G. Bebis, M. Nicolescu, and A. Skurikhin, "Investigating How and When Perceptual Organization Cues Improve Boundary Detection in Natural Images", **IEEE Workshop on Perceptual Organization in Computer Vision** (in conjunction with CVPR08), 2008.
- [90] G. Amayeh, G. Bebis and M. Nicolescu, "Gender Classification from Hand Shape", **IEEE Workshop on Biometrics** (in conjunction with CVPR08), 2008.
- [89] A. Tavakkoli, Mircea Nicolescu, Monica Nicolescu, and G. Bebis, "Incremental SVDD Training: Improving Efficiency of Background Modeling in Videos", **Signal and Image Processing (SIP08)**, Hawaii, August 2008.
- [88] A. Ambardekar, M. Nicolescu, and G. Bebis, "Efficient Vehicle Tracking and Classification for an Automated Traffic Surveillance System ", **Signal and Image Processing (SIP08)**, Hawaii, August 2008.
- [87] F. Scalzo, G. Bebis, M. Nicolescu, and L. Loss, "Multimodal Feature Fusion Hierarchies", **Benelearn**, Spa, Belgium, May 2008.
- [86] K. McDermott, I. Juricevic, G. Bebis, and M. Webster, "Adapting Images to Observers", **SPIE Electronic Imaging (Human Vision and Electronic Imaging XIII)**, vol. 6806, San Jose, CA, January 2008.
- [85] R. Kelley, A. Tavakkoli, C. King, Monica Nicolescu, Mircea Nicolescu, and George Bebis, "Understanding Human Intentions via Hidden Markov Models in Autonomous Mobile Robots", **ACM/IEEE International Conference on Human-Robot Interaction**, Amsterdam, Netherlands, March 2008.
- [84] A. Tavakkoli, R. Kelley, C. King, Mircea Nicolescu, Monica Nicolescu, and G. Bebis, "A Vision-based Architecture for Intent Recognition", **3rd International Symposium on Visual Computing (ISVC07)**, Lecture Notes of Computer Science (LNCS), vol. 4842, pp. 173-182, November 26-28, 2007, Lake Tahoe, NV.
- [83] M. Webster, K. McDermott, and G. Bebis, "Fitting the world to the mind: Transforming images to mimic perceptual adaptation", **3rd International Symposium on Visual Computing (ISVC07)**, Lecture Notes of Computer Science (LNCS), vol. 4842, pp. 757-768, November 26-28, 2007, Lake Tahoe, NV.
- [82] Z. Sun, G. Bebis, and N. Bourbakis, "Decision-Level Fusion for Vehicle Detection", **11th International Conference on Computers**, July 2007, Crete, Greece.
- [81] G. Amayeh, G. Bebis, A. Erol, and M. Nicolescu, "A new approach to Hand-based Authentication", **SPIE Defense and Security Symposium (DS26: Biometric**

Technology for Human Identification V), April 2007, Orlando, Florida.

- [80] G. Amayeh, G. Bebis, A. Erol, and M. Nicolescu, "A component-based Approach to Hand Verification", **IEEE Workshop on Biometrics (in conjunction with CVPR07)**, Minneapolis, MN, June 2007.
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Research Grants (serving as Principal Investigator (PI))

Agency: Nevada NASA Space Grant Consortium
Investigators: G. Bebis (PI) and K. Bekris (co-PI)
Title: Workforce Training in Imaging and Robotics
Period of Proposed Funding: August 2009 - July 2010
Amount Granted : \$80,000

Agency: Nevada NASA EPSCoR
Investigators: G. Bebis (PI)
Title: High Resolution 3D Lunar Maps Using Subpixel Accuracy and Adaptive Window Search
Period of Proposed Funding: July 2009 - June 2010
Amount Granted : \$40,000

Agency: NSF
Investigators: G. Bebis (PI)
Title: Hand-Based Biometrics
Period of Proposed Funding: July 2006 - December 2008
Amount Granted : \$70,000

Agency: eTreppid Technologies, LLC
Investigators: G. Bebis (PI)
Title: Object Detection, Tracking, and Classification
Period of Proposed Funding: June 2006 - December 2007
Amount Granted : \$130,000

Agency: UtopiaCompression Inc.
Investigators: G. Bebis (PI)
Title: Visual Surveillance
Period of Proposed Funding: May 2006 - December 2006
Amount Granted : \$80,000

Agency: NASA
Investigators: G. Bebis (PI), F. Harris, A. Yfantis, and M. Nicolescu
Title: Computer Vision Technologies for Effective Human-Computer Interaction in Virtual Environments (2nd phase)
Period of Funding: 1/2006 - 2/2008
Amount Granted : \$780,000

Agency: NASA
Investigators: G. Bebis (PI), F. Harris, A. Yfantis, and P. Stubberud
Title: Computer Vision Technologies for Effective Human-Computer Interaction in Virtual Environments (1st phase)
Period of Funding: 9/02 - 12/05
Amount Granted: \$1,148,940

Agency: NSF
Investigators: G. Bebis (PI), D. Egbert, E. Jacobson, and M. McIntosh
Title: Combined Research-Curriculum Development in Computer Vision
Period of Funding: 1/1/2001 - 8/31/2004
Amount Granted: \$650,243

Agency: NSF
Investigators: G. Bebis (PI)
Title: Request for Travel Grant for Undergraduate and Graduate Students
Period of Funding: 6/1/2001 - 12/31/2001
Amount Granted: \$8,831

Agency: ONR
Investigators: G. Bebis (PI) and G. Mauer
Title: Automatic Target Recognition Using Algebraic Functions of Views
Period of Funding: 4/1/2001 - 3/31/2005
Amount Granted : \$587,887

Agency: Ford Motor Company
Investigators: G. Bebis (PI) and D. Egbert
Title: Vehicle Detection, Classification, Tracking, and Depth Estimation for Driver Assistance and Collision Avoidance as part of Vehicle Compatibility Big Bang
Period of Funding: 1/1/2003-8/31/2005
Amount Granted : \$80,000

Agency: University of Nevada (Applied Research Initiative)
Investigators: G. Bebis (PI) and D. Egbert

Title: Vehicle Detection, Classification, Tracking, and Depth Estimation
Period of Funding: 1/1/2003-8/31/2005
Amount Granted : \$80,000

Agency: UNR - Research Advisory Board
Investigators: G. Bebis (PI)
Title: Robotic Vision Systems
Period of Funding: 7/1/98 - 6/30/99
Amount Granted: \$8,000

Research Grants (serving as co Principal Investigator (co-PI))

Agency: NSF
Investigators: E. Folmer (PI), G. Bebis (co-PI)
Title: TextSL: A Virtual World Interface for the Visually Impaired
Period of Proposed Funding: August 2009 - July 2012
Amount Granted : \$500,000

Agency: Nevada Dept of Transportation (NDoT)
Investigators: T. Tan (PI), G. Bebis (PI)
Title: Evaluation of Video Detection Systems and Development of Application Guidelines at Signalized Intersections
Period of Proposed Funding: October 2007 - October 2009
Amount Granted : \$165,000

Agency: NSF
Investigators: S. Louis (PI), G. Bebis, et al.
Title: Cognitive Information Processing Systems (part of "Research Infrastructure for Nevada's Growth - Targeting Research with Uniqueness and Excellence")
Period of Proposed Funding: June 2005 - June 2008
Amount Granted : \$1,200,000

Agency: Sanford Center for Aging
Investigators: M. Webster (PI), G. Bebis, M. Wessinger, M. Crognale
Title: Adaptation and Aging in the Human Visual System
Period of Proposed Funding: 7/2005 - 12/2006
Amount Granted : \$20,000

Agency: NASA
Investigators: M. Webster (PI) and G. Bebis
Title: Adaptation and Visual Exploration
Period of Proposed Funding: 1/2005 - 12/2005
Amount Granted : \$39,619

Agency: NSF
Investigators: D. Koracin (PI), G. Bebis
Title: Development of an Air-Sea Interaction Model with the Parameterization of the Ocean

Surface Gravity Waves

Period of Proposed Funding: 1/2006 - 12/2007

Amount Granted : \$70,000

Agency: UNR - Instructional Enhancement Grant

Investigators: D. Egbert (PI) and G. Bebis

Title: Teaching Modules for Computer Vision Research

Period of Funding: 1/1/2001 - 6/31/2001

Amount Granted: \$2,400

Agency: Honda

Investigators: Q. Ji (PI) and G. Bebis

Title: A Multi-Sensory Vision System for Monitoring Driver's Vigilance

Period of Funding: 11/1/98 - 10/31/99

Amount Granted: \$25,000

Agency: UNR - Applied Research Initiative

Investigators: Q. Ji (PI) and G. Bebis

Title: A Multi-Sensory Vision System for Monitoring Driver's Vigilance

Period of Funding: 11/1/98 - 10/31/99

Amount Granted: \$25,000