

# Mohammadreza Negahdar

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## Education

- University of Louisville** Louisville, KY  
Ph.D. in Electrical and Computer Engineering (June 2012)  
Dissertation: *3-D Lung Deformation and Function  
from Respiratory-gated 4-D X-ray CT Images:  
Application to Radiation Treatment Planning*  
Advisor: Dr. Amir A Amini
- Tehran University of Medical Sciences** Tehran, Iran  
M.S. in Biomedical Engineering (Bioelectric) (September 2006)  
Thesis: *Design and Implementation of a Novel 3-D  
Path Planning Method for Virtual Bronchoscopy*  
Advisors: Dr. Alireza Ahmadian and Dr. Nassir Navab
- Science and Research College** Tehran, Iran  
B.S. in Biomedical Engineering (Bioelectric) (September 2003)  
Thesis: *Design and Implementation of an Electromyography  
System and Analysis of the Recorded EMG Signal*

## Research Projects

- **University of Louisville, Medical Imaging Lab, Brown Cancer Center**  
*Advisor: Dr. Amir A Amini*  
*2011 – Present* *Louisville, KY*
  - Formulated and implemented an accurate 4-D CT derived regional pulmonary function map from treatment planning images.
  - Introduced, formulated, and implemented strain as a novel index of regional pulmonary function from treatment planning 4-D CT.
  - Clinical image acquisition and processing in patients with non-small cell lung cancer (NSCLC) at Brown Cancer Center under supervision of Dr. Shiao Woo and Dr. Neal Dunlap.
  - In-vivo validation of 4-D CT derived regional ventilation images with tomography SPECT ventilation and SPECT perfusion scans for patients with NSCLC.
  - Correlation of the 4-D CT derived regional function images with V/Q and pulmonary function tests for patients with NSCLC.

- **University of Louisville, Medical Imaging Lab**  
*Advisor: Dr. Amir A Amini*  
2007 – 2012 *Louisville, KY*

  - Survey on medical image registration and segmentation methods.
  - Derived and implemented a novel optical flow framework of thoracic 4-D CT.
  - Derived and implemented of a hybrid local/global landmark-based large deformation elastic registration method for longitudinal registration of CT images collected in patients undergoing radiation treatment for lung cancer.
  - Formulated a novel mechanical index of lung tissue functionality for measurement of regional lung ventilation via deformable image registration.
  - Collaboration with Brown Cancer Center to Design a tool for radiation treatment planning to track the progression of toxicity to surrounding normal tissue during the course of radiation therapy of lung.
  
- **Research center for Science and Technology in Medicine**  
*Advisor: Dr. Alireza Ahmadian*  
2006 – 2007 *Tehran, Iran*

  - Studied and compared methods for virtual bronchoscopy.
  - Wrote a successful proposal and secured funding for the project.
  - Used VTK for fly-through visualization of the airways for virtual bronchoscopy.
  
- **University of Tehran**  
*Advisor: Dr. Reza Zoroofi*  
2006 – 2007 *Tehran, Iran*

  - Surveyed various GUI and volume/surface rendering software for virtual endoscopy application.
  - Designed and implemented a VTK- and ParaView-based GUI for fly-through for virtual colonoscopy.
  
- **Technischen Universität München, Computer Aided Medical Procedures**  
*Advisor: Prof. Hubertus Feussner, Co-advisor: Prof. Nassir Navab*  
2006 – 2007 *Munich, Germany*

  - Developed a new algorithm to navigate with the bronchoscope for biopsies and/or tumor resection.
  
- **Tehran University of Medical Sciences, Technischen Universität München**  
*Advisor: Dr. Alireza Ahmadian, Co-advisor: Prof. Nassir Navab*  
2005 – 2006 *Tehran, Iran*

  - Performed comprehensive survey on path planning methods in robotics.
  - Developed a new fully-automated path planning algorithm for virtual bronchoscopy.
  - Programmed clinical software for 3-D path planning for virtual bronchoscopy.



## Academic Honors

- Chosen as the winner of Electrical Engineering Outstanding Graduate Student Award at the J.B. Speed School of Engineering Annual Honors and Awards Program, University of Louisville, April 2012.
- Chosen as a finalist in the SPIE Medical Imaging Symposium Best Student Paper Award Competition (one of the 8 for the entire symposium) for the paper: “A 3-D Optical Flow Technique Based on Mass Conservation for Deformable Motion Estimation from 4-D CT Images of the Lung”, Mohammadreza Negahdar and Amir A Amini, SPIE Medical Imaging Symposium, San Diego, CA, February 2012.
- Chosen for the 2012 Who’s Who Among Students in American Universities and Colleges in recognition of outstanding merit and accomplishment, representing the University of Louisville, January 2012.
- Letter of commendation from Peter Rowell, Ph.D., Associate Dean for Research at University of Louisville School of Medicine on having one of the best posters (amongst 300) in *Research!Louisville* for a poster entitled, “Planar Deformable Motion Estimation Incorporating Mass Conservation and Image Gradient Constancy”, October 2011.
- Ranked in the top 5 percent of graduate students at the University of Louisville-*Golden Key Honour Society*, 2009.
- Proclaimed as most productive researcher student in Research center for Science and Technology in Medicine (*RcSTIM*), 2006.
- Young investigator fellowship, German Academic Exchange Program, 2006.
- Ranked as top student in the Department of Biomedical systems and Medical Physics, Tehran University of Medical Sciences, 2005.
- First rank in nation-wide entry exam for the M.S. degree amongst 30,000 students, 2003.

## Patent

1. **Mohammadreza Negahdar**, Amir Amini, Neal Dunlap, and Shiao Woo, “Volumetric Deformable Registration Method for Thoracic 4-D Computed Tomography Images,” U.S. Provisional Patent, Application # 61/618,081.

## Publications

1. **Mohammadreza Negahdar**, Neal Dunlap, Albert Zacarias, A Cahid Civelek, Shiao Y Woo, and Amir A Amini, “*Strain as a Novel Index of Regional Pulmonary Function from Thoracic 4-D CT: In-Vivo Validation with Tomographic SPECT Ventilation and Perfusion*,” submitted to Medical Physics.
2. **Mohammadreza Negahdar** and Amir A Amini, “*A Multi-Scale Optical Flow Technique Incorporating Mass Conservation for Deformable Motion Estimation*”

- (*MOFID*) from 4-D X-ray CT Images of the Lung,” submitted to IEEE Transactions on Medical Imaging.
3. **Mohammadreza Negahdar**, Amir A Amini, Albert Zacarias, Bart L Lynch, Rebecca A Milam, Shiao Y Woo, and Neal Dunlap, “*Strain as a Novel Index of Regional Function from Treatment Planning Thoracic 4-D CT*,” Journal of Thoracic Oncology, supplement for the 2012 Chicago Multidisciplinary Symposium in Thoracic Oncology, Chicago, IL, USA, Sep 2012.
  4. **Mohammadreza Negahdar** and Amir A Amini, “*Regional Lung Strains via a Volumetric Mass Conserving Optical Flow Model*,” IEEE Int. Symposium on Biomedical Imaging (*ISBI*), Barcelona, Spain, May 2012.
  5. **Mohammadreza Negahdar**, Albert Zacarias, Rebecca A Milam, Neal Dunlap, Shiao Y Woo, and Amir A Amini, “*An Automated Landmark-based Elastic registration Technique for large Deformation Recovery from 4-D CT Lung Images*,” Proceedings of the *SPIE* Conference on Biomedical Applications in Molecular, Structural, and Functional Imaging, 8317-51, San Diego, CA, USA, Feb 2012.
  6. **Mohammadreza Negahdar** and Amir A Amini, “*A 3-D Optical Flow Technique Based on mass Conservation for Deformable Motion Estimation from 4-D CT Images of the Lung*,” Proceedings of the *SPIE* Conference on Biomedical Applications in Molecular, Structural, and Functional Imaging, 8317-50, San Diego, CA, USA, Feb 2012 [Chosen as a finalist in Medical Imaging Best Student Paper Award competition].
  7. **Mohammadreza Negahdar**, Hui Wang, and Amir A Amini, “*A Novel Optical Flow Method for Myocardial Deformation Analysis from Tagged MRI*,” *SCMR-ISMRM* Workshop on Exploring New Dimensions of cardiovascular Flow and Motion, Orlando, FL, USA, Feb 2012.
  8. **Mohammadreza Negahdar** and Amir A Amini, “*Multi-scale Optical Flow Including Normalized Mutual Information for Planar Deformable Lung Motion Estimation from 4-D CT*,” 33<sup>rd</sup> IEEE *EMBS* Annual Int. Conf., 4888-4892, Boston, MA, USA, Sep 2011.
  9. **Mohammadreza Negahdar** and Amir A Amini, “*Estimation of Affine Motion from Projection Data Using a Mass Conservation Model*,” 33<sup>rd</sup> IEEE *EMBS* Annual Int. Conf., 8041-8044, Boston, MA, USA, Sep 2011.
  10. **Mohammadreza Negahdar** and Amir A Amini, “*Planar Deformable Motion Estimation Incorporating Mass Conservation and Image Gradient Constancy*,” IEEE Int. Symposium on Biomedical Imaging (*ISBI*), 536-540, Chicago, IL, USA, Mar 2011 [NIH travel grant award].
  11. **Mohammadreza Negahdar** and Amir A Amini, “*Tracking Planar Lung Motion in 4-D CT with Optical Flow: Validations and Comparison of Global, Local, and Local-Global Methods*,” Proceedings of the *SPIE* Conference on Biomedical Applications in Molecular, Structural, and Functional Imaging, 7626-74, San Diego, CA, USA, Feb 2010.

12. **Mohamadreza Negahdar**, Alireza Ahmadian, and Nassir Navab, “*Stiff and Efficient Middle Axis Extraction of Airways for Virtual Bronchoscopy*,” Int. Conference of Telemedicine and e-Health, Tehran, Iran, Nov 2006.
13. **Mohamadreza Negahdar**, Alireza Ahmadian, Nassir Navab, and Kavous Firouznia, “*Path Planning for Virtual Bronchoscopy*,” 28<sup>th</sup> IEEE EMBS Annual Int. Conf., 156-159, New York, NY, USA, Sep 2006.
14. **Mohamadreza Negahdar**, Alireza Ahmadian, Nassir Navab, and Kavous Firouznia, “*Automated Path Planning Algorithm for Virtual Bronchoscopy*,” Iranian Journal of Medical Physics (*IJMP*), 3(11), 51-62 (2006).