# CURRICULUM VITAE

Nicholas J. Tustison

Assistant Professor

Department of Radiology and Medical Imaging

1. **Education**

2004 D.Sc. Biomedical Eng. Washington University in St. Louis

2000 M.S. Biomedical Eng. University of Virginia

1998 B.S. Applied Physics:

Computer science emphasis Brigham Young University

1. **Post-Graduate Education**

2005 Post-doctoral fellowship University of Pennsylvania

1. **Academic Appointments**

2010- Assistant Professor University of Virginia

2016- Visiting Assistant Researcher University of California, Irvine

Pending Adjunct Professor University of Pennsylvania

1. **Other Employment Pertaining to Current Professional Appointments**

Nov 2006-June 2010 Staff Scientist University of Pennsylvania

1. **Honors and Awards**

* 1st place, EMPIRE10 lung registration competition, MICCAI Conference 2010 (Team: Gang Song, Nick Tustison, Brian Avants, Jim Gee).
* 1st place, BRATS2013 multimodal brain tumor segmentation competition, MICCAI Conference 2013 (Team: Nick Tustison, Max Wintermark, Chris Durst, Brian Avants).
* Best paper award, STACOM2014 cardiac motion estimation challenge, MICCAI Conference 2014 (Team: Nick Tustison, Yang Yang, Michael Salerno).

1. **Areas of Research Interest**

I am a data scientist specializing in medical image analysis with technical expertise and international recognition in the development of high-quality, open-source computational strategies for clinically oriented research. My interests are focused on algorithmic and methodological innovation particularly with respect to medical imaging data which target a variety of applications including neuroscience, pulmonary, and cardiac research avenues.

1. **Current Projects**

**ANTs Development and Maintenance**

ANTs is a systematic framework for quantitative biological image analysis built on the Insight ToolKit.  ANTs was first created by Brian Avants and I as a way to rapidly disseminate our latest research to the community of scientists who depend on imaging analytics and to allow them to study different organ systems, species or modalities with the same sound foundation.  While originally focused on diffeomorphic image registration, ANTs grew to incorporate methods for segmentation, feature extraction and, more recently, full statistical pipelines via ANTsR. Brian, I and others, continue to develop and maintain ANTs and its interface to the R statistical projects known as ANTsR.

**Traumatic Brain Injury**

*Neuroimaging analysis for the CENC*—As one of the major responses to Operations Enduring Freedom and Iraqi Freedom, the Chronic Effects of Neurotrauma Consortium (CENC) was established to research the effects of traumatic brain injury in military service members. As part of the neuroimaging core, my responsibilities include development and deployment of image analysis techniques for large-scale data processing for statistical analysis.

*White matter hyperintensity segmentation in TBI cohort—*White matter hyperintensities (WMHs) are foci of abnormal signal intensity in white matter regions seen with magnetic resonance imaging (MRI). These imaging features are associated with normal aging and have shown prognostic value in neurological conditions such as traumatic brain injury (TBI). The impracticality of manually quantifying these lesions limits their clinical utility and motivates the utilization of machine learning techniques for automated segmentation workflows. We are currently developing a machine-learning framework with tailored features for segmenting WMHs in a TBI cohort. This framework is provided publicly through the Advanced Normalization Tools (ANTs) and ANTsR toolkits.

**Imaging biomarkers for pulmonary lung diseases**

*Quantitative assessment of hyperpolarized gas imaging in the lungs*— Clinically, lung imaging has played a limited role for the diagnosis and treatment of asthma. Spirometry is commonly employed despite its inadequacies for early detection and inability to provide regional information. Recent developments in MRI research utilizing noble gases, such as helium-3 and xenon-129, have demonstrated the capability of visualizing alveolar and bronchial air spaces. We are currently developing targeted algorithms for generating potential imaging biomarkers from hyperpolarized gas imaging.

*ITK-Lung*— This project is aimed at improving pulmonary scientists’ ability to explore clinical hypotheses concerning the structure and function of the human lung using multi-modal imaging data. Scientific research has been significantly enhanced by recent emphases on open-data and open-source tools. This success has been quite apparent within the neuroimaging community but no such publicly available computational resources exist for pulmonary imaging. By providing publicly available, user-friendly, widely interoperable, and extensively validated tools for pulmonary imaging analysis and mapping, the project will enable a broad field of scientists to leverage modern imaging technologies more effectively in answering basic science questions about the lung, which will lead to clinical insights and advancements.

**Collaborations with UC Irvine (Mike Yassa)**

*Structural MR imaging biomarkers for Alzheimers disease—*The Alzheimer’s Disease Neuroimaging Initiative is a large-scale investigation of the progression of Alzheimer’s Disease (AD) through the study of targeted biomarkers including those extracted from imaging data. An important aspect of this initiative is the public availability of the data to facilitate individual exploration of hypotheses. Current collaborative efforts with colleagues at UC Irvine involve using the ANTs cortical thickness pipelines to determine regional changes in the cortex in the presence of AD.

*Machine learning techniques for hippocampal subfield segmentation*—Recent standardization in MRI acquisition protocols for hippocampal subfields has been accompanied by relevant segmentation approaches. We are currently developing a publicly available extension of the well-known ASHS (automatic segmentation of hippocampal subfields) pipeline with the targeted application of extending the ANTs cortical thickness pipeline to integrate hippocampal subfield segmentations.

1. **Teaching Activities**

*Feb. 2008-present: ANTs and ANTsR online support.*

As one of the two primary developers of the Advanced Normalization Tools (ANTs, originating at sourceforge.net on 2008-06-26 and now residing at <http://stnava.github.io/ANTs/>), I provide online support, assistance, and online workable examples for our large user base. ANTs is a systematic framework for quantitative biological image analysis built on the Insight ToolKit.  ANTs was first created by Brian Avants and I as a way to rapidly disseminate our latest research to the community of scientists who depend on imaging analytics and to allow them to study different organ systems, species or modalities with the same sound foundation.  While originally focused on diffeomorphic image registration, ANTs grew to incorporate methods for segmentation, feature extraction and, more recently, full statistical pipelines via ANTsR.  In 2014, there were nearly 2000 citations to ANTs and the software is cloned, downloaded or otherwise accessed over 100-200 times per week, on average.

**Workshops and Tutorials**

*Oct. 2015:* [*SimpleITK tutorial*](http://www.itk.org/Wiki/SimpleITK/Tutorials/MICCAI2015)*, MICCAI, Munich, Germany.*

I helped organize and teach this half-day tutorial to introduce students and researchers to the ITK version 4 registration framework through the SimpleITK interface. Using a hands-on teaching method, numerous examples were prepared and solved in real time to learn the various components of the new registration framework including linear and deformable transforms, similarity metrics, and relevant optimizers. Guidance regarding tuning the various parameters was also provided.

*July 2015: ANTs workshop, Laboratory of Neuroimaging, Marina Del Rey, USA.*

This was a repeat of the tutorial given in Montreal of May 2015.

*May 2015: CREATE-MIA Summer Workshop,* [*ANTs Workshop*](http://aggie.cim.mcgill.ca:8080/create-mia/events/create-mia-summer-school-2015)*, Montreal, Canada.*

The two primary developers of ANTs (Brian Avants and Nicholas Tustison) created and provided a two-day tutorial for teaching the framework’s basic ideas and applications.  The morning sessions highlighted ANTs use cases and research.  The afternoon sessions showed attendees how to use the system to analyze a multiple modality neuroimaging dataset derived from publicly available data with statistical analysis performed using the ANTsR interface with the R statistical project.

*February 2012: SPIE Medical Imaging Workshop, Open source tools for medical image analysis, San Diego, USA*.

I was invited to give a presentation on medical image analysis tools that were publicly available with a special emphasis on my own work. Topics covered included preprocessing optimal registration approaches for brain and pulmonary MRI, ventilation-based segmentation for hyperpolarized gas MRI, and the latest image preprocessing techniques.

1. **Other Professional Activities (Boards, Editorships, etc.)**

2015-present Chronic Effects of Neurotrauma Consortium (CENC) Imaging Core

2014-2015 Frontiers Topic Editor: *Neuroinformatics with the Insight Toolkit*

2012-present SPIE Medical Imaging Conference Program Committee

2012-present Frontiers in Neuroinformatics Review Editorial Board

2004-present Developer, Insight Toolkit, National Library of Medicine

Manuscript Reviewer

* Academic Radiology
* American Journal of Neuroradiology
* Annals of Biomedical Engineering
* Artificial Intelligence in Medicine
* Biomedical Signal Processing and Control
* Computers in Biology and Medicine
* Computerized Medical Imaging and Graphics
* Focused Ultrasound Foundation ad hoc grant reviewer
* Human Brain Mapping
* Image and Vision Computing
* International Journal of Pattern Recognition and Artificial Intelligence
* IEEE Transactions on Medical Imaging
* IEEE Transactions on Pattern Analysis and Machine Intelligence
* IEEE Transactions on Biomedical Engineering
* Insight Journal
* Medical Image Computing and Computer Assisted Intervention
* International Journal of Biomedical Imaging
* International Journal of Computer Vision
* International Workshop on Medical Imaging and Augmented Reality
* IEEE International Symposium on Biomedical Imaging: From Nano to Macro
* Journal of Computed Tomography
* Journal of Electronic Imaging
* Journal of Magnetic Resonance Imaging
* Journal of Neurotrauma
* Journal of the Optical Society of America A
* Magnetic Resonance in Medicine
* Medical Physics
* Medical Image Analysis
* Neurobiology of Aging
* NeuroImage
* NeuroImage: Clinical
* Neuroradiology
* PLOS ONE
* Respirology
* SIAM Journal on Imaging Sciences

1. **Papers Published or in Press**

### **Peer Reviewed**

(Corresponding author indicated by \*. Trainee mentored by Dr. Tustison is underlined.)

1. Allen GI, Amoroso N, Anghel C, Balagurusamy V, Bare CJ, Beaton D, Bellotti R, Bennett DA, Boehme K, Boutros PC, Caberlotto L, Caloian C, Campbell F, Neto EC, Chang Y-C, Chen B, Chen C-Y, Chien T-Y, Clark T, Das S, Davatzikos C, Deng J, Dillenberger D, Dobson RJB, Dong Q, Doshi J, Duma D, Errico R, Erus G, Everett E, Fardo DW, Friend SH, Fröhlich H, Gan J, St George-Hyslop P, Ghosh SS, Glaab E, Green RC, Guan Y, Hong M-Y, Huang C, Hwang J, Ibrahim J, Inglese P, Jiang Q, Katsumata Y, Kauwe JSK\*, Klein A\*, Kong D, Krause R, Lalonde E, Lauria M, Lee E, Lin X, Liu Z, Livingstone J, Logsdon BA, Lovestone S, Lyappan A, Ma M, Malhotra A, Mangravite LM\*, Maxwell TJ, Merrill E, Nagorski J, Namasivayam A, Narayan M, Naz M, Newhouse SJ, Norman TC, Nurtdinov RN, Oyang Y-J, Pawitan Y, Peng S, Peters MA\*, Piccolo SR, Praveen P, Priami C, Sabelnykova VY, Senger P, Shen X, Simmons A, Sotiras A, Stolovitzky G, Tangaro S, Tateo A, Tung Y-A, **Tustison NJ**, Varol E, Vradenburg G, Weiner MW, Xiao G, Xie L, Xie Y, Xu J, Yang H, Zhan X, Zhou Y, Zhu F, Zhu H, Zhu S, Alzheimer's Disease Neuroimaging Initiative. Crowdsourced estimation of cognitive decline and resilience in Alzheimer's disease. *Alzheimers Dement*, In press. Cited 0 times; IF = 12.407; Rank 3 out of 192 clinical neurology.

The ANTs software library, written by Dr. Tustison, was used to provide cortical thickness measures.

1. **Tustison NJ\***, Qing K, Wang C, Altes TA, Mugler JP, III. Atlas-based estimation of lung and lobar anatomy in proton MRI. *Magn Reson Med*, In press. Cited 0 times; IF = 3.571; Rank 20 out of 125 radiology, nuclear medicine & medical imaging.
2. Hasan KM\*, Mwangi B, Cao B, Keser Z, **Tustison NJ**, Kochunov P, Frye RE, Savatic M, Soares J. Entorhinal cortex thickness across the human lifespan. *J of Neuroimaging*, 26(3) :278-82, May 2016. Cited 0 times; IF = 1.734; Rank 128 out of 192 clinical neurology, 12 out of 14 neuroimaging, and 65 out of 125 radiology, nuclear medicine & medical imaging.

The entorhinal cortical thickness measures for the well-known ADNI data set were provided by Dr. Tustison.

1. Pustina DP\*, Coslett BH, Turkeltaub PE, **Tustison N**, Schwartz MF, and Avants B. Automated segmentation of chronic stroke lesions using LINDA: Lesion Identification with Neighborhood Data Analysis, *Hum Brain Mapp*, 37(4) :1405-21, April 2016. Cited 0 times; IF = 5.969; Rank 2 out of 14 neuroimaging, 27 out of 252 neurosciences, 5 out of 125 radiology, nuclear medicine & medical imaging.

The core machine learning framework was written by Dr. Tustison and enhanced for lesion application.

1. Altes TA, Mugler JP, III, Ruppert K, **Tustison NJ**, Gersbach J, Szentpetery S, Meyer CH, de Lange EE, and Teague WG\*. Clinical Correlates of Lung Ventilation in Asthmatic Children. *J Allergy Clin Immun*, 137(3) :789-796, Mar 2016. Cited 0 times; IF = 11.476; Rank 1 out of 24 allergy, 6 out of 148 immunology.

Dr. Tustison provided the image analysis techniques for quantifying ventilation.

1. Qing K, Altes TA, **Tustison NJ**, Feng X, Chen X, Mata JF, Miller GW, de Lange EE, Tobias WA, Cates GD, Jr., Brookeman JR, Mugler JP, III\*. Rapid Acquisition of Helium-3 and Proton 3D Image Sets of the Human Lung in a Single Breath-hold using Compressed Sensing. *Magn Reson Med*, 74(4):1110-5, October 2015. Cited 1 time; IF = 3.571; Rank 20 out of 125 radiology, nuclear medicine & medical imaging.

Dr. Tustison provided the image analysis techniques for quantifying ventilation.

1. Menze BH\*, Jakab A, Bauer S, Kalpathy-Cramer J, Farahani K, Kirby J, Burren Y, Porz N, Slotboom J, Wiest R, Lanczi L, Gerstner E, Weber M-A, Arbel T, Avants BB, Ayache N, Buendia P, Collins DL, Cordier N, Corso JJ, Criminisi A, Das T, Delingete H, Demiralp C, Durst CR, Dojat M, Doyle S, Festa J, Forbes F, Geremia E, Glocker B, Golland P, Guo X, Hamamci A, Iftekharuddin KM, Jena R, John NM, Konukoglu E, Lashkari D, Mariz JA, Meier R, Pereira S, Precup D, Price SJ, Riklin-Raviv T, Reza SMS, Ryan M, Schwartz L, Shin H-C, Shotton J, Silva CA, Sousa N, Subbanna NK, Szekely G, Taylor TJ, Thomas OM, **Tustison NJ**, Unal G, Vasseur F, Wintermark M, Ye DH, Zhao L, Zhao B, Zikic D, Prastawa M, Reyes M, and Leemput KV. The Multimodal Brain Tumor Image Segmentation Benchmark (BRATS). *IEEE Trans Med Imaging*, 34(10):1993-2024, October 2015. Cited 96 times; IF = 3.390; Rank 5 out of 100 computer science, interdisciplinary applications, 12 out of 76 biomedical engineering, 18 out of 249 electrical & electronic engineering, 3 out of 24 imaging science & photographic technology, 21 out of 125 radiology, nuclear medicine & medical imaging.

This manuscript details automated brain tumor segmentation competitions for the years 2012 and 2013. Dr. Tustison competed in and won the competition in 2013.

1. Roberts JM, **Tustison N**, Stone J,Avants B, Cook P, Yassa MA. Entorhinal cortical thickness, ApoE4 status, and cognitive decline in ADNI participants. *Alzheimers Dement,* 11(7), Supplement, Page P35, July 2015. Cited 0 times ; IF = 12.407; Rank 3 out of 192 clinical neurology.
2. Durst CR\*, Michael N, **Tustison NJ**, Patrie JT, Raghavan P, Wintermark M, Velan SS. Noninvasive Evaluation of the Regional Variations of GABA using Magnetic Resonance Spectroscopy at 3 Tesla. *Magn Reson Imaging*, 33(5):611-7, June 2015. Cited 1 time; IF = 2.090; Rank 49 out of 125 radiology, nuclear medicine & medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. **Tustison NJ\***, Shrinhidi KL, Wintermark M, Durst CR, Kandel BM, Gee JC, Grossman MC, and Avants BB. Optimal symmetric multimodal templates and concatenated random forests for supervised brain tumor segmentation (simplified) with ANTsR. *Neuroinformatics*, 13(2):209-225, April 2015. Cited 10 times; IF = 2.825; Rank 13 out of 102 computer science, interdisciplinary applications, 124 out of 252 neurosciences.
2. Avants BB\*, Johnson HJ, **Tustison NJ**. Neuroinformatics and The Insight ToolKit. *Front Neuroinform,* 9:5, March 2015. Cited 1 time; IF = 3.261; Rank 8 out of 57 mathematical and computational biology, 105 out of 252 neurosciences.

This is an opinion piece introducing a special issue all the co-authors co-edited.

1. Avants B\*, Duda J, Kilroy E, Jann K, Kandel B, Yan L, Jog M, **Tustison N**, Smith R, Wang Y, Krasileva K, Rapretto M, and Wang D. The Pediatric Template of Brain Perfusion, *Scientific Data*, February 2015. Cited 3 times (new journal).

The ANTs software library, written by Drs. Avants and Tustison, was used to provide the quantitative image measures.

1. Xin Y, Song G, Cereda M, Kadlecek S, Hamedani H, Jiang Y, Rajaei J, Clapp J, Profka H, Meeder N, Wu J, **Tustison N**, Gee J, and Rizi R\*. Semi-Automatic Segmentation of Longitudinal Computed Tomography Images in a Rat Model of Lung Injury by Surfactant Depletion. *J Appl Physiol,* 118(3):377-85, February 2015. Cited 2 times; IF = 3.056; Rank 26 out of 83 physiology, 8 out of 81 sport sciences.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. Yoder JH, Peloquin JM, Song G, **Tustison NJ**, Moon SM, Wright AC, Vresilovic EJ, Gee JC, and Elliott DM\*. Internal Human Intervertebral Disc 3D Strains Under Axial Compression Quantified Non-invasively with MRI and Image Registration. *J Biomech Eng-T ASME*, 136(11), Nov 2014. Cited 7 times; IF = 1.780; Rank 51 out of 73 biophysics, 37 out of 76 biomedical engineering.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. **Tustison NJ\***, Cook PA, Klein A, Song G, Das SR, Duda JT, Kandel BM, van Strien N, Stone JR, Gee JC, and Avants BB. Large-Scale Evaluation of ANTs and FreeSurfer Cortical Thickness Measurements. *NeuroImage*, 99:166-179, Oct 2014. Cited 28 times; IF = 6.357; Rank 1 out of 14 neuroimaging, 24 out of 252 neurosciences, 3 out of 125 radiology, nuclear medicine & medical imaging.
2. Said N, Elias WE, Raghavan P, Cupino A, **Tustison N**, Frysinger R, Patrie J, Xin W, and Wintermark M\*. Correlation of Diffusion Tensor Tractography and Intraoperative Macro-Stimulation during Deep Brain Stimulation for Parkinson's Disease. *J Neurosurg,* 25:1-7, July 2014. Cited 3 times; IF = 3.737; Rank 39 out of 192 clinical neurology, 20 out of 198 surgery.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. Wintermark M\*, **Tustison NJ**, Patrie JT, Xin W, Demartini N, Eames M, Sumer S, Lau B, Cupino A, Snell J, Hananel A, Kassell N, and Aubry JF. T1-weighted MRI as a substitute to CT for refocusing planning in MR-guided focused ultrasound. *Phys Med Biol*, 59(13):3599-614, July 2014. Cited 2 times; IF = 2.761; Rank 21 out of 76 biomedical engineering, 34 out of 125 radiology, nuclear medicine and medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. Wintermark M\*, Huss DS, Shah BB, **Tustison N**, Druzgal TJ, Kassell N, and Elias J. Thalamic Connectivity in Patients with Essential Tremor Treated with MR Imaging-guided Focused Ultrasound: In Vivo Fiber Tracking by Using Diffusion-Tensor MR Imaging. *Radiology*, 272(1):202-9, July 2014. Cited 5 times; IF = 6.867; Rank 2 out of 125 radiology, nuclear medicine and medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. **Tustison NJ\***, Avants BB, Cook PA, Kim J, Whyte J, Gee JC, and Stone JR. Logical Circularity in voxel-based analysis: normalization strategy may induce statistical bias. *Hum Brain Mapp*, 35:745-759, March 2014. Cited 18 times; IF = 5.969; Rank 2 out of 14 neuroimaging, 27 out of 252 neurosciences, 5 out of 125 radiology, nuclear medicine & medical imaging.
2. Durst CR, Raghavan P, Shaffrey ME, Schiff D, Lopes MB, Sheehan JP, **Tustison NJ**, Patrie JT, Xin W, Elias WJ, Liu KC, Helm GA, Cupino A, and Wintermark M. Multimodal MR imaging model to predict tumor infiltration in patients with gliomas. *Neuroradiology*, 56(2):107-115, February 2014. Cited 7 times; IF = 2.485; Rank 80 out of 192 clinical neurology, 7 out of 14 neuroimaging, 41 out of 125 radiology, nuclear medicine and medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. **Tustison NJ\*** and Avants BB. Explicit B-spline regularization in diffeomorphic image registration. *Front Neuroinform*, 7:39, 2013. Cited 18 times; IF = 3.261; Rank 8 out of 57 mathematical & computational biology, 105 out of 252 neurosciences.
2. **Tustison NJ\*,** Johnson HJ, Rohlfing T, Klein A, Ghosh SS, Ibanez L, and Avants BB. Instrumentation bias in the use and evaluation of scientific software: recommendations for reproducible practices in the computational sciences. *Front Neurosci,* 7:162, 2013. Cited 11 times; IF = 3.656; Rank 82 out of 252 neurosciences.
3. Song G\*, Barbosa JR EM, **Tustison NJ**, Gefter WB, Kreider M, Gee JC, and Torigian DA. A Comparative Study of HRCT Image Metrics and PFT Values for Characterization of ILD and COPD. *Acad Radiol*, 19(7):857–64, July 2012. Cited 5 times; IF = 1.751; Rank 63 out of 125 radiology, nuclear medicine and medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. Yilmaz C, **Tustison NJ**, Dane DM, Ravikumar P, Takahashi M, Gee JC, and Hsia CCW. Functional computed tomography: Progressive adaptation in regional mechanics following extensive lung resection, *J Appl Physiol*, 111(4):1150–8, October 2011. Cited 8 times; IF = 3.056; Rank 26 out of 83 physiology, 8 out of 81 sport sciences.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. Avants BB\*†, **Tustison NJ**†, Wu J, Cook PA, and Gee JC. An Open Source Framework for n-Tissue Segmentation with Evaluation on Public Data, *Neuroinformatics*, 9(4):381– 400, December 2011. †Joint first authorship. Cited 80 times; IF = 2.825; Rank 13 out of 102 computer science, interdisciplinary applications, 124 out of 252 neurosciences.
2. Murphy K\*, van Ginneken B, Reinhardt JM, Kabus S, Ding K, Deng X, Cao K, Du K, Christensen GE, Garcia V, Vercauteren T, Ayache N, Commowick O, Malandain G, Glocker B, Paragios N, Navab N, Gorbunova V, Sporring J, de Bruijne M, Han X, Heinrich MP, Schnabel JA, Jenkinson M, Lorenz C, Modat M, McClelland JR, Ourselin S, Muenzing SEA, Viergever MA, De Nigris D, Collins DL, Arbel T, Peroni M, Li R, Sharp GE, Schmidt-Richberg A, Ehrhardt J, Werner R, Smeets D, Loeckx D, Song G, **Tustison N**, Avants B, Gee JC, Staring M, Klein S, Stoel BC, Urschler M, Werlberger M, Vandemeulebroucke J, Rit S, Sarrut D, and Pluim JPW. Evaluation of Registration Methods on Thoracic CT: The EMPIRE10 Challenge, *IEEE Trans Med Imaging*, 30(11):1901–20, November 2011. Cited 177 times; IF = 3.390; Rank 5 out of 100 computer science, interdisciplinary applications, 12 out of 76 biomedical engineering, 18 out of 249 electrical & electronic engineering, 3 out of 24 imaging science & photographic technology, 21 out of 125 radiology, nuclear medicine & medical imaging.

This manuscript details a lung registration challenge occurring in 2010. Dr. Tustison’s team competed in and won the competition.

1. **Tustison NJ\***, Avants BB, Altes TA, de Lange EE, Mugler III JP, and Gee JC. Ventilation-Based Segmentation of the Lungs Using Hyperpolarized 3He MRI, *J Magn Reson Imaging*, 34(4):831–841, October 2011. Cited 21 times; IF = 3.210; Rank 23 out of 125 radiology, nuclear medicine and medical imaging.
2. Barbosa Jr EM\*, Song G, **Tustison N**, Kreider M, Gee JC, Gefter W, and Torigian DA. Computational Analysis of Thoracic Multidetector Row HRCT for Segmentation and Quantification of Small Airway Air Trapping and Emphysema in Obstructive Pulmonary Disease, *Acad Radiol*, 18(10):1258-1269, October 2011. Cited 20 times; IF = 1.751; Rank 63 out of 125 radiology, nuclear medicine and medical imaging.

The ANTs software library, written by Dr. Tustison, was used to provide the quantitative image measures.

1. **Tustison NJ\***, Avants BB, Siqueira M, and Gee JC. Topological Well-Composedness and Glamorous Glue: A Digital Gluing Algorithm for Topologically Constrained Level Set Segmentation, *IEEE T Image Process*, 20(6):1756-1771, June 2011. Cited 4 times; IF = 3.625; Rank 12 out of 123 computer science, artificial intelligence, 14 out of 249 electrical and electronic engineering.
2. **Tustison NJ\***, Cook TS, Song G, and Gee JC. Pulmonary Kinematics from Image Data—A Review, *Acad Radiol*, 18(4):402–417, April 2011. Cited 15 times; IF = 1.751; Rank 63 out of 125 radiology, nuclear medicine and medical imaging.
3. **Tustison NJ\***, Awate SP, Song G, Cook TS, and Gee JC. Point Set Registration Using Havrda-Charvat-Tsallis Entropy Measures. *IEEE Trans Med Imaging*, 30(2):451–460, February 2011. Cited 15 times; IF = 3.390; Rank 5 out of 100 computer science, interdisciplinary applications, 12 out of 76 biomedical engineering, 18 out of 249 electrical & electronic engineering, 3 out of 24 imaging science & photographic technology, 21 out of 125 radiology, nuclear medicine & medical imaging.
4. Avants BB\*, **Tustison NJ**, Song G, Cook PA, Klein A, and Gee JC. A Reproducible Evaluation of ANTs Similarity Metric Performance in Brain Image Registration, *NeuroImage*, 54(3):2033–2044, February 2011. Cited 370 times; IF = 6.357; Rank 1 out of 14 neuroimaging, 24 out of 252 neurosciences, 3 out of 125 radiology, nuclear medicine & medical imaging.

Drs. Avants and Tustison jointly performed the evaluation.

1. **Tustison NJ\***, Avants BB, Cook PA, Egan A, Zheng Y, Yushkevich PA, and Gee JC. N4ITK: Improved N3 Bias Correction, *IEEE Trans Med Imaging*, 29(6):1310–1320, June 2010. Cited 305 times; IF = 3.390; Rank 5 out of 100 computer science, interdisciplinary applications, 12 out of 76 biomedical engineering, 18 out of 249 electrical & electronic engineering, 3 out of 24 imaging science & photographic technology, 21 out of 125 radiology, nuclear medicine & medical imaging.
2. **Tustison NJ\***, Altes TA, Song G, de Lange EE, Mugler III JP, and Gee JC. Feature Analysis of Hyperpolarized Helium-3 Pulmonary MRI: A Study of Asthmatics versus Non-Asthmatics, *Magn Reson Med*, 63(6):1448–1455, June 2010. Cited 32 times; IF = 3.571; Rank 20 out of 125 radiology, nuclear medicine & medical imaging.
3. **Tustison NJ\***, Awate SP, Cai J, Altes TA, Miller GW, de Lange EE, Mugler III JP, and Gee JC. Pulmonary Kinematics from Tagged Hyperpolarized Helium-3 MRI, *J Magn Reson Imaging*, 31(5):1236–1241, May 2010. Cited 13 times; IF = 3.210; Rank 23 out of 125 radiology, nuclear medicine and medical imaging.
4. **Tustison NJ\***, Avants BB, and Gee JC. Directly manipulated free-form deformation image registration. *IEEE T Image Process,* 18(3):624–35, March 2009. Cited 50 times; IF = 3.625; Rank 12 out of 123 computer science, artificial intelligence, 14 out of 249 electrical and electronic engineering.
5. Siqueira M\*, Latecki LJ, **Tustison N**, Gallier J, and Gee J. Topological Repairing of 3D Digital Images. *J Math Imaging Vis,* 30(3):249–274, March 2008. Cited 21 times; IF = 1.552; Rank 54 out of 123 computer science, artificial intelligence, 23 out of 104 computer science, software engineering, 34 out of 257 applied mathematics.

Dr. Tustison implemented the topological repairing algorithm and ran the evaluation.

1. **Tustison NJ** and Amini AA\*. Biventricular myocardial strains via nonrigid registration of anatomical NURBS model. *IEEE Trans Med Imaging* 25(1):94–112, January 2006. Cited 38 times; IF = 3.390; Rank 5 out of 100 computer science, interdisciplinary applications, 12 out of 76 biomedical engineering, 18 out of 249 electrical & electronic engineering, 3 out of 24 imaging science & photographic technology, 21 out of 125 radiology, nuclear medicine & medical imaging.
2. **Tustison NJ** and Amini AA\*. Myocardial kinematics from tagged MRI based on a 4-D B- spline model. *IEEE T Bio-med Eng,* 50(8):1038–1040, August 2003. Cited 31 times; IF = 2.348; Rank 28 out of 76 biomedical engineering.
3. Hagspiel KD\*, Altes TA, Mugler III JP, Mata JF, **Tustison NJ**, and Brookeman JR. MR virtual colonography using hyperpolarized 3He as an endoluminal contrast agent: demonstration of feasibility. *Magn Reson Med,* 44(5):813, November 2000. Cited 16 times; IF = 3.571; Rank 20 out of 125 radiology, nuclear medicine & medical imaging.

Dr. Tustison ran the software to perform the evaluation.

**B. Books and/or Chapters**

1. **Tustison NJ**, Amini AA: Analysis of 4-D Cardiac MR Data with NURBS Deformable Models: Temporal Fitting Strategy and Nonrigid Registration. Parametric and Geometric Deformable Models: An Application in Biomaterials and Medical Imagery. Jasjit S. Suri and Aly Farag (eds.). Springer Publishers, II, May 2007.

**C. Short Communications**

1. **Tustison NJ**, Avants BB: The TVDMFFDVR Algorithm, Insight Journal 2012, http: //hdl.handle.net/10380/3334.
2. **Tustison NJ**, Cook PA, Avants BB, Stone JR: Simulated Diffusion-Weighted Imaging for the ITK Masses, Insight Journal 2011, <http://hdl.handle.net/10380/3315>.
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9. **Tustison NJ**, Gee JC: Stochastic Fractal Dimension Image, Insight Journal 2009, http://hdl.handle.net/1926/1525 (accepted into the Insight Toolkit), Publication of the Month April 2009.
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**D. Abstracts and Conference Proceedings**

1. Qing K, Mehrad B, Mugler JP, Ruppert K, Mata JF, Tustison NJ, Guan S, Shim YM, Ruset IC, Hersman FW, Altes TA. Assessing Functional Changes in Lungs with Idiopathic Pulmonary Fibrosis using Hyperpolarized Xenon-129 MRI. In Proceedings of the 24th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Singapore, 2016.
2. Qing K, Shim YM, **Tustison NJ**, Altes TA, Ruppert K, Mata JF, Mehrad B, Miller GW, Guan S, Ruset IC, Hersman FW, Mugler JP. Hyperpolarized Xenon-129 MRI: A New Tool To Evaluate COPD. American Thoracic Society International Conference, May 2016.
3. **Tustison N**, Yang Y, Salerno. Advanced Normalization Tools for Cardiac Motion Correction. Statistical Atlases and Computational Models of the Heart - Imaging and Modelling Challenges - 5th International Workshop, STACOM 2014, Held in Conjunction with MICCAI 2014, Boston, MA, USA, September 18, 2014. Lecture Notes in Computer Science 8896, Springer 2015.
4. Durst C, Raghavan P, **Tustison N**, Patrie, J, Cupino A, Xin W, Wintermark M. Mul- tiparametric Imaging Model to Accurately Predict Extent of Invasion of High-Grade Gliomas. ASNR Scientific Paper (Oral), 2013.
5. **Tustison NJ**, Muratore A, Contrella B, Mugler III JP, de Lange EE, and Altes TA. Voxelwise Comparison of Hyperpolarized He-3 and Xe-129 Lung Ventilation MR Imaging in Cystic Fibrosis. In Proceedings of the 21st Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Salt Lake City, 2013.
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8. **Tustison NJ**, Contrella B, Altes TA, Avants BB, de Lange EE, Mugler III JP: Longitudinal assessment of treatment effects on pulmonary ventilation using 1H/3He MRI multivariate templates. In: SPIE Medical Imaging: Biomedical Applications in Molecular, Structural, and Functional Imaging. Orlando 2013.
9. **Tustison NJ**, Avants BB, Cook PA, Gee JC, Stone JR: Statistical Bias in Optimized VBM. In: SPIE Medical Imaging: Biomedical Applications in Molecular, Structural, and Functional Imaging. Orlando 2013.
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11. Avants BB, **Tustison NJ**, Song G, Wu B, Stauffer M, McCormick MM, Johnson HJ, Gee JC, Insight Software Consortium: A Unified Image Registration Framework for ITK4. In: Proceedings of the Workshop on Biomedical Image Registration. Nashville 2012.
12. Stone JR and **Tustison NJ**. Understanding the Inside of the Black Box: Optimizing Approaches for the Analysis of Diffusion Tensor Imaging and Cortical Maps in TBI. *Keystone Conference: Clinical and Molecular Biology of Acute and Chronic Traumatic Encephalopathies,* 2012*.*
13. Qing K, Altes TA, Tustison NJ, Mata JF, Miller GW, de Lange EE, Tobias WA, Cates GD, Brookeman JR, Mugler JP. Quantitative Assessment of Compressed-Sensing Reconstruction Fidelity for 3D He-3 and H-1 Acquisitions in One Breath-hold. In Proceedings of the 20th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Melbourne, 2012.
14. Contrella B, **Tustison NJ**, Altes TA, Avants BB, Mugler III JP, de Lange EE: 4D seg- mentation and normalization of 3He MR images for intra-subject assessment of ventilated lung volumes. In: SPIE Medical Imaging: Biomedical Applications in Molecular, Structural, and Functional Imaging. San Diego 2012.
15. Zheng Y, Keller B, Wang Y, **Tustison N**, Song G, Bakic PR, Maidment AD, Conant EF, Gee JC, Kontos D: A Fully-Automated Software Pipeline for Parenchymal Pattern Analysis in Digital Breast Images: Towards the Translation of Imaging Biomarkers in Routine Breast Cancer Risk Assessment. In: The Quantitative Imaging Reading Room Showcase at RSNA 2011 Annual Meeting and Scientific Assembly, Chicago 2011.
16. **Tustison NJ**, Avants BB, Cook P, Kim J, Whyte J, Gee JC, Ahlers S, Stone J: Multivari- ate Analysis of Diffusion Tensor Imaging and Cortical Thickness Maps in a Traumatic Brain Injury (TBI) Cohort Using Advanced Normalization Tools (ANTs). In: Proceedings of the 2011 annual meeting of the National Neurotrauma Society, Fort Lauderdale, 2011.
17. Qing K, Altes TA, **Tustison NJ**, Mata JF, Miller GW, de Lange EE, Tobias WA, Cates GD, Brookeman JR, Mugler JP: Acquisition of Spatially-registered Helium-3 and Proton 3D Image Sets of the Lung in less than 10 seconds using Compressed Sensing. In Proceedings of the 19th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Montreal, 2011.
18. **Tustison NJ**, Avants BB, Flors L, Altes TA, de Lange EE, Mugler II JP, Gee JC: Seg- mentation of Lung Ventilation Defects Using Hyperpolarized 3 He MRI. In: Proceedings of the 2011 International Functional Pulmonary Imaging Workshop, Philadelphia, 2011.
19. **Tustison NJ**, Avants BB, Flors L, Altes TA, de Lange EE, Mugler II JP, Gee JC: Ventilation-Based Segmentation of the Lungs Using Hyperpolarized Helium-3 MRI. In: Joint Meeting combining The 3rd meeting of the Japanese Society of Pulmonary Functional Imaging and 5th International Workshop for Pulmonary Functional Imag- ing, Hyogo, 2011.
20. Hsia CCW, Yilmaz C, **Tustison NJ**, Dane DM, Ravikumark P, Takahashi M, Gee JC: Non-invasive measurement of regional mechanical strain and shear following extensive lung resection by high-resolution computed tomography (HRCT). In: Proceedings of the American Thoracic Society International Conference, Denver, 2011.
21. Song G, **Tustison NJ**, Avants BB, Gee JC: Lung CT Image Registration Using Dif- feomorphic Transformation Models. In: Proceedings of the Pulmonary Image Registration (EMPIRE) Grand Challenge organized by the 13th International Conference on Medical Image Computing and Computer Assisted Intervention, Beijing, 2010.
22. **Tustison NJ**, Avants BB, Altes TA, Mugler II JP, Gee JC: Automatic Segmentation of Ventilation Defects in Hyperpolarized 3He MRI. In: Proceedings of the Annual Meeting of the Biomedical Engineering Society, Austin, 2010.
23. Avants B, Cook PA, McMillan C, Grossman M, **Tustison NJ**, Zheng Y, Gee JC: Sparse Unbiased Analysis of Anatomical Variance in Longitudinal Imaging. In: Proceedings of the Medical Image Computing and Computer Assisted Intervention Society (MICCAI), Beijing, 2010.
24. Avants B, Klein A, **Tustison N**, Woo J, Gee J: Evaluation of an Open-Access, Auto- mated Brain Extraction Method on Multi-Site Multi-Disorder Data. In: Proceedings of the 16th Annual Meeting of the Organization for Human Brain Mapping (HBM), Barcelona, 2010.
25. Wright AC, Yoder J, **Tustison N**, Gee J, Wehrli FW, Elliot DM: High-Resolution MRI at 7T of Local Strains in the Intervertebral Disc. In: Proceedings of the 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Stockholm, 2010.
26. **Tustison NJ**, Altes TA, Miller GW, de Lange EE, Mugler JP, Gee JC: Retrospective Bias Correction of Hyperpolarized 3He MRI of the Lung. In: Proceedings of the 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Stockholm, 2010.
27. **Tustison NJ**, Altes TA, Song G, de Lange EE, Mugler JP, Gee JC: Hyperpolarized 3He Image Feature Analysis in Asthmatics. In: Proceedings of the 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Stockholm, 2010.
28. **Tustison NJ**, Avants BB, Cook P, Gee J: N4ITK: Improved N3 Bias Correction with Robust B-Spline Approximation. In: Proceedings of the 7th Annual IEEE International Symposium on Biomedical Imaging: From Nano to Macro (ISBI), Rotterdam, 2010.
29. Tustison NJ, Altes TA, Song G, Mugler JP, de Lange EE, Gee JC: Feature Analysis of Hyperpolarized Helium-3 Pulmonary MRI in Asthmatics versus Non-Asthmatics. In: Proceedings of the 2nd International Workshop on Pulmonary Image Analysis, London, 2009.
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31. Song G, **Tustison NJ**, Barbosa Jr E, Gee JC, Gefter W, Kreider M, Torigian DA: A Comparative Study of HRCT Image Metrics and PFT Values for Characterization of ILD and COPD. In: Proceedings of the 2nd International Workshop on Pulmonary Image Analysis, London, 2009.
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33. Cook T, Barbosa E, **Tustison N**, Song G, Torigian D, Koo C, Gefter W, Gee J: Quantitation of Pulmonary Alveolar Proteinosis, Pre- and Post-Lavage: A Feasibility Study. In: Proceedings of the 2nd World Congress of Thoracic Imaging and Diagnosis in Chest Disease, Valencia, 2009.
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36. **Tustison NJ**, Kotzer CJ, Logan GA, Podolin PL, Altes TA, Wright AP, Song G, Zhao H, Haczku A, Barnette MS, Panettieri Jr RA, Gee JC: Detection of elastase induced emphysema in free-breathing mice using micro computed tomography (CT). In: Proceedings of the Annual International Conference of the American Thoracic Society, Toronto, 2008.
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38. **Tustison N**, Awate SP, Cai J, Altes T, Miller G, Lange E, Mugler J, Gee JC: Point-set registration of tagged He-3 images using a structurally-based Jensen-Shannon divergence measure within a deterministic-annealing framework. In: Proceedings of the 5th Annual IEEE International Symposium on Biomedical Imaging: From Nano to Macro (ISBI), pp. 772–775, Paris, 2008.
39. **Tustison NJ**, Altes TA, Gee JC, Cai J, de Lange EE, Mugler III JP: Pulmonary Kinematics From Hyperpolarized Helium-3 Tagged Magnetic Resonance Imaging. In: Proceedings of the 4th Annual IEEE International Symposium on Biomedical Imaging: From Nano to Macro (ISBI), pp. 368–371, Washington D.C., 2007.
40. Cook TS, **Tustison N**, Biederer J, Tetzlaff R, Gee J: How do registration parameters affect quantitation of lung kinematics? In: Proceedings of the 10th International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 10(Pt 1):817–24, 2007.
41. **Tustison NJ**, Avants BB, Gee JC: Improved FFD B-Spline Image Registration. Proceedings of the 11th Biennial IEEE International Conference on Computer Vision (ICCV), pp. 1–8, Rio de Janeiro, 2007.
42. **Tustison NJ**, Gee, JC: Generalized *n*-D *Ck* B-spline scattered data approximation with confidence values. Proceedings of the 3rd International Workshop on Medical Imaging and Augmented Reality (MIAR), pp. 76–83, Shanghai, 2006.
43. **Tustison NJ**, Avants BB, Sundaram TA, Duda JT, Gee JC: A Generalization of Free-Form Deformation Image Registration Within the ITK Finite Element Frame- work. Proceedings of the 3rd International Workshop on Biomedical Image Registration (WBIR), pp. 238–246, Utrecht, 2006.
44. Song Z, **Tustison NJ**, Avants BB, Gee JC: Adaptive graph cuts with tissue priors for brain MRI segmentation. In: Proceedings of the 3rd Annual IEEE International Symposium on Biomedical Imaging: From Nano to Macro (ISBI), pp. 762–765, Arlington, 2006.
45. Chen J, **Tustison NJ**, Amini AA: Accurate recovery of 4D left ventricular deformations using volumetric B-splines incorporating phase based displacement estimates. In: Proceedings of SPIE: Medical Imaging 2006: Physiology, Function, and Structure from Medical Images, 6143, San Diego, 2006.
46. **Tustison NJ**, Amini AA: Comparison of parallel and spiral tagged MR imaging geometries in estimation of 3D myocardial strains. In: Proceedings of SPIE: Medical Imaging

2005: Physiology, Function, and Structure from Medical Images, 5746:571–579, San Diego, 2005.

1. **Tustison NJ**, Amini AA: Lagrangian and Eulerian biventricular strains from anatomical NURBS models using tagged MRI. In: Proceedings of SPIE: Medical Imaging 2006: Physiology, Function, and Structure from Medical Images, 5746:192–204, San Diego, 2005.
2. **Tustison, NJ**, Abendschein D, Amini AA: Biventricular myocardial kinematics based on tagged MRI from anatomical NURBS models. In: Proceedings of the IEEE Computer Vision and Pattern Recognition (CVPR), 2:514, Quebec City, 2004.
3. **Tustison NJ**, Amini AA: Myocardial Kinematics Based on Tagged MRI From Geometric Deformable Models. Proceedings of SPIE: Medical Imaging 2006: Physiology, Function, and Structure from Medical Images, 5369:22-33, San Diego, 2004.
4. **Tustison NJ**, Amini AA: Tracking Myocardial Beads from SPAMM-MRI with a 4-D B- Spline Model. In: Proceedings of the 2nd Joint EMBS/BMES Conference, pp. 993–994, Houston, 2002.
5. **Tustison NJ**, Abendschein D, Davila-Roman VG, Amini AA: Myocardial Strain Imaging with Tagged MRI. In: Proceedings of the 16th International Conference on Pattern Recognition (ICPR), 1:723–726, Quebec City, 2002.
6. Cooley B, Acton ST, Salerno M, Brookeman JR, **Tustison NJ**, de Lange EE, Altes TA: Automated Scoring of Hyperpolarized Helium-3 MR Lung Ventilation Images: Initial Development and Validation. In: Proceedings of the 11th annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Honolulu, 2002.
7. **Tustison NJ**, Yablonskiy D, Conradi M, Amini AA: Deformable Registration of 3HeMR and X-ray CT images of the lungs. In: Proceedings of the 11th annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Honolulu, 2002.
8. Spellman MJ, Hagspiel KD, Altes TA, Mugler III JP, Mata JF, **Tustison NJ**, Brookeman JR: MR Virtual Colonoscopy using Hyperpolarized 3He as an Endoluminal Contrast Agent. In: Proceedings of the 8th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM), Philadelphia, 1999.
9. Invited Lectures and Symposiums

Oct. 2014 *Logical Circularity in Voxel-Based Analysis*, Laboratory of

Neuroimaging, University of Southern California, Los Angeles, USA.

Sep. 2013 *Big × (Science + ~~Data~~Imaging) @ UVA*, School of Medicine Retreat,

University of Virginia, Chralottesville, VA, USA.

Apr. 2012 *Computational Image Analysis of TBI*, Department of Physical Medicine

and Rehabilitation, University of Virginia, Charlottesville, USA.

Dec. 2011 *Logical Circularity in Voxel-Based Analysis*, University of Iowa, Iowa City, USA.

Nov. 2010 *Computational Tools for the Xbox 360 Generational Radiologist*, Department of Radiology and Medical Imaging, University of Virginia, Charlottesville, USA.

1. Financial Resources (Grants and Contracts)

Sponsor: NASA/Medical University of South Carolina

Title: Human Cerebral Vascular Autoregulation and Venous Outflow In

Response to Microgravity-Induced Cephalad Fluid Redistribution

Role: Co-investigator

Period: 5/16/2013 – 5/15/2018

Sponsor: NIH-NHLBI

Title: Simultaneous Xe129 MRI of Regional Lung Ventilation and Gas Uptake

in COPD

Role: Co-investigator

Period: 7/1/2011 – 5/31/2016

Sponsor: The Geneva Foundation

Title: Brain Injury Biomarkers and Behavioral Characterization of mTBI in

Soldiers Following Repeated, Low-Level Blast Exposure

Role: Co-investigator

Period: 1/1/2013 – 5/31/2015

Sponsor: NIH-NHLBI

Title: Single-session bronchial thermoplasty for severe asthmatics guided by

Hxe MRI

Role: Principal investigator on UVa subcontract

Period: 9/1/2011 – 1/31/2015

Sponsor: NIH-NHLBI

Title: Regulatory Advancement of HXe as an MRI Contrast Agent

Role: Co-investigator

Period: 9/1/2011 – 1/31/2015

Sponsor: Novartis Pharmaceuticals Corp.

Title: Hyperpolarized noble-gas enhanced imaging of b2-agonist

pharmacodynamics and pharmacokinetics in mild to moderate asthma

Role: Co-investigator

Period: 10/15/2010 – 5/31/2014

Sponsor: Naval Medical Research Center

Title: Experineced Breacher Study

Role: Co-investigator – UVa subcontract

Period: 6/1/2012 – 5/30/2014

Sponsor: Vertex Pharmaceuticals, Inc.

Title: A Phase II, Single-Blind, Placebo-Controlled Crossover Study to Evaluate

the Effect of VX-770 on Hyperpolarized Helium-3 Magnetic Resonance

Imaging in Subjects with Cystic Fibrosis, the G551D Mutation and FEV1

≥40% Predicted

Role: Physicist

Period: 9/9/2010 – 9/8/2012

Sponsor: NIH-NLM

Title: Fundamental Refactoring of Deformable Image Registration in ITK with

Distributed Computing and GPU Acceleration

Role: Principle investigator of UVa subcontract

Period: 7/1/2011 – 6/30/2012