M. Murat Dundar, Ph.D.
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Research Interests: Dr. Dundar's area of expertise is in machine learning with a special focus on self-adjusting models and inference, where the traditional brute-force approach of fitting a fixed model onto the data is replaced with more flexible models that can account for the non-stationary nature of real-world machine learning problems by dynamically updating data model to better accommodate prospective data in offline as well as online settings. This is achieved by placing suitably chosen non-parametric Bayesian priors over class distributions to model not only observed classes but unobserved ones as well in an effort to perform joint classification and clustering. Scalable online and offline stochastic inference for non-parametric Bayesian models that can potentially enable self-adjusting machine learning has been at the center of Dr. Dundar's most recent research efforts.

(i) Education

Bogazici University, Istanbul	Electrical & Electronics Engineering	BSc 1997
Purdue University, West Lafayette	Electrical & Computer Engineering	MS 1999
Purdue University, West Lafayette	Electrical & Computer Engineering	PhD 2003

(ii) Appointments

- 2014 – present Associate Professor, Department of Computer & Information Science, Indiana University – Purdue University, Indianapolis
- 2008 - 2014   Assistant Professor, Department of Computer & Information Science, Indiana University – Purdue University, Indianapolis
- 2003 - 2008   Research Scientist, Computer-aided Diagnosis & Knowledge Solutions, Siemens Healthcare, USA.

(iii) Awards

- 2013 NSF Early Faculty Career Development (CAREER) Award
  Self-adjusting Models as a New Direction in Machine Learning (NSF IIS)
- 2010 Best Scientific Paper Award in Biomedical and Bioinformatics Applications Track, International Conference on Pattern Recognition (ICPR'10), awarded by International Association of Pattern Recognition
- 2009 Data Mining Practice Prize, "Mining Medical Images", by Association for Computing Machinery (ACM)

(iv) Selected Publications (* indicates student co-authors)

- Halid Z. Yerebakan* and **Murat Dundar**, "Partially Collapsed Parallel Gibbs Sampler for Dirichlet Process Mixture Models," *Pattern Recognition Letters. To appear subject to minor revisions.*

- Baichuan Zhang*, **Murat Dundar**, Muhammed Hasan, "Bayesian Non-Exhaustive Classification A Case Study: Online Name Disambiguation using Temporal Record Streams," *in Proceedings of ACM CIKM*, Indianapolis, US, Oct 2016.
- **Murat Dundar**, Bethany Ehlmann, "Rare Jarosite Detection in CRISM Imagery by Non-Parametric Bayesian Clustering," *in Proceedings of IEEE WHISPERS'16*, Los Angeles, US, Aug 2016.
- Bartek Rajwa, Paul Wallace, Elizabeth Griffiths, **Murat Dundar**, "Automated Assessment of Disease Progression in Acute Myeloid Leukemia by Probabilistic Analysis of Flow Cytometry Data," *IEEE Transactions on Biomedical Engineering. Hard copy to appear, electronic copy published in July 16.*
- **Murat Dundar**, Qiang Kou, Baichuan Zhang, Yicheng He, Bartek Rajwa, "Simplicity of Kmeans versus Deepness of Deep Learning: A Case of Unsupervised Feature Learning with Limited Data," *In Proceedings of IEEE International Conference on Machine Learning Applications,* Miami, FL, USA, December 11-13, 2015
- Halid Z. Yerebakan*, Bartek Rajwa, **Murat Dundar**, "The Infinite Mixture of Infinite Gaussian Mixtures," *Advances in Neural Information Processing Systems (NIPS'14)*, Montreal, Canada, December 8-13, 2014.
- Xiaofan Zhang, Wei Liu, **Murat Dundar**, Sunil Badve, Shaoting Zhang "Large-Scale Histopathological Image Analysis: Hashing-Based Image Retrieval," *IEEE Transactions on Medical Imaging*, vol.34, no.2, pp. 496-506, Feb. 2015.
- **Murat Dundar**, Ferit Akova, Halid Z. Yerebakan, Bartek Rajwa, "A Non-parametric Bayesian Model for Joint Cell Clustering and Cluster Matching: Identification of Anomalous Sample Phenotypes with Random Effects," *BMC Bioinformatics* 15 (1), 314, 2014.
- **Murat Dundar**, Halid Z. Yerebakan, Bartek Rajwa, "Batch Discovery of Recurring Rare Classes toward Identifying Anomalous Samples," *In Proceedings of the 20th Annual SIGKDD International Conference on Knowledge Discovery and Data Mining (SIGKDD'14)*, New York, USA, Aug 24-27 2014.
- Ferit Akova*, Yuan Qi, Bartek Rajwa, **Murat Dundar**, "Self-adjusting Models for Semi-supervised Learning in Partially-observed Settings," In *Proceedings of the IEEE International Conference on Data Mining (ICDM'12)*, Brussels, Belgium, December 10-13, 2012.
- **Murat Dundar**, Ferit Akova*, Yuan Qi, Bartek Rajwa, "Bayesian Nonexhaustive Learning for Online Discovery and Modeling of Emerging Classes," In John Langford and Joelle Pineau (Eds.)*, Proceedings of the 29th International Conference on Machine Learning (ICML'12)*, Edinburgh, Scotland, June 26-July 1, 2012 (pp. 113-120). Omnipress, 2012.
- **Murat Dundar**, Sunil Badve, Gokhan Bilgin, Vikas Raykar, Olcay Sertel, Metin N. Gurcan, "Computerized Classification of Intraductal Breast Lesions using Histopathological Images", *IEEE Transactions on Biomedical Engineering*, Volume 58, No. 7, pp. 1977-1984, July 2011.
- Bartek Rajwa, **Murat Dundar**, Ferit Akova, Amanda Betasso, Valery Patsekin, E. Dan Hirleman, Arun K. Bhunia, J. Paul Robinson, "Discovering unknown: detection of emerging pathogens using label-free light scattering system," *Cytometry Part A*, 77A(12):1103–1112, 2010.
- Ferit Akova*, **Murat Dundar**, V. Jo Davisson, E. Daniel Hirleman, Arun K. Bhunia, J. Paul Robinson, Bartek Rajwa, "A Machine-learning Approach for Label-free Detection of Unmatched Bacterial Serovars", *Statistical Analysis and Data Mining Journal*, Volume 3, No 5, pp 289-301, October 2010.

- **Murat Dundar**, Sunil Badve, Vikas Raykar, Rohit Jain, Olcay Sertel, Metin Gurcan, "A Multiple Instance Learning Approach toward Optimal Classification of Pathology Slides", *Proc. of 20th International Conference on Pattern Recognition,* August 23-26, Istanbul, Turkey, 2010 **(Best scientific paper in Biomedical and Bioinformatics applications).**
- **Murat Dundar**, Daniel Hirleman, Arun K. Bhunia, J. Paul Robinson, and Bartek Rajwa, "Learning with a Nonexhaustive Training Dataset. A Case Study: Detection of Bacteria Cultures using Optical-Scattering Technology", In *Proceedings of the Fifteenth Annual SIGKDD International Conference on Knowledge Discovery and Data Mining*, June 28-July 1 2009, Paris, France.
- **Murat Dundar**, Matthias Wolf, Sarang Lakare, Marcos Salganicoff, Vikas Raykar "Polyhedral Classifiers for Target Detection: A Case Study: Colorectal Cancer", In *Proceedings of the 25th International Conference on Machine Learning* (ICML 2008), pp.288-295, Helsinki, July 2008.
- Vikas C. Raykar, Balaji Krishnapuram, Jinbo Bi, **Murat Dundar**, and R. Bharat Rao, "Bayesian Multiple Instance Learning: Automatic Feature Selection and Inductive Transfer" , In Proceedings of the 25th International Conference on Machine Learning (ICML 2008), pp.808 - 815, Helsinki, July 2008
- **Murat Dundar**, Glenn Fung, Balaji Krishnapuram, Bharat Rao, "Multiple Instance Learning Algorithms for Computer Aided Diagnosis", IEEE Transactions on Biomedical Engineering, Volume 55, No. 3, pp 1005-1015, March 2008.
- **Murat Dundar**, Jinbo Bi, "Joint optimization of cascaded classifiers for computer aided detection", IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR '07), 18-23 June 2007, Minneapolis, Minnesota, USA **(Full paper, Acceptance Rate: 4.8%)**
- **Murat Dundar**, Balaji Krishnapuram, Jinbo Bi, Bharat Rao, "Learning from Non-IID Data", In proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI 2007), Hyderabad, India, January 6-12, 2007
- Glenn Fung, **Murat Dundar**, Balaji Krishnapuram, Bharat Rao, "Multiple Instance Algorithms for Computer Aided Diagnosis", Advances in Neural Information Processing Systems 19 (NIPS 2006), Vancouver, CA, 2006
- Jinbo Bi, Glenn Fung, **Murat Dundar**, Bharat Rao, "Semi-Supervised Mixture of Kernels via LPBoost Methods", In Proceedings of the Fifth IEEE international Conference on Data Mining (ICDM '05). IEEE Computer Society, November 27 - 30, 2005, Washington, DC, 569-572.
- **Murat Dundar**, Glenn Fung, Jinbo Bi, Sandilya Sathyakama, Bharat Rao, "Sparse Fisher Discriminant Analysis for Computer Aided Detection", SIAM International Data Mining Conference (SDM '05), 2005, Newport Beach, CA, USA.
- Glenn Fung, **Murat Dundar**, Jinbo Bi, and R. Bharat Rao, "A fast iterative algorithm for fisher discriminant using heterogeneous kernels" In Proceedings of the Twenty-First international Conference on Machine Learning (ICML '04), July 04 - 08, 2004, Banff, Alberta, Canada, vol. 69. ACM Press, New York, NY, 40
- **Murat Dundar**, G. Fung, Luca Bogoni, M. Macari, A. Megibow, B. Rao, "A Methodology for Training and Validating a CAD System and Potential Pitfalls," Computer Assisted Radiology and Surgery (CARS '04). Proceedings of the 18th International Congress and Exhibition, Chicago, USA, June 23-26, 2004
- **Murat Dundar** and David Landgrebe, "A Cost-effective Semi-supervised Classifier Approach with Kernels," *IEEE Transactions on Geoscience and Remote Sensing*, Volume 42, No. 1, pp 264-270, January, 2004

- **Murat Dundar** and David Landgrebe, "Toward an Optimal Supervised Classifier for the Analysis of Hyperspectral Data," *IEEE Transactions on Geoscience and Remote Sensing*, Volume 42, No. 1, pp 271-277, January, 2004
- **Murat Dundar** and David Landgrebe, "A Model Based Mixture Supervised Classification Approach in Hyperspectral Data Analysis," *IEEE Transactions on Geoscience and Remote Sensing*, Volume 40, No. 11, pp 2692 -2699, December 2002

(v) Research Support

<u>ACTIVE</u>

1252648 (PI: Dundar)   3/1/2013 – 2/28/2018
NSF/IIS
Title: CAREER: Self-adjusting Models as a New Direction in Machine Learning

<u>COMPLETED</u>

1R21EB015707 (PI: Rajwa)   7/1/2012 – 6/30/2014
NIH/NIBIB
Title: Automated Spectral Data Transformations and Analysis Pipeline for High-throughput
Flow Cytometry
Role: co-investigator

1R21AI085531-01A1 (MPI: Dundar, Rajwa)   5/1/2010 – 4/30/2012
NIH /NIAID
Title: Machine-Learning Approach to Label-free Detection of new Bacterial Pathogens

1R56A1089511-01A1 (PI: Robinson)   8/1/2010 – 7/1/2011
NIH/NIAID
Title: A Distributed Clinical and Biodefense National Network for Rapid Organism
Identification
Role: co-investigator

Small Business grant (PI: Green)   3/1/2011 – 2/28/2012
NIH/NIDDK
Title: Digital image analysis for quantitative and qualitative assessment of pig islets
Role: senior investigator