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EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Massachusetts:
Ph.D. (Feb 2013), Department of Electrical Engineering and Computer Science
Dissertation title: "*Identifying Evolving Multivariate Dynamics in Individual and Cohort Time Series, with Application to Physiological Control Systems*."

UNIVERSITY OF OKLAHOMA, Norman, Oklahoma:
M.S. (2007), Signal Processing, Computational & Applied Mathematics
Thesis title: "*Fractional Fourier Transforms for Feature Vector Design with Applications to Stochastic Signal Pattern Recognition*."
B.A. (2006), Mathematics, Phi Beta Kappa

CURRENT POSITION

James S. McDonnell Postdoctoral Fellow,
Intelligent Probabilistic Systems Group,
Harvard School of Engineering and Applied Sciences
Project title: "*Complex Physiological Systems and Big Data: Identifying and Exploiting Switching Dynamics in Multivariate Time Series,"* January 2013 - December 2014.

RESEARCH INTERESTS: Machine Learning, Physiological Signal Processing, Modeling, and Control for Real-Time Clinical Decision Making, Computational Neuroscience and Brain Machine Interface

PUBLICATIONS

2013

1. **S. Nemati,** B. A. Edwards, B. P. Polletta, J. P. Butler, A. Malhotra, "Respiration and Heart Rate Complexity: Effects of Age and Gender Assessed by Band-limited Transfer Entropy," *Respiratory physiology & neurobiology,* 189(1), 27-33.
2. **S. Nemati**, L. H. Lehman, R. P. Adams, "Learning Outcome-Discriminative Dynamics in Multivariate Physiological Cohort Time Series," *In Engineering in Medicine and Biology Society (EMBC), 2013 35th Annual International Conference of the IEEE,* pp. 7104-7107. (Invited Talk)
3. Wellman A, Edwards BA, Sands SA, Owens RL, **Nemati S**, Butler JP, Passaglia CL, Jackson AC, Malhotra A, White DP, "A simplified method for determining phenotypic traits in patients with obstructive sleep apnea," *J Appl Physiol.* 2013.
4. **S. Nemati**, L. H. Lehman, L. Mayaud, and G. D. Clifford, R. P. Adams, "Time Series Dynamics and Patient State Monitoring: Application to ICU Bedside Predictive Analytics," *Neural information processing (NIPS) Workshop on Machine learning for clinical data analysis, Lake Tahoe, Nevada,* 2013.
5. **S. Nemati**, S. W. Linderman and Z. Chen, "A Probabilistic Modeling Approach for Uncovering Neural Population Rotational Dynamics," *Computational and Systems Neuroscience (COSYNE)* 2014.
6. L. H. Lehman, R. P. Adams, L. Mayaud, G. B. Moody, A. Malhotra, R. G. Mark, and **S. Nemati**, "A Physiological Time Series Dynamics-Based Approach to Patient Monitoring and Outcome Prediction", *IEEE Journal of Biomedical and Health Informatics (J-BHI),* 2013. –Under review.

7. L. H. Lehman, **S. Nemati**, R. P. Adams, G. Moody, A. Malhotra, R. Mark, "Tracking Progression of Patient State of Health in Critical Care Using Inferred Shared Dynamics in Physiological Time Series," *In Engineering in Medicine and Biology Society (EMBC), 2013 35th Annual International Conference of the IEEE,* pp. 7072-7075.

2012

8. **S. Nemati**, L. H. Lehman, R. P. Adams, and A. Malhotra, "Discovering shared cardiovascular dynamics within a patient cohort," *In Engineering in Medicine and Biology Society (EMBC), 2012 Annual International Conference of the IEEE,* pp. 6526-6529.
9. J. Lee, **S. Nemati**, I. Silva, B. A. Edwards, J. P. Butler, and A. Malhotra. "Transfer Entropy Estimation and Directional Coupling Change Detection in Biomedical Time Series," *BioMedical Engineering OnLine,* 11 (1): 1-17, 2012.
10. L. H. Lehman, **S. Nemati**, R. P. Adams, R. G. Mark, "Discovering Shared Dynamics in Physiological Signals: Application to Patient Monitoring in ICU," *In Engineering in Medicine and Biology Society (EMBC), 2012 Annual International Conference of the IEEE,* pp. 5939-5942.

2011

11. **Nemati, S**., Edwards, B.A., Sands, S.A., Berger, P.J., Wellman, A., Verghese, G.C., Malhotra, A., & Butler, J.P., "Model-based characterization of ventilatory stability using spontaneous breathing," *J Appl Physiol*. 2011 Jul; 111(1): 55-67. See also the invited editorial: Jacono FJ, Dick TE. Variability, Measuring the Spice of Life. *J Appl Physiol*. 2011 Jun 30.

2010

12. **S. Nemati,** A. Malhotra, and G. D. Clifford, "Data Fusion for Improved Respiration Rate Estimation," *EURASIP Journal on Advances in Signal Processing*, vol. 2010, 10 pages, 2010.
13. **Nemati, S**., Malhotra, A., and Clifford G. D., "T-Wave Alternans Patterns During Sleep in Healthy, Cardiac Disease and Sleep Apnea Patients," *The Journal of Electrocardiology*, October 2010, Issue No. 1, Janaury 2011.
14. **Nemati S**., Monasterio V., Abdala O., Yim-Yeh S., Malhotra A., and Clifford G., "A Non-Parametric Surrogate-based Test of Significance for T-Wave Alternans Detection," *IEEE Trans Biomed Eng*, issue 99, April 2010.
15. G. D. Clifford, **S. Nemati**, and R. Sameni, "An artificial vector model for generating abnormal electrocardiographic rhythms," *IOP Physiol. Meas.*, vol. 31, no. 4, April 2010.

2009

16. M. Yeary, **S. Nemati**, T.-Y. Yu, Y. Wang, Y. Zhai and A. Fagg, "Support vector machines to simultaneously minimize classification error and maximize geometric margin for RF sensor spectral signatures," *IEEE Transactions on Instrumentation and Measurement*, vol. 58, pp. 221-228, January 2009.

2008

17. G. D. Clifford, **S. Nemati**, and R. Sameni, "An artificial multi-channel model for generating abnormal electrocardiographic rhythms," *Computers in Cardiology*, vol. 35, September 2008.
18. Khaustov, A. and **Nemati, S.** and Clifford, G. D., "An Open-Source Standard T-Wave Alternans Detector for Benchmarking", *Computers in Cardiology*, vol. 35, pp509-512; IEEE Computer Society Press, September 2008.
19. **S. Nemati**, A. H. Fagg, N. G. Hatsopoulos, L. E. Miller, "Constructing Robust Neural Decoders Using Limited Training Data", *IEEE Transaction on Biomedical Engineering*, 2008, electronically published.
20. Y. Wang, T.-Y. Yu, M. Yeary, A. Shapiro, **S. Nemati**, M. Foster, D. Andra, and M. Jain, "Tornado Detection Using a Neuro-fuzzy System to Integrate Shear and Spectral Signatures," *Journal of Atmospheric and Oceanic Technology*, as published by the American Meteorological Society. Vol. 25, pp. 1136-1148, July 2008.

2007

21. **S. Nemati**, M. Yeary, T.-Y. Yu, Y. Wang, Y. Zhai and A. Fagg, "Spectral Signature Classification Using A Support Vector Classifier," *IEEE-IMTC*, pp. 1-4, DOI 10.1109/IMTC.2007.379046, Warsaw, May 2007.

22. **Nemati, S.** Fagg, A. H., Hatsopoulos, N., Miller, L. (2007), "A Comparison of Linear and Kalman Filter Models for Arm Motion Prediction," *Proceedings of the Spring Meeting on the Neural Control of Movement*, electronically published.
23. Fagg, A. H., Hatsopoulos, N. G., de Lafuente, V., Moxon, K. A., **Nemati, S.**, Rebesco, J. M., Romo, R., Solla, S. A., Reimer, J., Tkach, D., Pohlmeyer, E. A., and Miller L. E., "Biomimetic brain machine interfaces for the control of movement," *Journal of Neuroscience*, 27(44):11842-11846, 2007.
24. M. Yeary, **S. Nemati**, T.-Y. Yu, and Y. Wang, "Tornadic time series detection using Eigen analysis and a machine intelligence based approach,'' *IEEE Geoscience and Remote Sensing Letters*, vol 4, no. 3, pp. 335-339, July 2007.
25. Y. Wang, T.-Y. Yu, M. Yeary, A. Shapiro, **S. Nemati**, M. Foster, D. Andra, Jr., and M. Jain, "A novel approach of tornado detection using a machine intelligence system based on shear and spectral signatures," *AMS Radar Meteorology*, Aug 2007.
26. Y. Zhai, M. Yeary, and **S. Nemati**, "Enhanced Video Surveillance using a Multiple Model Particle Filter," *IEEE SAFE '07 Workshop,* Washington, DC. pp. 1-4, June 2007.

2006

27. M. Ozaydin, **S. Nemati**, M. Yeary and V. DeBrunner, "Orthogonal Projections and Discrete Fractional Fourier Transforms," *12th IEEE DSP Workshop*, pp. 429–433, Sept 2006.
28. M. Yeary, Y. Zhai, T.-Y. Yu, **S. Nematifar**, and A. Shapiro, "Spectral Calculations and Target Tracking for Remote Sensing," *IEEE Transactions on Instrumentation and Measurement*, vol. 55, no. 4, pp. 1430-1442, Aug 2006.
29. Y. Zhai, M. Yeary, J.-C. Noyer, J. Havlicek, **S. Nemati**, and P. Lanvin, "Visual target tracking using improved and computationally efficient particle filtering," *IEEE International Conference on Image Processing*, Atlanta, GA. pp. 1757-1760, Oct 2006.
30. Y. Wang, T.-Y. Yu, M. Yeary, A. Shapiro, S. Nemati, M. Foster, and D. Andra, "Tornado identification using a neuro-fuzzy approach to integrate shear and spectral signatures," *AMS Severe Local Storms Conference*, P9.1, CD-ROM. Nov 2006.

2005

31. M. Yeary, T. Yu, S. Nematifar, A. Shapiro, "Spectral Signature Calculations for Remote Sensing," *IEEE-Instrumentation and Measurement Technology Conference*, pp. 2071-2075, May 2005.

WORK EXPERIENCE

- Postdoctoral Fellow, Harvard Intelligent Probabilistic Systems Group (HIPS) (2013-current).
- Research Fellow, Department of Sleep Medicine, Brigham and Women's Hospital (2009-2012).
- Laboratory for Computational Physiology and Clinical Inference Group, MIT (2009-2012).
- Laboratory for Computational Physiology, MIT (2008-2009), integrating Data, Models and Reasoning in Critical Care.
- Retinal Implant Research Group, Research Laboratory of Electronics, MIT (2007-2008): Worked on neural signal decoding via a point-process statistical framework, likelihood modeling, and optimization.
- Symbiotic Computing Laboratory, Univ. of Oklahoma (2006-2007): Utilized Machine-Learning methodologies for Modeling Motor Cortical Activities.
- Weather Radar Laboratory, Univ. of Oklahoma (2004-2005): Worked on Machine Intelligence based severe weather prediction/detection algorithms (under NSF grant 0410564).

TEACHING EXPERIENCE

- Teaching Fellow, Harvard University (CSCI E-181: Intelligent Machines: Perception, Learning, and Uncertainty) (Spring 2013).
- Teaching Assistant in Harvard-MIT Division of Health Sciences & Technology (HST.582J/6.555J: Biomedical Signal and Image Processing) (2008).

- Graduate Teaching Assistant, Department of Mathematics, Univ. of Oklahoma (2005-2006).

HONORS

- Recipient of James S. McDonnell Postdoctoral Fellowship in Studying Complex Systems (January 2013 - December 2014): http://www.jsmf.org/apply/fellowship/2012.php
- NIH Training Grant Recipient, Division of Sleep Medicine, Harvard Medical School (2009-2012): https://sleep.med.harvard.edu/people/trainees/1206/Shamim
- Recipient of Harold Huneke Graduate Assistant Teaching Award at the Univ of Oklahoma (2006-2007).
- First Place in IEEE Region 5 student paper contest (2005).
- Outstanding Junior award, School of Electrical and Computer Engineering (2005).
- Recipient of Clyde Farrar Scholarship at the University of Oklahoma (2004-2005).
- President's Honor Roll (Six Semesters).
- Dean's Honor Roll at the University of Oklahoma (Four Semesters).
- Engineering Physics Achievement Award from the University of Central Oklahoma.

SELECTED LIST OF RECENT INVITED TALKS AND CONFERENCE ABSTRACTS

- Invited guest expert to the Harvard Radcliffe Exploratory Seminar[1], March 2014.
- Invited guest expert to the Excel Medical Electronics (EME) and IBM Streaming Analytics for Bedside Monitoring Symposium, November 2013.
- **S. Nemati**, A. Wellman, B.A. Edwards, S.A. Sands, A. Malhotra, "*Model-Based Characterization Of Ventilatory Stability During Spontaneous Breathing: A Human Study*," ATS 2012.
- P. I. Terrill, B. A. Edwards, A. Wellman, **S. Nemati**, R. L. Owens, J. P. Butler, A. Malhotra, S. A. Sands, "*Model-based quantification of loop gain using clinical polysomnography in patients with obstructive sleep apnea*," IEEE EMBS 2013, mini-symposium.
- Sands, S. A., **S. Nemati**, Y. Mebrate, B. A. Edwards, C. Manisty, A. Wellman, K. Willson, D. P. Francis, and A. Malhotra. "*Ventilatory oscillations in stable control systems as an interaction between external disturbances and feedback stability*," In SLEEP, vol. 35, pp. A48-A48, 2012.
- S.A. Sands, **S. Nemati**, Y. Mebrate, B.A. Edwards, C. Manisty, A. Wellman, K. Willson, D.P. Francis, A. Malhotra, "*Characterizing Ventilatory Oscillations Emerging From Disturbances To Stable Control Systems: A Mechanism Of Mild-Moderate Central Sleep Apnea*," ATS 2012.
- Wellman, A., D. J. Eckert, A. S. Jordan, B. A. Edwards, R. L. Owens, S. S. Sands, **S. Nemati**, J. Butler, A. Malhotra, and D. P. White. "*Relationship between the upper airway response to loading in nrem sleep and apnea severity in rem sleep*." In SLEEP, vol. 34, pp. A159-A160, 2011.
- S. A. Sands, **S. Nemati**, B. A. Edwards, D. A. Wellman, E. S., G. Hamilton, M. Naughton, G. Verghese, A. Malhotra, J. P. Butler, P. Berger, "*Estimation of Respiratory Control Parameters and Loop Gain from Spontaneous Breathing*," IEEE EMBS 2011, invited mini-symposium.
- A. Malhotra, D. P. White, D. J. Eckert, B. A. Edwards, R. Owens, S. A. Sands, **S. Nemati**, J. P. Butler, C. P., A. J., D. A. Wellman, "*Obstructive Sleep Apnea: A Mechanistic Approach*," IEEE EMBS 2011, invited mini-symposium.
- **S. Nemati**, "Estimation of respiratory control system parameters from spontaneous breathing," NHLBI-VCU 2011; World Congress on Mathematical Modeling and Computational Simulation of Cardiovascular and Cardiopulmonary Dynamics.
- BA Edwards, SA Sands, RL Owens, DJ Eckert, SH Loring, J Bulter, **S Nemati**, DP White, A Malhotra & A Wellman, The Use Of Diaphragm Activity To Measure Ventilatory Instability (Loop Gain) In Obstructive Sleep Apnea: A Validation Study, *ATS*, 2011.

[1] "*Moving from Reaction to Prediction: Leveraging High Speed Data Recording and Advanced Computational Tools for Prediction Sedation-Related Adverse Events in Children." Organized by Drs. B. Krauss (HMS) and G. Verghese (MIT).*

- **S. Nemati**, "*Closed-loop Analysis of Respiratory Chemoreflex Feedback-loop in Response to Dopaminergic Manipulation,"* Johns Hopkins Asthma and Allergy Center, 2010.
- J. L. Wyatt, Jr, S. Valavanis, Y.-C. Wu, **S. Nemati**, A. Eisenman, S. Fried, S. Stasheff, J.F. Rizzo, "*A Likelihood Method for Estimating Visual Motion Parameters from Retinal Ganglion Cell Responses*, ARVO, Fort Lauderdale, FL, April 27-May 1, 2008.
- **S. Nemati**, A. H. Fagg, N. Hatsopoulos, and L. Miller, "*A Comparison of Linear and Kalman Filter Models for Arm Motion Prediction,*" 17th Annual Meeting of Neural Control of Movement, Seville, Spain, March 25-30, 2007.
- **S. Nemati**, A. H. Fagg, "*Decoding of Motor Cortical Activities*, *Kalman vs. Wiener*", Gatsby Computational Neuroscience Unit, UCL, March 2007.
- **S. Nemati** and A. H. Fagg, "*Kalman vs. Wiener: A BMI Showdown*," Dept. of Physiology, Northwestern University, November 2006.
- **S. Nemati**, "*Bayesian Inference and Decoding of Motor Cortical Activities*," Dept. of Mathematics, University of Oklahoma, November 2006.
- **S. Nemati**, "*Discrete Fractional Fourier Transform and Chirp Filtering,"* National Weather Center, Norman, Oklahoma, August 2006.
- **S. Nemati**, "*A Fuzzy Logic Based Approach to Tornado Detection,*" Atmospheric Radar Research Laboratory, University of Oklahoma, August 2005.
- **S. Nemati** and M. Walker, "*Using Neural Networks to Identify Tornados,"* R5 IEEE Conference, Colorado, April 8-10, 2005 (Won the 1st prize in the student paper contest).

OTHER ACTIVITIES, MEMBERSHIPS AND RELATED EXPERIENCES

- Institute of Electrical & Electronics Engineering (IEEE).
- Phi Beta Kappa Honor Society.
- Sidney Pacific Graduate Community House Government, MIT
- Co-chair, "Kalman Filter and Markov Model ", IEEE Engineering in Medicine and Biology Society conference, San Diego, August 2012.
- **Associated reviewer for**
  - The Journal of Applied Physiology (JAP)
  - IEEE Journal of Biomedical and Health Informatics (J-BHI)
  - Physiological Measurement
  - Biomedical Signal Processing and Control
  - Computer Methods and Programs in Biomedicine
  - Medical & Biological Engineering & Computing (MBEC)

RELEVANT WEBPAGES:
http://hips.seas.harvard.edu/pubs/author/21
http://www.rle.mit.edu/cpci/people_nemati.htm
http://www.mit.edu/~shamim/
http://dspace.mit.edu/handle/1721.1/79223 (MIT PhD Thesis)

CITIZENSHIP: U.S.A.