

## RICHARD CASTILLO, PhD

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### EDUCATION

#### 2007 - 2011:

The University of Texas Graduate School of Biomedical Sciences  
Degree Earned: Doctor of Philosophy  
Advisor: Thomas Guerrero, MD, PhD  
Thesis entitled: *Evaluation of Deformable Image Registration for Improved 4DCT-derived Ventilation for Image Guided Radiotherapy*

#### 2004 - 2007:

The University of Texas Graduate School of Biomedical Sciences  
Degree Earned: Master of Science  
Advisor: Thomas Guerrero, MD, PhD  
Thesis entitled: *CT-Based Pulmonary Compliance Imaging in Rodents*

#### 2000 - 2004:

Trinity University, San Antonio, TX  
Degree Earned: Bachelor of Science  
Major 1: Physics  
Major 2: Mathematics

#### 1996 - 2000:

Antonian College Preparatory High School, San Antonio, TX

### ACADEMIC APPOINTMENTS

#### Nov. 2011 – Present:

*Postdoctoral Fellow*  
Department of Radiation Oncology, The University of Texas M. D. Anderson Cancer Center

### RESEARCH & EMPLOYMENT OBJECTIVES

My research is primarily focused on the use of deformable image registration (DIR) in medical image analysis and functional lung imaging from computed tomography (CT). Deformable registration is a quickly developing

technology with many potential applications in diagnostic imaging and radiotherapy. My recent contributions in this area involve (1) investigation of quantitative/statistical methods for evaluation of DIR spatial accuracy for purposes of model validation, the development of acceptance testing protocols, and quality assurance in routine clinical application, and (2) the development of methods for utilizing DIR output to extract functional information from CT images, including quantitative pulmonary ventilation and perfusion, with application to both therapeutic and diagnostic settings.

My graduate training in medical physics combines clinical and research components in both radiation therapy and diagnostic imaging physics into a single educational framework, giving me strong confidence to thrive in academic, clinical, or industry setting.

## PROFESSIONAL ACTIVITIES & SERVICE

2011 – Present:

*Article referee* for peer-reviewed scientific publications in the journals:

- Journal of Applied Clinical Medical Physics
- Medical Image Analysis
- Medical Physics
- Signal, Image and Video Processing

Feb. 2009 – Present:

<http://www.DIR-lab.com>: *Website developer and manager of data sharing & technical support*. The DIR-Lab website makes publically available a repository of reference image data and image analysis software for quantitative clinical evaluation of deformable image registration. Over 130 research groups from around the world have registered, and regularly receive research and technical support. Registered users represent a cross-section of academic, commercial, and government interests, and come from various countries including the United States, Canada, the United Kingdom, France, Germany, Spain, The Netherlands, Australia, Thailand, and Japan.

Jan. 2010 – May 2010:

*Diagnostic Imaging Physics Clinical Rotation* at The University of Texas M. D. Anderson Cancer Center.

Clinical Instruction Supervisor: Charles Willis, PhD

Clinical Physics Training Including:

- Routine quality assurance protocols and measurements, with clinical observation in the following: *computed/digital radiography, computed tomography, mammography, angiography/fluoroscopy, ultrasound, magnetic resonance imaging, PET/SPECT, PACS, shielding, and film processing and monitor calibration*

Aug. 2007 – Dec. 2007:

*Radiation Therapy Physics Clinical Rotation* at The University of Texas M. D. Anderson Cancer Center.

Clinical Instruction Supervisor: Sam Beddar, PhD

Clinical Physics Training Including:

- Linear accelerator commissioning and acceptance testing
- Brachytherapy
- External beam radiation physics services: *thoracic, breast, genitourinary, and head and neck*

## ACADEMIC AWARDS & SCHOLARSHIPS

March 2012:

Recipient of the UT Graduate School of Biomedical Sciences 2012 Aaron Blanchard Award in Medical Physics

July 2011:

American Association of Physicists in Medicine (AAPM) Annual Meeting, Vancouver, British Columbia, *John R. Cunningham Young Investigator Competition Finalist\**

*\*Unable to participate in final competition due to illness*

April 2011:

Top 10 cited paper in the past 2 years in the journal *Physics in Medicine and Biology* - A framework for evaluation of deformable image registration spatial accuracy using large landmark point sets, **Castillo, R.**, Castillo, E., Guerra, R., Johnson, V. E., McPhail, T., Garg, A. K., Guerrero, T.

2008 - 2011:

National Institute of Health (NIH) Training Grant (T32CA119930)

May 2004:

Outstanding Graduating Senior, Department of Physics & Astronomy, Trinity University

## PENDING GRANT APPLICATIONS

- NIH Extramural Loan Repayment Award (LRP)
  - *A Robust Quality Control Framework for Clinical 4D CT Ventilation Imaging*
- NIH Ruth L. Kirschstein National Research Service Award (F32)
  - *Pulmonary Radiation Dose-Response using 4D CT-Ventilation and Post-Treatment PET*

## PEER-REVIEWED PUBLICATIONS

- Matthew McCurdy, **Richard Castillo**, Josue Martinez, Mohammad N Al Hallack, Jessica Lichter, Nicolas Zouain, Thomas Guerrero. [18F]-FDG Uptake Dose Response Correlates with Radiation Pneumonitis in Lung Cancer Patients. **ARTICLE IN PRESS: *Radiotherapy and Oncology***.
- **Richard Castillo**, Edward Castillo, Matthew R. McCurdy, Daniel R. Gomez, Alec M. Block, Derek Bergsma, Sarah Joy, Thomas Guerrero. Spatial correspondence of 4D CT ventilation and SPECT pulmonary perfusion defects in patients with malignant airway stenosis. *Physics in Medicine & Biology*, 57: 1855-1871, 2012.
- Yevgeniy Y. Vinogradskiy, **Richard Castillo**, Edward Castillo, Adam Chandler, Mary K. Martel, Thomas Guerrero. Use of Weekly 4DCT-based Ventilation Maps to Quantify Changes in Lung Function for Patients Undergoing Radiation Therapy. *Medical Physics*, 39: 289-298, 2012
- **Richard Castillo**, Edward Castillo, Josue Martinez, Thomas Guerrero. Ventilation from Four Dimensional Computed Tomography: Density versus Jacobian Methods. *Physics in Medicine & Biology*, 55: 4661-4685, 2010.

- Xuejun Gu, Hubert Pan, Yun Liang, **Richard Castillo**, Deshan Yang, Dongju Choi, Edward Castillo, Amitava Majumdar, Thomas Guerrero, Steve B. Jiang. Implementation and evaluation of various demons deformable image registration algorithms on GPU. *Physics in Medicine & Biology*, 55: 207-219, 2010.
- Edward Castillo, **Richard Castillo**, Josue Martinez, Maithili Shenoy, Thomas Guerrero. Four dimensional deformable image registration using trajectory modeling. *Physics in Medicine and Biology*, 55: 305-327, 2010.
- Edward Castillo, **Richard Castillo**, Yin Zhang, and Thomas Guerrero. Compressible image registration for thoracic computed tomography images. *Journal of Medical and Biomedical Engineering*, 29: 222-233, 2009.
- **Richard Castillo**, Edward Castillo, Rudy Guerra, Valen Johnson, Travis McPhail, Amit K. Garg, and Thomas Guerrero. A framework for evaluation of deformable image registration spatial accuracy using large landmark point sets. *Physics in Medicine and Biology*, 54: 1849-1870, 2009.
- Thomas Guerrero, **Richard Castillo**, Josue Noyola-Martinez, Mylin Torres, Xinhui Zhou, Rudy Guerra, Dianna Cody, Ritsuko Komaki, and Elizabeth Travis. Reduction of pulmonary compliance found with high-resolution computed tomography in irradiated mice. *International Journal of Radiation Oncology\*Biography\*Physics*, 67: 879-887, 2007.
- Thomas Guerrero, **Richard Castillo**, Kevin Sanders, Roger Price, Ritsuko Komaki, and Dianna Cody. Novel method to calculate pulmonary compliance images in rodents from computed tomography acquired at constant pressures. *Physics in Medicine and Biology*, 51: 1101-1112, 2006.
- Tinsu Pan, Osama Mawlawi, Sadek A. Nehmeh, Yusuf E. Erdi, Dershan Luo, Hui H. Liu, **Richard Castillo**, Radhe Mohan, Zhongxing Liao, and H. A. Macapinlac. Attenuation correction of PET images with respiration-averaged CT images in PET/CT. *The Journal of Nuclear Medicine*, 46: 1481-1487, 2005.

## MANUSCRIPTS IN REVIEW

- Matthew McCurdy, Derek P. Bergsma, Thomas Kim, Enid Choi, Edward Castillo, **Richard Castillo**, Eric Hyun, Thomas Guerrero. Radiation Pneumonitis and Anatomic Variation of <sup>18</sup>F-FDG PET Radiation Dose Response in Lung: A Retrospective Study. SUBMITTED: *International Journal of Radiation Oncology\*Biography\*Physics*.
- Ying Yuan, **Richard Castillo**, Thomas Guerrero, and Valen E. Johnson. Evaluation of Image Registration Spatial Accuracy Using a Bayesian Hierarchical Model. SUBMITTED: *Annals of Applied Statistics*.
- Alfredo E. Echeverria, Matthew R. McCurdy, **Richard Castillo**, Vincent Bernard, Natalia V. Ramos, William R. Buckley, Edward Castillo, Ping Liu, Eric D. Hyun, Thomas Guerrero. Proton therapy radiation pneumonitis local dose-response in esophagus cancer patients. SUBMITTED: *Radiotherapy and Oncology*.
- Edward Castillo, **Richard Castillo**, and Thomas Guerrero. Least median of squares filtering of locally optimal point matches for compressible flow image registration. SUBMITTED: *Physics in Medicine & Biology*.

- Lindsay Mathew, **Richard Castillo**, Edward Castillo, Brian Yaremko, George B. Rodrigues, Grace Parraga, Thomas Guerrero. Comparison of  $^3\text{He}$  Magnetic Resonance Imaging and Four-dimensional x-ray Computed Tomography Pulmonary Functional Imaging in Lung Cancer. SUBMITTED: *Medical Physics*.

## INVITED LECTURES

- London Regional Cancer Center, Thoracic Rounds, *Numerical Methods for Computing Ventilation from Thoracic CT*, September 2010.
- University of California San Diego, Pulmonology Group Seminar, *Quantifying Regional Ventilation using Computed Tomography: Applications in Diagnostic Imaging and Thoracic Radiotherapy*, June 2010.
- University of California San Diego, Department of Radiation Physics, *Evaluation of Deformable Image Registration for Improved 4D CT-Derived Ventilation Image Generation*, June 2009.
- University of Texas M. D. Anderson Cancer Center, Department of Radiation Physics, *Performance Evaluation of Deformable Image Registration*, January 2009.

## CONFERENCE ABSTRACTS & PRESENTATIONS

- Alfredo E Echeverria, Matthew McCurdy, **Richard Castillo**, Vincent Bernard, Natalia Velez-Ramos, William Buckley, Edward Castillo, Ping Liu, Eric Hyun, Thomas Guerrero. American Radium Society 94<sup>th</sup> Annual Meeting, Las Vegas, Nevada, *Radiation Pneumonitis: Proton Therapy Local Dose Response and Clinical Symptoms*. May 2012.
- Matthew R McCurdy, Vincent Bernard, Alfredo Echeverria, Natalia V Ramos, **Richard Castillo**, Edward Castillo, William Buckley, Derek Bergsma, Alec Block, Eric Hyun, Faisal Ahmed, Thomas Guerrero. American Radium Society 94<sup>th</sup> Annual Meeting, Las Vegas, Nevada, *Effect of End Range Protons on Metabolic Radiation Dose Response of the Lung*. May 2012.
- Enid Choi, Thomas Kim, Derek Bergsma, Matthew R McCurdy, **Richard Castillo**, Edward Castillo, Alec Block, Thomas Guerrero. American Radium Society 94<sup>th</sup> Annual Meeting, Las Vegas, Nevada, *Comparing Effects of Radiation Therapy on Upper versus Lower Lung Lobes*. May 2012.
- **Richard Castillo**, Edward Castillo, Daniel Gomez, Jose Lopez, and Thomas Guerrero. American Association of Physicists in Medicine (AAPM) Annual Meeting, Vancouver, British Columbia, John R. Cunningham Young Investigator Competition Finalist, *Spatial Correlation of 4DCT Ventilation and SPECT Pulmonary Perfusion Defects in Patients with Malignant Airway Stenosis*. July 2011.
- Yevgeney Vinogradskiy, **Richard Castillo**, Edward Castillo, Adam Chandler, Mary Martel, and Thomas Guerrero. American Association of Physicists in Medicine (AAPM) Annual Meeting, Vancouver, British Columbia, *Use of Weekly 4DCT-Based Ventilation Maps to Quantify Changes in Lung Function for Patients Undergoing Radiation Therapy*. July 2011.
- Matthew McCurdy, Mohamad Wazni, Josue Martinez, **Richard Castillo**, and Thomas Guerrero. American Association of Physicists in Medicine (AAPM) Annual Meeting, Vancouver, British Columbia,

*Post-Radiation Normalized FDG-PET Versus Radiation Dose Correlates with Radiation Pneumonitis Symptoms and the Nitric Oxide Ratio.* July 2011.

- **Richard Castillo**, Edward Castillo, Josue Martinez, and Thomas Guerrero. American Association of Physicists in Medicine (AAPM) Annual Meeting, Philadelphia, PA, *Ventilation from Four Dimensional Computed Tomography: Density versus Jacobian Methods.* July 2010.
- Matthew McCurdy, Maithili Shenoy, Josue Martinez, **Richard Castillo**, and Thomas Guerrero. American Radium Society (ARS) Annual Meeting, Cancun, Mexico, *Radiation Pneumonitis Response of the Upper versus Lower Lung Lobes,* May 2010.
- Thomas Guerrero, Matthew McCurdy, Ivorlyne Greene, Jan Pagilagan, and **Richard Castillo**. National Cancer Institute (NCI) Translational Science Annual Meeting, Vienna, Virginia, *Validation of the Pulmonary Metabolic Radiation Response as An Imaging Biomarker,* November 2009.
- Matthew McCurdy, Josue Martinez, **Richard Castillo**, Nicolas Zouain, and Thomas Guerrero. American Society for Therapeutic Radiology and Oncology (ASTRO) Annual Meeting, Chicago, IL, *Radiation Pneumonitis: Pulmonary Metabolic Response to Radiation in Lung Cancer Patients,* November 2009.
- **Richard Castillo**, Travis McPhail, Rudy Guerra, Edward Castillo, Joe Warren, Amit K. Garg, and Thomas Guerrero. ASTRO Annual Meeting, Boston, MA, *Interior Landmark Point Pairs Improve Deformable Image Registration Spatial Accuracy within the Lung,* September 2008.

#### **PROFESSIONAL AFFILIATIONS**

- American Association of Physicists in Medicine (AAPM), Student Member, 2009 – Present

#### **PERSONAL AFFILIATIONS**

- Crohn's & Colitis Foundation of America (CCFA), 2009 – Present