

Research and Professional Activities

Dr. Mitra Basu

Personal Information:

- **Address**
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- **Telephone:** 410-293-6823 (Naval Academy), 410-516-4782 (Johns Hopkins University)
- **E-mail:** basu@usna.edu, basu@cs.jhu.edu
- **Education:** Ph. d. in Electrical Engineering
Purdue University, 1985

Professional Experience:

- Distinguished Visiting Professor of Information Technology, United States Naval Academy (October 2006-Present)
- Visiting Professor, Computer Science Department, Johns Hopkins University (Sept. 2006-Present)
- Tenured Faculty, The City College and the Graduate Center of CUNY
 - Department of Electrical Engineering (1985-Present)
 - New York Center for Biomedical Engineering (NYCBE) (1994-Present)
 - Doctoral Faculty of CUNY Computer Science Program (2001-Present)
- Program Director, National Science Foundation (Sept. 2002-Sept. 2006)
- Research Staff, Bell Laboratories (Summer 1998)
- Research Staff, Courant Institute, New York University (1988-1991)

Scholarly Activities:

Editorship:

1. A Special Issue on Syntactic and Structural Pattern Recognition, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Editors: Mitra Basu (**Lead**), Horst Bunke, Alberto Delbimbo, Publication Date: July 2005
2. A Special Issue on Grammatical Inference Techniques and Applications, *Pattern Recognition Journal*, Elsevier, Editor: Mitra Basu, Publication Date: April 2005
3. Editorial Board, *International Journal of Bioinformatics Research and Applications*, Inderscience Publisher, 2004-Present
4. Associate Editor, *Pattern Recognition Journal*, Elsevier Publisher, 2001-Present

Keynote Address:

1. "Status of Research in Bioinformatics," *International Symposium on Bioinformatics and Bioengineering*, March 10-12, 2003, Washington, DC.

Invited Talks:

1. “The CISE Funding Opportunities & Perspectives for HealthCare Professionals,” NSF Day, Dec 8, 2004.
2. “Research opportunities in the interface of Nano-Bio Sciences,” Invited Talk, Foundations of Nano Science Workshop, April 22, 2004, Snowbird, Utah.
3. “New Funding Opportunities at NSF,” January 28, 2004, The Graduate Center, CUNY
4. “Information processing in the biological organism: A Systems Biology Approach,” Invited Talk at the DIMACS Workshop, Nov 3, 2003, NIH, Bethesda, MD.
5. “Reorganization of CISE and New Funding Opportunities,” October 24, 2003, University of Pennsylvania.
6. “Biologically motivated computational models,” Panel Moderator, International Joint Conf. On Neural Networks, July 20-24, 2003, Portland, Oregon.
7. “Bioinformatics research – NSF Perspective,” U.S.-Ireland R&D Taskforce Workshop, February 24, 2003, NSF.
8. “Alternative Computational Models,” Invited talk, September 5, 2001, DARPA.
9. “An adaptive model to capture the signal communication pathways among bone cells,” Invited Talk, Indian Statistical Institute, Calcutta, India, July 22, 2000.
10. “Syntactic pattern Recognition – An Overview,” Invited Talk, May 20, 2000, Bell Laboratories, Lucent Technologies, Murray Hills, NJ.

Tutorials:

1. “Computational Techniques in Bioinformatics” Tutorial Talk, International Conference on Neural Information Processing, Nov. 18-22, 2002, Singapore.
2. “Introduction to Biological Sequence Analysis” Tutorial Talk, World Congress on Computational Intelligence, May 12, 2002, Honolulu, Hawaii.

Publications: Categorized into six groups according research area.

❖ Pattern Recognition/Image Processing Area

❑ **Books:**

- Data Complexity in Pattern Recognition, *Springer Verlag*, Editors: Mitra Basu & Tin Kam Ho, Publication Date: December 2005.

❑ **Book Chapters:**

1. “Discriminant Analysis with Linear or Nonlinear data,” Data Complexity in Pattern Recognition (Eds. Basu and Ho), *Springer Verlag*, December 2005.
2. “Classification problems – Grades of complexity,” Data Complexity in Pattern Recognition (Eds. Basu and Ho), *Springer Verlag*, December 2005 (with T. K. Ho).

□ **Articles:**

1. "Measuring the complexity of classification problems," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, Vol. 24, No. 3, 2002, pp. 289-300 (with T. K. Ho).
2. "Measuring complexity of classification problems," *Proc. of Intl. Conf. on Pattern Recognition*, Barcelona, Spain, September 3-8, 2000 (with T. K. Ho).
3. "Image synthesis using multi-scale models," (Invited Paper presented in a special session on Wavelets), *Proc. IEEE Intl. Conf. on Systems, Man and Cybernetics*, October 17-20, 1993, Le Touquet, France.
4. "Multi-scale modeling of texture," *Proc. of 11th Intl. Conf. on Pattern Recognition*, August 30- Sept. 3, 1992, The Hague, The Netherlands (with Z. Lin).
5. "Texture analysis in cytology using fractals," *Proc. SPIE* (Applications of Digital Image Processing XII), San Diego, CA, Aug. 6-11, 1989 (with J. Barba).
6. "Obscured object recognition for an ATR Application," *Proc. SPIE*, 1099 (Advances in Image Compression & ATR), Orlando, FL, March 30-31, 1989 (with G. Eichmann & L. Roytman).

□ **Survey Articles**

1. "Gaussian-Based Edge Detection Methods – A Survey, *IEEE Trans. On Systems Man and Cybernetics, Part C*, Vol. 32, No. 3, 2002.

❖ **Syntactic/Structural Pattern Recognition Area**

□ **Articles:**

1. "Parallel optical syntactic pattern recognizers" *Special Issue on Artificial Intelligence and Non-Numeric Computing of Applied Optics*, 26, 10, 1987 (with G. Eichmann).
2. "Image segmentation by semantic method," *Pattern Recognition*, 20, 5, 1987, pp.497-511.
3. "Image segmentation by syntactic method," *Pattern Recognition*, 20, 1, 1987, pp.33-44 (with K. S. Fu).
4. "On the relationship between augmented transition network & attributed grammar," *Proc. of 9th Intl. Conf. on Pattern Recognition*, Nov. 14-17, 1988, Rome, Italy.
5. "Finite states attributed grammar and languages," *SIAM 35th Anniversary Meeting*, Denver, Colorado, 1987.
6. "Error correcting optical syntactic pattern recognizers," *Proc. SPIE*, Los Angeles, CA, Jan. 11-16, 1987 (with G. Eichmann).
7. "A semantic approach to image segmentation," *Proc. of IEEE Conf. on Systems, Man and Cybernetics*, Atlanta, Georgia, October 14-17, 1987.
8. "A syntactic approach to image segmentation," *Proc. of the Conference on Pattern Recognition in Practice II*, Amsterdam, Holland, June 19-21, 1985 (with K. S. Fu).

❖ Neural Network/Learning Theory Area

□ Articles:

1. "A Hybrid Learning System for Image Deblurring," *Pattern Recognition*, Vol. 35, Dec. 2002, pp. 2881-2894 (with M. Su).
2. "The fractional correction rule: a new perspective," *Neural Networks*, 11, 1998, pp.1027-1039 (with Q. Liang).
3. "Application of projection pursuit learning to boundary detection & deblurring in images," *Pattern Recognition*, 33, 12, 2000, pp.2019-2031 (with L. Kennedy).
4. "Mixing supervised & unsupervised learning for image deblurring," *Proc. of the Joint Conf. on Information Sciences*, 2002, March 8-14, 2002, Durham, NC, (with M. Su).
5. "Gating improves neural network performance," *Proc. International Joint Conference on Neural Networks*, July 14-19, 2001, Washington, DC (with M. Su).
6. "Input data clustering to improve neural network performance," *Proc. International Joint Conference on Neural Networks*, July 14-19, 2001, Washington, DC (with M. Su).
7. "Study of Site-Specific Bone Formation Using A Neural Network Model," *Proc. International Joint Conference on Neural Networks*, Como, Italy, July 24-27, 2000 (with L.Y. Mi, S. Fritton and S. Cowin).
8. "Deblurring images using projection pursuit learning network," *Proc. International Joint Conference on Neural Networks*, July 10-16, 1999, Washington, DC (with M. Su).
9. "The learning behavior of single neuron classifiers on linearly separable or nonseparable input," *Proc. International Joint Conference on Neural Networks*, July 10-16, 1999, Washington, DC (with T. K. Ho).
10. "Experiments with projection pursuit learning on gray scale images," *Proc. of the Joint Conf. on Information Sciences*, (JCIS '98), Oct. 23-28, 1998, Durham, N.C. (with L. Kennedy).

❖ Biologically Inspired Pattern Recognition Area

□ Articles:

1. "A biologically motivated computational learning model," *NATO Advanced Study Institute on Learning Theory and Practice*, July 8-21, 2002, K.U., Leuven, Belgium.
2. "Image smoothing with exponential functions," *Intl. J. of Pattern Recognition & Artificial Intelligence*, 15, 4, 2001, pp. 1-18 (with M. Su).
3. "A Gaussian derivative operator for authentic edge detection & accurate edge localization," *Intl. J. of Pattern Recognition & Artificial Intelligence*, 13, 3, 1999, pp.367-380 (with L. Kennedy).
4. "Image enhancement using a human visual system model," *Pattern Recognition*, 30, 12, 1997, pp.2001-2014 (with L. Kennedy).
5. "Scale space contours and localization property of a Gaussian derivative edge enhancement operator," *Proc. IEEE Intl. Conf. System Man & Cybernetics.*, Vol. 1, 1997, pp.643-648.

6. "An experiment with Gaussian Derivatives for Image Enhancement," Proc. IEEE Intl. Conf. on Systems, Man and Cybernetics, Oct. 22-25, 1995, Vancouver, BC, Canada (with L. Kennedy).
7. "Gaussian derivative model for edge enhancement," Pattern Recognition, 27, 11, 1994, pp 1451-1461.

❖ Computational Biology/Bioinformatics Area

□ **Articles:**

1. "Analysis of Avian Bone Response to Mechanical Loading Part I: Distribution of bone fluid shear stress induced by bending and axial loading," accepted, Journal of Biomechanics and Modeling in Mechanobiology, 2005 (with L. Y. Mi, S. Fritton, S. Cowin).
2. "Analysis of Avian Bone Response to Mechanical Loading Part II: Development of a computational connected cellular network to study bone intercellular communication," accepted, Journal of Biomechanics and Modeling in Mechanobiology, 2005 (with L. Y. Mi, S. Fritton, S. Cowin).
3. "Simulation of the Bone Cellular Network Using a Neural Network Model," Annals of Biomedical Engineering, 28(S1):S-49, 2000 (with L.Y. Mi, S. P. Fritton & S.C. Cowin).
4. "Multi-domain Gating Network for Classification of Cancer Cells Using Gene Expression Data," Proc. International Joint Conference on Neural Networks, May 12-17, 2002, Honolulu, Hawaii (with M. Su and A. Toure).
5. "Variance of Neural Network Algorithms for Gene Expression Classification," Proc. Intl. Conference on Intelligent Systems for Molecular Biology, August 3-7, 2002, Edmonton, Canada (with M. Su and A. Toure)
6. "Computational Connected Cellular Network - A novel learning system to study bone formation," Proc. International Joint Conference on Neural Networks, July 14-19, 2001, Washington, DC (with L. Y. Mi, S. Cowin, S. Fritton).
7. "Application of neural networks to gene expression data for cancer classification," Proc. International Joint Conference on Neural Networks, July 14-19, 2001, Washington, DC (with A. Toure)
8. "A learning algorithm for computational connected cellular network," Proceedings of the International Conference on Neural Information Processing, Nov. 18-22, 2002, Singapore.
9. "Simulation of the Bone Cellular Network Using a Neural Network Model," Proc. of the Biomedical Engineering Society Annual Meeting, Seattle, Washington, October 12-14, 2000 (with L. Y. Mi, S. Fritton and S. Cowin).

Professional Society Activities:

1. Panel Moderator, International Joint Conf. On Neural Networks, 2003
2. Session Chair IEEE International Joint Conf. On Neural Networks, 1999
3. Program Committee Joint Conf. on Information Sciences 2000, 2001, 2002
4. Program Committee Advanced Concepts for Intelligent Vision Systems, 2000, 2001, 2002
5. Session Organizer & Chair for Joint Conf. on Information Sciences, 1998
6. Reviewer for Pattern Recognition, IEEE IP, PAMI & SMC journals

Honors:

1. Member of the New York Center for Biomedical Engineering
2. Senior Member, IEEE
3. Cited in *Who's Who Among America's Teachers*, 1998-2002
4. Member of Engineering Honor Society

Courses Taught (2006-2007):

1. Topics on Bio-nano technology (Spring 2007, JHU)
2. Introduction to bio-nano technology (Spring 2007, Naval Academy)
3. A seminar course on "Alternative Computing Paradigm (Spring 2007, Naval Academy)