

Burak Erem

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EDUCATION

Northeastern University, Boston, MA
Doctor of Philosophy, Electrical Engineering May 2013

- Thesis: Differential Geometric Models and Optimization Methods for Dynamic Analysis of Electrocardiographic Signals and the Inverse Problem of Electrocardiography
- Supervised by Prof. Dana H. Brooks

Master of Science, Computer Engineering May 2008
Bachelor of Science, Electrical Engineering May 2006

RESEARCH INTERESTS

Imaging and signal processing problems, specializing in modeling and use of dynamics and geometric structures arising in biomedical problems and in inverse problems. Mathematical modeling leveraging ideas from differential geometry, signal processing, optimization theory, and machine learning. Developing software tools and libraries for visualization and for computationally efficient numerical solutions to challenging computational problems.

RESEARCH EXPERIENCE

Boston Children’s Hospital and Harvard Medical School, Boston, MA
Postdoctoral Research Fellow July 2013–Present
Computational Radiology Lab, PI: Prof. Simon K. Warfield

- Developed algorithms for patient motion estimation and image reconstruction for MRI.
- Created algorithms for EEG data analysis and source localization (inverse problem).

Northeastern University, Boston, MA
Research Assistant May 2008–June 2013
Biomedical Imaging and Signal Processing Lab, PI: Prof. Dana H. Brooks

- Developed computational methods for simulation and estimation in the forward and inverse problems of electrocardiography (ECG).
- Created mathematical tools to analyze the dynamics in bioelectric signals, including ECG, electroencephalography (EEG), and magnetoencephalography (MEG).
- Contributed to open source Center for Integrative Biomedical Computing (CIBC) software repositories.
- Performed highly collaborative research as a member of the CIBC at the Scientific Computing and Imaging (SCI) Institute at the University of Utah.
- Led collaborative activities with researchers in Utah, The Netherlands, and the Czech Republic.
- Won award for best poster at Communications and Digital Signal Processing Center Workshop 2013 at Northeastern University.

Research Assistant May 2006–May 2008
Northeastern University Computer Architecture Research Group, PI: Prof. David Kaeli

- Developed interactive software tools in SCIRun for visualization and analysis of 4D X-ray computed tomography datasets of human anatomy moving due to respiration.

- Collaborated closely with researchers in the Radiation Oncology Department at Massachusetts General Hospital, Boston, MA.

PUBLICATIONS *Journals:*

1. B. Erem, P.M. van Dam, and D.H. Brooks. "Identifying Model Inaccuracies and Solution Uncertainties in Non-Invasive Activation-Based Imaging of Cardiac Excitation using Convex Relaxation," *IEEE Transactions on Medical Imaging*, April 2014.
2. B. Erem, J. Coll Font, R. Martinez Orellana, P. Stovicek, and D.H. Brooks. "Using Transmural Regularization and Dynamic Modeling for Non-Invasive Cardiac Potential Imaging of Endocardial Pacing with Imprecise Thoracic Geometry," *IEEE Transactions on Medical Imaging*, March 2014.
3. B. Erem, R. Martinez Orellana, D.E. Hyde, J. Peters, F.H. Duffy, P. Stovicek, S.K. Warfield, R.S. MacLeod, G. Tadmor, and D.H. Brooks. "Machine Learning Methods for Analysis of Dynamics in Bioelectric Signals," *In preparation*.

Refereed Conferences:

4. J. Coll Font, B. Erem, A. Karma, and D.H. Brooks. "An Inverse Spectral Method to Localize Discordant Alternans Regions on the Heart from Body Surface Measurements," *International Conference on Functional Imaging and Modeling of the Heart (FIMH)*, 2013, *to appear*.
5. R. Martinez Orellana, B. Erem, and D.H. Brooks, "Time invariant multielectrode averaging for biomedical signals," *IEEE International Conference in Acoustics, Speech and Signal Processing (ICASSP)*, 2013, *to appear*.
6. B. Erem, P. Stovicek, and D.H. Brooks. "Manifold learning for analysis of low-order nonlinear dynamics in high-dimensional electrocardiographic signals," *International Symposium on Biomedical Imaging (ISBI)*, 2012.
7. B. Erem, D.H. Brooks, P.M. van Dam, J.G. Stinstra and R.S. MacLeod. "Spatiotemporal Estimation of Activation Times of Fractionated ECGs on Complex Heart Surfaces," *IEEE EMBS Conference (EMBC)*, 2011.
8. B. Erem, P.M. van Dam and D.H. Brooks. "Analysis of the Criteria of Activation-Based Inverse Electrocardiography Using Convex Optimization," *IEEE EMBS Conference (EMBC)*, 2011.
9. B. Erem, P.M. van Dam and D.H. Brooks. "A Convex Relaxation Framework for Initialization of Activation-Based Inverse Electrocardiography," *Noninvasive Functional Source Imaging (NFSI)*, 2011.
10. B. Erem and D.H. Brooks. "Differential Geometric Approximation of the Gradient and Hessian on a Triangulated Manifold," *International Symposium on Biomedical Imaging (ISBI)*, 2011.
11. B. Erem, P.M. van Dam, A. Keely, J.G. Stinstra, T.F. Oostendorp and D.H. Brooks. "Methods for Initialization of Activation-Based Inverse Electrocardiography using Graphs Derived from Heart Surface Geometry," *Computers in Cardiology (CinC)*, 2009.
12. B. Erem, G.C. Sharp, Z. Wu and D.R. Kaeli. "Interactive Deformable Registration Visualization And Analysis Of 4D Computed Tomography," *International Conference on Medical Biometrics (ICMB)*, 2008.

TEACHING EXPERIENCE

- Northeastern University, Boston, MA
 Co-Instructor of *Biomedical Signal Processing and Imaging Course* Spring 2012
- Graduate/Undergraduate course about the basics of signal processing in EEG and ECG, and imaging with X-ray Computed Tomography and Magnetic Resonance Imaging.

- Responsibilities included lesson planning, lecturing, project advising, and homework/project grading.

Tutor to IGERT Intelligent Diagnostics

Fall 2010

- Recommended by instructor as tutor for graduate-level Linear Systems Analysis course to Integrative Graduate Education and Research Traineeship (IGERT) Intelligent Diagnostics program.
- Provided supplemental instruction and problem-solving in weekly 2-hour sessions to IGERT Fellows with diverse educational backgrounds.

Teaching Assistant

Fall 2006–Spring 2008

Undergraduate Courses:

- Linear Systems – Fall 2006 (Prof. Eric Miller)
- Linear Systems – Spring 2007 (Prof. Anthony Devaney)

Graduate Courses:

- Fundamentals of Computer Engineering – Fall 2007 (Prof. Stefano Basagni)
- Computer Security – Spring 2008 (Prof. David Kaeli)

**WORK
EXPERIENCE**

Telerem, LLC, Beacon Falls, CT

Software Engineering Intern

October 2003–August 2004

- Wrote APIs for image processing, data transfer, and document conversion.
- Developed PHP web applications and libraries.

**COMPUTER
SKILLS**

Languages & Software: Matlab, C/C++, Shell Scripting, PHP, Git, Subversion, SCIRun

Operating Systems: Mac OS X, Linux, Windows

ADDITIONAL

U.S. Citizen

Languages: English and Turkish

Website: <http://burak.nu>

References available upon request.

(Last Revised: April 16, 2014)