

Curriculum Vitae

Personal Information

Name Doru-Cristian BALCAN
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Research Interests

Image Processing and Coding, Multiresolution and Multiscale Representations, Independent Component Analysis, Matrix Analysis, Algebraic Signal Processing Theory, Frame Theory, Algorithms

Current Position

Postdoctoral Fellow within the School of Interactive Computing, at Georgia Institute of Technology.
Supervisors: Prof. Aaron Bobick and Prof. Frank Dellaert.

Education

- 2002 – 2009: **Ph.D.** - Computer Science, Carnegie Mellon University
Thesis advisor: Michael S. Lewicki.
Dissertation Title: **Efficient and Robust Signal Approximations** (June 2009).
Thesis committee: Michael Lewicki, Jelena Kovačević, Manuel Blum, Markus Püschel, Gary Miller.
- 2000 – 2002: **M.S.** - Computer Science, University of Bucharest, Romania
- 1996 – 2000: **B.S.** - Computer Science and Mathematics, University of Bucharest, Romania.

Awards and Fellowships

- 2002 – 2009: Graduate Assistant Fellowship, Carnegie Mellon University, Computer Science Dept.
- 2004: NSF support grant for attending the Workshop on "Multiscale Geometry in Image Processing and Coding", at the Institute for Pure and Applied Mathematics, UCLA, Los Angeles, CA September 20-24, 2004.

- 2001: Grant offered by the sponsors of the Advanced Study Institute and by Institut für Informatik, München, Germany, for attending the "International Student Summer School on Proof and System-Reliability", Marktoberdorf, Germany, July 24 - August 5, 2001
- 1999 – 2000: 4 month scholarship at the University of Patras, Greece, offered by the European Community, within the Erasmus/Socrates Student Interchange Program
- 2000 – 2001: Merit Fellowship offered by the Romanian Department of Education (during my MS studies)
- 1996 – 2000: Merit Fellowship offered by the Romanian Department of Education (during my undergraduate studies)

Publications

Journal and Conference Papers

1. **Generalized Subgraph Preconditioners for Large-Scale Bundle Adjustment.** Yong-Dian Jian, Doru C. Balcan, Frank Dellaert. In International Conference on Computer Vision (ICCV), Barcelona, Spain, 2011.
2. **Convergence Behavior of the Active Mask Segmentation Algorithm.** Doru C. Balcan, Gowri Srinivasa, Matthew C. Fickus, and Jelena Kovačević. In Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Dallas, TX, 2010.
3. **Efficient and Robust Signal Approximations.** Doru C. Balcan (Ph.D. Thesis). Carnegie Mellon University, Technical Report CMU-CS-09-129, 2009.
4. **Point Coding: Sparse Image Representation with Adaptive Shiftable-Kernel Dictionaries.** Doru C. Balcan and Michael S. Lewicki. In Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS), Saint Malo, France, 2009.
5. **Adaptive Coding of Images via Multiresolution ICA.** Doru C. Balcan and Michael S. Lewicki. In Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Taipei, Taiwan, 2009.
6. **Alternatives to the Discrete Fourier Transform.** Doru Balcan, Aliaksei Sandryhaila, Jonathan Gross, and Markus Püschel. In Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Las Vegas, NV, 2008.
7. **Robust Coding over Noisy Overcomplete Channels.** Eizaburo Doi, Doru C. Balcan, and Michael S. Lewicki. *IEEE Transactions on Image Processing*, 16(2):442–452, February 2007.
8. **Statistical Inference of Missing Speech Data in the ICA Domain.** Justinian Rosca, Timmo Gerkmann, and D.C. Balcan. In Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Toulouse, France, 2006.
9. **Independent Component Analysis for Speech Enhancement with Missing TF Content.** Doru C. Balcan and Justinian Rosca. In Proc. International Conference on Independent Component Analysis (ICA), Charleston, SC, USA, 2006.
10. **A Theoretical Analysis of Robust Coding over Noisy Overcomplete Channels.** Eizaburo Doi, Doru C. Balcan, and Michael S. Lewicki. In Advances in Neural Information Processing Systems (NIPS). Vancouver, Canada, 2006.

11. **Handwritten Text Localization in Skewed Documents.** Ergina Kavallieratou, Doru C. Balcan, Maria Florina Popa, and Nikos Fakotakis. In Proc. IEEE International Conference on Image Processing (ICIP), volume 1, pages 1102–1105, Thessaloniki, Greece, 2001.
12. **An Adaptive Resonance Theory (ART) Based Approach of Handwritten / Machine-Printed Text Discrimination.** Maria Florina Popa and Doru C. Balcan. In Multi-Conference on Systemics, Cybernetics and Informatics (ISAS-SCI), Orlando, FL, 2001.
13. **An Adaptive Resonance Theory (ART) Based Approach of Handwritten / Machine-Printed Text Discrimination - an extended report.** Maria Florina Popa and Doru C. Balcan. In Proc. International Conference on Computer and Industrial Engineering, Montreal, Canada, 2001.
14. **Approaches to Handwritten/Machine Printed Discrimination Problem.** Maria Florina Popa and Doru C. Balcan. *University of Bucharest Annals - Computer Science*, 2000.
15. **New Methods in Handwritten/Machine-Printed Discrimination.** Maria Florina Popa and Doru C. Balcan. In 8th Conf. on Applied and Industrial Mathematics, Pitesti, Romania, 2000.

Working manuscripts

1. **Novel Support-Theoretical Techniques Applied to Large-scale Optimization Problems in Robotics.** Doru C. Balcan, Viorela S. Ila, Yong-Dian Jian, and Frank Dellaert. 2011.
2. **Guaranteeing Convergence of Iterative Skewed Voting Algorithms for Image Segmentation.** Doru C. Balcan, Gowri Srinivasa, Matthew C. Fickus, and Jelena Kovačević. 2011. (Submitted to *Applied and Computational Harmonic Analysis*).
3. **Adaptive Image Coding via Multiresolution ICA.** Doru C. Balcan and Michael S. Lewicki. 2010. (To be submitted to *IEEE Transactions on Image Processing*.)
4. **Characterization and Computation of Robust Coding Solutions.** Doru C. Balcan and Michael S. Lewicki.

Other Publications

- Segmentation of Fluorescence Microscope Cell Images Using the Active Mask Algorithm.**
Gowri Srinivasa, Matthew C. Fickus, Doru C. Balcan, Anupama Kuruvilla, and Jelena Kovačević.
In Proc. XXV Congress of the Intl. Society for the Advancement of Cytometry (ISAC), Seattle, WA, May 2010.
- Optimal filters under biological constraints predict population coding of retinal ganglion cells.**
Eizaburo Doi, Doru C. Balcan, and Michael S. Lewicki. Society for Neuroscience Abstracts.
Atlanta, GA. October 2006.
- Data Defining Language.** Maria Florina Balcan, Doru C. Balcan, and Cristian Paun. Chapter 1 in
II. Popescu, editor, *Procedural and Non-procedural Query Resolution in ORACLE8*. Ed. Tehnica,
Bucharest, 2002. (in Romanian).
- Determination of Thermodynamic Parameters of Ethoxylated Nonionic Surfactants by means of Reversed-Phase High-Performance Liquid Chromatography.** Marieta Balcan, Dan F. Anghel, Anca Voicu, and Doru C. Balcan. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 204(1-3):141151, 2002.

Work Experience

June – August 2005: Research Intern, Siemens Corporate Research, Princeton, NJ. Research in Signal Processing.

2001 – 2002: Instructor, Computer Science Department, Faculty of Mathematics and Computer Science, University of Bucharest, Romania.

October 1999 – January 2000: Research Assistant, Speech and Language Processing Group at the Wire Communications Laboratory, University of Patras, Greece. Research in Optical Character Recognition.

Teaching Experience

Guest Lect., Spring 2009: Carnegie Mellon University, 42-731/18-795 “Bioimage Informatics” (Instr. Jelena Kovačević).

TA, Fall 2004: Carnegie Mellon University, 15451 “Algorithms” (Instrs. Avrim Blum and Manuel Blum). Responsibilities included weekly sections, grading, and office hours.

TA, Spring 2004: Carnegie Mellon University, 15750 “Graduate Algorithms” (Instr. Manuel Blum). Responsibilities included preparing homeworks, grading and office hours.

TA, Spring 2002: University of Bucharest, “Introduction to Computer Science”. Responsibilities included weekly labs, preparing homeworks, and grading.

TA, Fall 2001: University of Bucharest, “Introduction to Computer Science”. Responsibilities included weekly labs, preparing homeworks, and grading.

TA, Fall 2001: University of Bucharest, “Algorithms and Programming Techniques”. Responsibilities included weekly sections, preparing homeworks, and grading.

TA, Spring 2001: University of Bucharest, “Introduction to Computer Science”. Responsibilities included weekly labs, preparing homeworks, and grading.

TA, Fall 2000: University of Bucharest, “Introduction to Computer Science”. Responsibilities included weekly labs, preparing homeworks, and grading.

Professional Service

Journal refereeing: IEEE Transactions on Information Theory, Journal of Vision, Applied and Computational Harmonic Analysis, Neural Computation, IEEE Transactions on Audio, Speech and Language Processing.

Conference refereeing: Neural Information Processing Systems (NIPS), ACM-SIAM Symposium on Discrete Algorithms (SODA), IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), IEEE International Symposium on Biomedical Imaging (ISBI), Conf. on Advanced Concepts for Intelligent Vision Systems.

Other activities: Student Volunteer at Neural Information Processing Systems (NIPS) Conference and Workshops.

Recent Presentations

Efficient Structure Discovery for Representation and Computation

- Center for Comprehensive Informatics, Emory University, February 2011.

Efficient and Robust Signal Approximations

- Minerva Research Group, Georgia Tech, September 2010.
- Compressed Sensing Group, Georgia Tech, September 2009.
- Thesis Defense, Carnegie Mellon Univ., May 2009.

Convergence Behavior of the Active Mask Segmentation Algorithm

- IEEE Intl. Conf. on Acoustics, Speech and Signal Processing (ICASSP), Dallas, TX, March 2010.
- Compressed Sensing Group, Georgia Tech, February 2010.

Sample Complexity for Multiresolution ICA

- NIPS Workshop "New Challenges in Theoretical Machine Learning: Data Dependent Concept Spaces", Whistler, Canada, December 2008.

Multiscale/Multiresolution Adaptive Image Representations (MrICA)

- Ecole Polytechnique Fédérale de Lausanne, May 2008.
- University of Southern California, December 2007.

Alternatives to the Discrete Fourier Transform

- Compressed Sensing Group, Georgia Tech, November 2010.
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Las Vegas, NV, April 2008.
- NIPS Workshop "Algebraic and combinatorial methods in machine learning", Whistler, Canada, December 2008.

Characterization of Robust Linear Coding Solutions

- Theory Lunch, Carnegie Mellon Univ., April 2007.

ICA for Speech Enhancement with Missing TF Content

- Intl. Conf. on Independent Component Analysis (ICA), Charleston, SC, March 2006.

Robust Coding over Noisy Overcomplete Channels

- Advances in Neural Information Processing Systems (NIPS), Vancouver, BC, December 2005.

Professional affiliations

- IEEE, SIAM, ACM, AMS.

Skills

- Programming Languages: Matlab (expert), C/C++ (proficient), Java (previous experience), Pascal, Prolog, ML (previous exposure)
- Spoken Languages: English (fluent), Romanian (native), French (competent), Russian (beginner)

References

- **Michael S. Lewicki** (Ph.D. advisor)
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