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Department of Statistics

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Professional History

- August 2007 – present: Assistant Professor, Department of Statistics, Florida State University
- October 2006 – August 2007: Project Manager, Siemens Corporate Research, Princeton, NJ. Leading three other people for a total of four projects.
- October 2005 – September 2006: Scientist, Siemens Corporate Research, Princeton, NJ
- Summer 2005: Internship at Siemens Corporate Research, New Jersey
- Summer 2004: Internship at Microsoft Research, Beijing, China
- 2002-2005: Graduate Research Associate, UCLA, Computer Science Department, Los Angeles, CA
- 2000-2002: Graduate Research Associate, Ohio State University, Computer Science Department, Columbus, OH
- 1995-2000 :Graduate Teaching Associate, Ohio State University, Mathematics Department, Columbus, OH
- 1994-1995: Research Assistant: Institute of Mathematics of the Romanian Academy, Bucharest, Romania

Education

Ph.D. Computer Science, UCLA, June 2005.

Advisor: Prof. Song-Chun Zhu. Specialization: Computer Vision.

Ph.D. Mathematics, Ohio State University, July 2000.

Advisor: Prof. Avner Ash. Specialization: Algebra.

B.Sc. Mathematics, University of Bucharest, June 1995,

Advisor: Prof. Nicolae Popescu.

Research Experience

Siemens Corporate Research: 2005-2007. Managed and guided the successful design and implementation of a number of projects in medical imaging and surveillance:

1. Fluoroscopy: Guidewire and catheter localization and tracking, Vessel segmentation. Tumor registration and tracking.
2. CT volumes: Fast segmentation (1 second) of multiple heart chambers (Left Ventricle, Left Atrium, etc), Ileo-cecal valve detection, Rectal tube detection and segmentation in CT (has now been incorporated into the Siemens Colon application), Polyp detection and segmentation, Lymph node detection.
3. Aerial images: Learning algorithms for registration of surveillance videos with satellite maps.

University of California, Los Angeles: 2000-2005, Computer Science Department. Doctoral dissertation research, advisor: Dr. Song Chun Zhu.

- Motion segmentation and stereo matching using statistical models and stochastic algorithms integrating high-level knowledge with low or medium level priors, in the presence of occlusion.
- Cluster sampling algorithms on arbitrary probabilities, using data-driven techniques that increase performance hundreds of times over the Gibbs sampler. Applications to image segmentation, perceptual organization, motion segmentation and stereo matching.

- Multi-level and multi-grid versions of the cluster sampling algorithm that allow integration of many levels of representation in a hierarchical framework.
- Other Monte Carlo techniques: reversible jumps, diffusion, simulated annealing, parallel tempering, basin hopping.

Research Interests

- Learning-based optimization for high performance computer vision and medical imaging application:
 - Active Random Fields
 - Marginal Space Learning
- A theory for Artificial Prediction Markets with application to supervised learning.
- Hierarchical, part based statistical modeling using machine learning for:
 - Object detection and segmentation
 - Integrating detection and segmentation
- Applications to medical imaging:
 - 2D/3D detection or objects of interest: tumors, lymph nodes, landmarks, organs
 - 2D/3D thin, flexible structure localization and tracking (e.g catheter, guidewire)
 - 2D/3D vessel segmentation
 - 3D organ segmentation (lymph nodes, liver, kidneys, heart, polyps, etc)

Funding

1. MCS: Research on Detection and Classification of 2D and 3D Shapes in Cluttered Point Clouds. NSF, 400k (CO-PI)
2. Statistical and Semantic Approaches for Object, Activity and Intent Recognition. ONR, 443k (CO-PI)
3. Landmark Detection Using Discriminative Anatomical Network and Active Random Fields. Siemens, 31k (PI)
4. Cooperative Systems: Task Allocation for Heterogeneous Agent Teams Via Stochastic Clustering Auctions, ARO, 16k (Subcontract)

Journal Publications

1. F. Bunea, A. Tsybakov, M. Wegkamp and A.Barbu. SPADES and mixture models. *Annals of Statistics*, **38**, No. 4, 2525–2558, 2010.
2. F. Bunea and A.Barbu. Dimension reduction and variable selection in case control studies via regularized likelihood optimization. *Electronic Journal of Statistics*, **3**, 2009.
3. A. Barbu. Training an Active Random Field for Real-Time Image Denoising. *IEEE Trans. Image Processing* **18**, No 11, November 2009.
4. Y. Zheng, A. Barbu, B. Georgescu, M. Scheuring and D. Comaniciu. Four-Chamber Heart Modeling and Automatic Segmentation for 3D Cardiac CT Volumes Using Marginal Space Learning and Steerable Features. *IEEE Trans Medical Imaging*, November 2008.
5. A. Barbu, S.C. Zhu. Generalizing Swendsen–Wang for Image Analysis. *J. Computational and Graphical Statistics*, **16**, No 4, pp.877-900, December 2007
6. A. Barbu, S.C. Zhu. Generalizing Swendsen-Wang to sampling arbitrary posterior probabilities, *IEEE Trans. Patt. Anal. Mach. Intell.*, **27**, pp 1239-1253, August 2005.
7. C.V. Ciobanu, A. Barbu, R.M. Briggs, Interactions of incorporated carbon atoms and dimer vacancies on the Si(001) surface. *J. Eng. Materials and Technology*, **127**, pp 462-467, October 2005,
8. A. Barbu. On the range of non-vanishing p-torsion cohomology for $GL_n(\mathbb{F}_p)$, *J. Algebra*, **278**, pp 456-472, August 2004.
9. A. Barbu. On a conjecture of Ash. *J. Algebra*, **251**, pp 178-184, May 2002.

10. A. Barbu. The ring generated by the elements of degree 2 in $H^*(U_n(F_p), Z)$, *J. Algebra*, **237**, pp 247-261, March 2001.

Peer Reviewed Conference Publications

1. K. Zhang, E. Collins, A. Barbu A Novel Stochastic Clustering Auction for Task Allocation in Multi-Robot Teams. *IROS 2010*
2. A. Barbu, M. Suehling, X. Xu, D. Liu, S. K. Zhou, D. Comaniciu. Automatic Detection and Segmentation of Axillary Lymph Nodes. *MICCAI 2010*. (oral, acceptance rate 5.7%)
3. N. Lay, A. Barbu. Supervised Aggregation of Classifiers using Artificial Prediction Markets. *ICML 2010* (acceptance rate 25%).
4. A. Barbu. Learning Real-Time MRF Inference for Image Denoising. *CVPR 2009* (acceptance rate 26%).
5. A. Barbu, R. Ionasec. Boosting Cross-Modality Image Registration. *Joint Urban Remote Sensing Event, 2009*
6. A. Meyer-Baese, S. Lespinats, F. Steinbrucker, A. Saalbach, T. Schlossbauer, A. Barbu. Visual exploratory analysis of DCE-MRI data in breast cancer based on novel nonlinear dimensional data reduction techniques. *SPIE Defense and Security, 2009*.
7. S. Seifert, A. Barbu, S. Zhou, D. Liu, J. Feulner, M. Huber, M. Sühling, A. Cavallaro, D. Comaniciu. Hierarchical parsing and semantic navigation of full body CT data. *SPIE Medical Imaging, 2009* (oral, acceptance rate 21%)
8. L. Lu, A. Barbu, J. Liang, L. Bogoni, M. Salganicoff and D. Comaniciu. Simultaneous Detection and Registration for Ileo-Cecal Valve Detection in 3D CT Colonography. *ECCV 2008*
9. L. Lu, A. Barbu, M. Wolf, J. Liang, M. Salganicoff and D. Comaniciu. Accurate Polyp Segmentation for 3D CT Colonography Using Multi-Staged Probabilistic Binary Learning and Compositional Model. *CVPR 2008*
10. R. Socher, A. Barbu, D. Comaniciu. A Learning Based Hierarchical Model for Vessel Segmentation. *IEEE International Symposium on Biomedical Imaging, 2008*
11. Y. Zheng, B. Georgescu, A. Barbu, M. Scheuering, and D. Comaniciu. Four-Chamber Heart Modeling and Automatic Segmentation for 3D Cardiac CT Volumes, *SPIE Medical Imaging, 2008*.
12. Y. Zheng, A. Barbu, B. Georgescu, M. Scheuering, D. Comaniciu. Fast Automatic Heart Chamber Segmentation from 3D CT Data Using Marginal Space Learning and Steerable Features. *ICCV 2007*
13. S Lakare, M Wolf, L Bogoni, A Barbu, M Dunder, L Lu, M Salganicoff, Evaluation of a Learning-based Component for Suppression of False Positives Located on the Ileo Cecal Valve or Rectal Tube, *RSNA 2007*
14. A. Barbu, V. Athitsos, B. Georgescu, S. Boehm, P. Durlak, D. Comaniciu. Hierarchical Learning of Curves: Application to Guidewire Localization in Fluoroscopy. *CVPR 2007*
15. S Lakare, A. Barbu, M. Dunder, M. Wolf, L Bogoni, D Comaniciu. Learning-based Component for Suppression Rectal Tube False Positives: Evaluation of Performance on 780 CTC Cases, *RSNA 2006*.
16. A. Barbu, L. Bogoni, D. Comaniciu. Hierarchical Part-Based Detection of 3D flexible tubes: Application to CT Colonoscopy, *MICCAI 2006*.
17. Z. Tu, X.S. Zhou, A. Barbu, L. Bogoni, D. Comaniciu. Probabilistic 3D Polyp Detection in CT Images: The Role of Sample Alignment, *CVPR 2006*.
18. A. Barbu, S.C. Zhu. Incorporating Visual Knowledge Representation in Stereo Reconstruction, *ICCV, 2005*.
19. A. Barbu, S.C. Zhu. Multigrid and Multi-level Swendsen-Wang Cuts for Hierarchic Graph Partition, *CVPR, 2004*.
20. A. Barbu, A.L. Yuille. Motion Estimation by Swendsen-Wang Cuts, *CVPR, 2004*.

21. A. Barbu, S.C. Zhu. On the relationship between image and motion segmentation, *SCVMA, ECCV*, 2004.
22. A. Barbu, S.C. Zhu. Graph Partition by Swendsen-Wang Cuts, *ICCV*, 2003.

Ph.D. Theses

1. A. Barbu. Cluster Sampling and its Applications to Segmentation, Stereo and Motion. PhD thesis, UCLA 2005.
2. A. Barbu. On the cohomology $GL_n(F_p)$, with F_p coefficients. PhD thesis, OSU 2000.

Invited Talks

1. Supervised Aggregation of Classifiers using Artificial Prediction Markets, SRCOS 2010.
2. Supervised Aggregation using Artificial Prediction Markets. FSU Department of Education, February 12th, 2010
3. Supervised Aggregation using Artificial Prediction Markets. UCLA, November 10th, 2009
4. Marginal Space Learning for Fast Object Detection in Medical Imaging. Tutorial on Discriminative Learning Methods in Medical Imaging, MICCAI 2009.
5. Training an Active Random Field for Real-Time Image Denoising. Max Plank Institute, Saarbrucken, Germany, July 16th, 2008
6. The Swendsen-Wang Cuts Algorithm with Applications in Computer Vision, Georgia Tech University, June 2008
7. Active Random Fields for Real-Time Image Denoising, Siemens Corporate Research, May 2008
8. Hierarchical Image-Motion Segmentation using Swendsen-Wang Cuts, *Third Cape Cod MCMC Workshop*, Harvard, 2007
9. A General Cluster Sampling Method for Bayesian Inference, *Joint Statistical Meetings*, Minneapolis, 2005
10. Swendsen-Wang for Perceptual Grouping. *Second Cape Cod Workshop on Monte Carlo Methods*, Harvard, 2004

Patents

1. Z. Tu, A. Barbu. Probabilistic Boosting Tree Framework for Learning Discriminative Models. Patent No **7,702,596**
2. Z. Tu, X. Zhou, D. Comaniciu, L. Bogoni, A. Barbu. System and Method for Using Learned Discriminative Models to Segment Three dimensional Colon Image Data. Patent No **7,583,831**.
3. Z. Tu, A. Barbu, D. Comaniciu. Method for Detecting Polyps in a Three Dimensional Image Volume. Patent No **7,558,413**.
4. S.K. Zhou, J. Shao, J. Dowdall, A. Barbu, B. Georgescu, D. Comaniciu. System and method for using a similarity function to perform appearance matching in image pairs. Pub No. 20070237370
5. A. Barbu, V. Athitsos, B. Georgescu, S. Boehm, P. Durlak, D. Comaniciu. System and Method for Detecting and Tracking A Guidewire In A Fluoroscopic Image Sequence. Pub No 20070270692.
6. W. Zhang, A. Barbu, S. Prummer, M. Ostermeier, C.Reddy and D. Comaniciu. System and Method for Coronary Digital Subtraction Angiography. Pub no 20080025588
7. A. Barbu, L. Bogoni, D. Comaniciu. System and Method For Detecting A Three Dimensional Flexible Tube In An Object. Pub no 20080044071.
8. W. Zhang, A. Barbu, Y. Zheng and D. Comaniciu. Method and System for Object Detection Using Probabilistic Boosting Cascade Tree. Pub no 20080071711
9. A. Barbu, V. Athitsos, D. Comaniciu. System and Method for Online Optimization of Guidewire Visibility in Fluoroscopic Systems. Pub no. 20080080754.

10. A. Barbu, Y. Zheng, B. Georgescu, D. Comaniciu. System and Method for Detecting an Object in a High Dimensional Space. Pub no. 20080085050.
11. Y. Zheng, A. Barbu, B. Georgescu, M. Scheuering, D. Comaniciu. System and Method For Segmenting Chambers Of A Heart In A Three Dimensional Image. Pub no. 20080101676
12. B. Georgescu, P. Durlak, A. Barbu, V. Athitsos, D. Comaniciu. System and Method for Simultaneously Subsampling Fluoroscopic Images and Enhancing Guidewire Visibility. Pub no. 20080107314.
13. A. Barbu, L. Lu, L. Bogoni, M. Salganicoff, D. Comaniciu. Method and System for Detection and Registration of 3D Objects Using Incremental Parameter Learning. Pub no. 20080211812.
14. Y. Zheng, A. Barbu, B. Georgescu, M. Lynch, M. Scheuering, D. Comaniciu. Method and System for Generating a Four-Chamber Heart Model. Pub no. 20080262814.
15. W. Zhang, Y. Zhu, A. Barbu, R. Socher, S. Boehm, P. Durlak, D. Comaniciu. Methods and Apparatus for Virtual Coronary Mapping. Pub no 20080275335.
16. A. Barbu; W. Zhang; N. Strobel; A. Galant; U. Bill; D. Comaniciu. Method and system for catheter detection and tracking in a fluoroscopic image sequence. Pub no 20090062641
17. W. Zhang, Y. Zhu, A. Barbu, R. Socher, S. Boehm, P. Durlak, D. Comaniciu. Method and System for Vessel Segmentation in Fluoroscopic Images. Pub no 20090080728.
18. W. Zhang, A. Barbu, S. Prummer, M. Ostermeier and D. Comaniciu. Method and System for Evaluating Image Segmentation Based on Visibility. Pub no 20090080729.
19. M. Wolf, S. Lakare, A. Barbu, L. Lu, L. Bogoni, M. Salganicoff, B. Cynwyd, D. Comaniciu. User Interface for Polyp Annotation, Segmentation and Measurement in 3D Computed Tomography Colonography. Pub no 20090080747.
20. L. Lu, A. Barbu, M. Wolf, S. Lakare, L. Bogoni, M. Salganicoff, D. Comaniciu. Method and System for Polyp Segmentation for 3D Computed Tomography Colonography. Pub no 20090074272.
21. A. Barbu. Training an Active Random Field for Real-Time Image Denoising. Patent Submitted.
22. A. Barbu, N. Lay. Supervised Aggregation using Artificial Prediction Markets. Provisional patent submitted.

Technical Skills:

- 9+ Years programming experience in C, C++ and Matlab
- Software Engineering experience in C++ and Java
- Experience in algorithm design for Medical Imaging and Computer Vision
- Experience in Machine Learning, System Design, OpenGL and Visual Basic
- Working knowledge of Computer Architecture, Numerical Algorithms, Level Set methods, Hardware Design, Delphi and Mathematica

Students Mentored:

- Josue Anaya, BSc student, Statistics department, FSU. Currently working with me.
- Liangjing Ding, PhD student, Department of Scientific Computing, FSU. Currently working with me.
- Nathan Lay, PhD student, Department of Scientific Computing, FSU. Currently working with me.
- Johnathan Moody, PhD student, Statistics department, FSU.
- Dan Crane, MS, Statistics department, FSU, 2008.
- Razvan Ionasec, PhD student, Technical University, Munchen, Germany. Mentored during all his 6-month internship in Siemens while studying in University of Erlangen.

- Richard Socher, PhD student, Princeton University. Mentored during all his 6-month internship in Siemens while in Saarland University, Germany.
- Chandan Reddy, PhD student, Cornell University. Mentored during all his 3-month internship in Siemens.
- Wei Zhang, PhD student, George Mason University. Mentored during all his 3-month internship in Siemens.
- Jonathan Dowdall, PhD Student, University of Houston. Mentored during all his 3-month internship in Siemens.

Memberships and Awards

- Reviewer for IEEE PAMI, IJCV, JMLR, TIP, TMI, JCGS, JVCI, PR, CVPR06, CVPR07, CVPR09, CVPR10, ICCV07, ICCV09, ECCV08, J. Algebra, Math Reviews
- NSF Computer Vision Panel member, 2007
- Research Assistantship, Summer 1998, 2000-present
- Teaching Assistantship 1995-2000
- Summer Fellowship, 1995, 1996, 2000
- Nominated for Graduate Teaching Award, 1999
- 2nd Prize, [International Mathematics Olympiad](#), Braunschweig, Germany, 1989
- 1st Prize, Balkanic Mathematics Olympiad, Nicosia, Cyprus, 1988

Additional Information

- Languages spoken: English, French, Romanian

References

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