

# Doga Demirel

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## EDUCATION

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### University of Arkansas at Little Rock

Pursuing Doctor of Philosophy in Integrated Computing

Expected Graduation December 2018

### University of Central Arkansas

Master of Science in Applied Computing

August 2013-December 2015

### University of Arkansas at Little Rock

Bachelor of Science

**Major:** Computer Sciences

**Minor:** Mathematics

August 2009-May 2013

## RESEARCH INTERESTS

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Virtual Surgical Design and Development

Virtual Reality

Mixed Reality

Computer Graphics

Medical Simulations

Non-linear Optimization

Haptics

Data Analysis

Visualization

## ACADEMIC EXPERIENCE

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### Graduate Assistant at University of Arkansas at Little Rock

*August 2018—Present*

- Instructor for Assembly Language (Fall 2018).
- Instructor for Computer Literacy (Fall 2018).

### Research Assistant at University of Arkansas at Little Rock

*January 2016—Present*

- Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP)
  - Design and development of a virtual simulator for rotator cuff surgery using C/C++, OpenGL, GLSL and haptic device technology.
- Generative Anatomy Modeling Language (GAML)
  - Developed a platform for 3D model modification using commands in real-time and by satisfying any geometric constraints imposed by the human anatomy via a non-linear optimization model (WebGL, JavaScript and HTML/CSS).
- Partition-based Optimization Model for GAML(POM-GAML)
  - Effectively computes solution for non-linear optimization model and reduces computation time from exponential to linear time by using geometric partitions.
- Virtual Endoscopic Surgical Simulation (VESS)
  - Design and development of endoscopic submucosal dissection surgery in Unity and haptic device technology.
- Virtual Fundamentals of Arthroscopic Surgery Training (VFAST)
  - Design and development of a virtual environment for orthopedic surgeons in-training to develop necessary skills for arthroscopic surgery in Unity and haptic device technology.

### Graduate Seminar Volunteer at University of Arkansas at Little Rock

*January 2017—May 2017*

- Help set up invited speakers to discuss and exchange ideas on research topics of general interest to the graduate programs in Engineering and Information Technology.

## Research Assistant at University of Central Arkansas

August 2013—December 2015

- Virtual Pancreatic Cancer Surgery: Whipple Surgery Simulator (VPanSS)
  - Design and development of a preliminary navigation task in abdominal anatomy with real time collision detection using WebCL, WebGL, JavaScript and HTML/CSS.
- Mobile Mixed Reality system for Physical & Occupational Therapies for Hand and Wrist Ailments (MoMiReS)
  - Development of a pressure sensor pen using Arduino.
- Natural Orifice Transluminal Endoscopic Surgery (NOTES)
  - Worked on visualization and realism of the overall simulator.
- Virtual Airway Skills Trainer (VAST)
  - Design and development of Cricothyroidotomy and Endotracheal intubation simulators for Oculus Rift using C/C++, OpenGL, GLSL and haptic device technology.
  - Data collection from surgeons for validation.

## Graduate Assistant at University of Central Arkansas

August 2013—December 2015

- Lab instructor and teaching assistant for Computer Science Programming 1(Fall 2013).
- Teaching assistant for Assembly Language and Computer Organization (Fall 2014 and Fall 2015).
- Teaching assistant for Computer Architecture (Spring 2015 and Spring 2015).

## INDUSTRIAL EXPERIENCE

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### System Support Specialist Intern

June 2012—August 2012

### ASELSAN

Ankara, Turkey

- Created a social network for employees of the company to communicate with each other.

## PUBLICATIONS

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### Journal Publications:

- **D. Demirel**, A. Yu, S. Baer-Cooper, T. Halic, and C. Bayrak, “Generative Anatomy Modeling Language (GAML),” International Journal of Medical Robotics and Computer Assisted Surgery, vol.13, no. 4, 2017.
- **D. Demirel**, A. Yu, S. Baer-Cooper, A. Dendukuri, T. Halic, S. Kockara, N. Kockara, and S. Ahmadi, “A hierarchical task analysis of shoulder arthroscopy for a virtual arthroscopic tear diagnosis and evaluation platform (VATDEP),” International Journal of Medical Robotics and Computer Assisted Surgery, vol. 13, no. 3, 2017.
- **D. Demirel**, K. L. Butler, T. Halic, G. Sankaranarayanan, D. Spindler, C. Cao, E. Petrusa, M. Molina, D. Jones, S. De, and M. DeMoya, “A Hierarchical Task Analysis of Cricothyroidotomy Procedure for a Virtual Airway Skills Trainer (VAST) Simulator,” American Journal of Surgery, vol. 212, pp. 475-484, 2016.
- **D. Demirel**, S. Baer-Cooper, M. Tunc, T. Halic, S. Kockara, N. Kockara, M. E. Rogers, S. Ahmadi, “Scoring Metrics for Assessing Skills in Arthroscopic Rotator Cuff Repair: Performance Comparison Study of Novice and Expert Surgeons”. (Submitted)
- **D. Demirel**, B. Cetinsaya, T. Halic, S. Kockara, S. Ahmadi, “Partition-based Optimization Model for Generative Anatomy Modeling Language (POM-GAML)”. (Submitted)
- B. Cetinsaya, M. A. Gromski, S. Lee, Z. Xia, **D. Demirel**, T. Halic, C. Bayrak, C. Jackson, S. De, S. Hegde, J. Cohen, M. Sawhney, S. N. Stavropoulos, D. Jones, “A Task and Performance Analysis of Endoscopic Submucosal Dissection (ESD) Surgery”. (Submitted)
- A. Ryason, E. Petrusa, U. Kruger, **D. Demirel**, T. Halic, D. Jones, S. De, S. Jones “Development of a simulator-based assessment of endotracheal intubation”. (Submitted)

### Conference Publications:

- **D. Demirel**, S. Baer-Cooper, J. Farmer, T. Halic, S. Kockara, and S. Ahmadi, “Optimization for Arthroscopic Rotator Cuff using Generative Anatomy Modeling Language,” 2018 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XV), 2018. ([Abstract](#))

- D. Qi, U. Kruger, N. Milef, E. Petrusa, M. Turkseven, **D. Demirel**, T. Halic, D. Jones, S. Dem N. Saillant, “Establishing Novice and Expert Groups to Assess a Virtual Reality Simulator for Rare and Emergent Sugical Procedures”, 38<sup>th</sup> Annual Meeting of the Association for Surgical Eucation (ASE), 2018. ([Abstract](#))
- **D. Demirel**, A. Yu, S. Baer-Cooper, T. Halic, S. Kockara, N. Kockara, and S. Ahmadi, “Difficulty Scenario Modeling for Virtual Arthroscopic Rotator Cuff With GAML,” Computational & Mathematical Biomedical Engineering Conference, vol. 2, pp. 814-817, 2017. ([Podium Presentation, Proceedings](#))
- **D. Demirel**, A. Yu, S. Baer-Cooper, T. Halic, S. Kockara, N. Kockara, and S. Ahmadi, “Difficulty Scenario Modeling for Virtual Arthroscopic Rotator Cuff With GAML,” 101<sup>st</sup> Arkansas Academy of Science, 2017. ([Podium Presentation, Abstract](#))
- **D. Demirel**, S. Baer-Cooper, J. Farmer, T. Halic, S. Kockara, and S. Ahmadi, “Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP),” Arkansas INBRE, 2017. ([Abstract](#))
- **D. Demirel**, S. Baer-Cooper, J. Farmer, T. Halic, S. Kockara, and S. Ahmadi, “Optimization for Arthroscopic Rotator Cuff using Generative Anatomy Modeling Language,” Arkansas INBRE, 2017. ([Abstract](#))
- M. Tunc, **D. Demirel**, T. Halic, S. Kockara, and S. Ahmadi, “Dynamic Voxelization for Virtual Rotator Cuff Surgery,” Arkansas INBRE, 2017. ([Abstract](#))
- B. Cetinsaya, M. A. Gromski, S. Lee, Z. Xia, **D. Demirel**, T. Halic, C. Bayrak, C. Jackson, S. De, S. Hegde, J. Cohen, M. Sawhney, S. N. Stavropoulos, D. Jones, “Virtual Endoluminal Surgery Simulator,” Arkansas INBRE, 2017. ([Abstract](#))
- **D. Demirel**, A. Yu, T. Halic, G. Sankaranarayanan, A. Ryason, D. Spindler, K. L. Butler, C. Caroline, E. Petrusa, M. Molina, D. Jones, S. De, M. Demoya, S. Jones, “Virtual Airway Skills Trainer (VAST) Simulator,” Med. Meets Virtual Real. 22 NextMedMMVR22, vol. 220, p. 91, 2016. ([Podium Presentation, Proceedings](#))
- **D. Demirel**, A. Yu, S. Baer-Cooper, T. Halic, S. Kockara, and S. Ahmadi, “Time and video analysis of Virtual Arthroscopic Tear Diagnosis and Evaluation Platform,” 2016 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XIII), 2016. ([Abstract](#))
- A. Yu, **D. Demirel**, T. Halic, S. Kockara, and S. Ahmadi, “Dynamic Voxelization for Virtual Rotator Cuff Surgery,” 2016 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XIII), 2016. ([Abstract](#))
- A. Yu, **D. Demirel**, T. Halic, and S. Kockara, “Virtual Intraoperative Cholangiogram Using WebCL,” Med. Meets Virtual Real. 22 NextMedMMVR22, vol. 220, p. 459, 2016. ([Abstract, Proceedings](#))
- **D. Demirel**, A. Yu, T. Halic, S. Kockara, “Parallel Continuous Collision Detection for Surgery Simulations with WebCL,” 13<sup>th</sup> US National Congress on Computational Mechanics. ([Podium Presentation, Abstract](#))
- A. Yu, **D. Demirel**, T. Halic, S. Kockara, “Virtual Cholangiogram,” 13<sup>th</sup> US National Congress on Computational Mechanics. ([Podium Presentation, Abstract](#))
- **D. Demirel**, A. Yu, T. Halic, and S. Kockara, “Parallel Continuous Collision Detection with WebCL,” 2015 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XII), 2015. ([Podium Presentation, Abstract](#))
- **D. Demirel**, A. Yu, S. Baer-Cooper, A. Dendukuri, T. Halic, S. Kockara, and S. Ahmadi, “A hierarchical task analysis of a Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP),” Arkansas INBRE, 2015. ([Abstract](#))
- **D. Demirel**, A. Yu, T. Halic, and S. Kockara, “Web based camera navigation for virtual pancreatic cancer surgery: Whipple surgery simulator (VPanSS),” in 2014 IEEE Innovations in Technology Conference (InnoTek), 2014, pp. 1–8. ([Podium Presentation, Proceedings](#))
- T. Halic, S. Kockara, **D. Demirel**, M. Willey, “MoMiReS: Mobile mixed reality system for physical & occupational therapies for hand and wrist ailments,” in 2014 IEEE Innovations in Technology Conference (InnoTek), 2014, pp. 1–6. ([Podium Presentation, Proceedings](#))

## **PARTICIPATION IN GRANTS**

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- **Development and Validation of a Virtual Airway Skill Trainer (VAST)**

Funded by: National Institutes of Health (NIH) / National Heart, Lung, and Blood Institute (NHLBI)

Project Number: 5R01HL119248

Award Amount: \$2,860,421 until Fiscal Year 2017

Project Period: 01/04/2014 - 31/03/2019

Collaborators: Rensselaer Polytechnic Institute, Harvard School of Medicine (Beth Israel Deaconess Medical Center (BIDMC) and Massachusetts General Hospital (MGH)), Wright State University

My Role:

- Design and development of Cricothyroidotomy and Endotracheal intubation simulators using a head mounted display (Oculus Rift) to represent clinical environment.
- Realistic force feedback using haptics.
- Development of different simulation scenarios.
- Initial validation of the simulator by data collection from surgeons.

• **Development and Validation of a Virtual Endoluminal Surgical Simulator (VESS) for Treatment of Colorectal Cancer**

Funded by: National Institutes of Health (NIH) / National Cancer Institute (NCI)

Project Number: 1R01CA197491

Award Amount: \$953,143 until Fiscal Year 2017

Project Period: 25/08/2016 - 31/08/2020

Collaborators: Rensselaer Polytechnic Institute, Harvard School of Medicine (Beth Israel Deaconess Medical Center (BIDMC) and Massachusetts General Hospital (MGH))

My Role:

- Design and development of endoscopic submucosal dissection surgery.
- Realistic force feedback using haptics.
- Development of different simulation scenarios.
- Initial validation of the simulator by data collection from surgeons.

• **Developing Physics-based Virtual Simulation Technology for Natural Orifice Transluminal Endoscopic Surgery (NOTES)**

Funded by: National Institutes of Health (NIH) / National Institute of Biomedical Imaging and Bioengineering (NIBIB)

Project Number: 5R01EB009362

Award Amount: \$2,613,478

Project Period: 06/05/2011 - 30/04/2016

Collaborators: Rensselaer Polytechnic Institute, Harvard School of Medicine (Beth Israel Deaconess Medical Center (BIDMC))

My Role:

- Worked on visualization and realism of the simulator.

• **Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP)**

Funded by: Arkansas INBRE program, National Institutes of Health (NIH) / National Institute of General Medical Sciences (NIGMS)

Project Number: P20 GM103429

Collaborators: University of Arkansas for Medical Sciences

My Role:

- Design and development of a virtual simulator for rotator cuff surgery.
- Realistic force feedback using haptics.
- Development of different simulation scenarios.
- Initial validation of the simulator by data collection from surgeons.

• **Virtual Fundamentals of Arthroscopic Surgery Training (VFSAT)**

Funded by: Arkansas INBRE program, National Institutes of Health (NIH) / National Institute of General Medical Sciences (NIGMS)

Project Number: P20 GM103429

Collaborators: University of Arkansas for Medical Sciences

### My Role:

- Design and development of a virtual environment for orthopedic surgeons in-training to develop necessary skills.
- Realistic force feedback using haptics.
- Development of different tasks(field of view, triangulation, maze, picking) and simulation scenarios.

## **SERVICES AND AWARDS**

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### Reviewer:

- The International Journal of Medical Robotics and Computer Assisted Surgery.
- American Medical Informatics Association (AMIA).

### Awards:

- 2016 Outstanding Publication Award - University of Arkansas at Little Rock.
- 2016 Student Research and Creative Works Expo 3<sup>rd</sup> place - University of Arkansas at Little Rock.
- 2016 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XIII) 2<sup>nd</sup> place in best poster presentation.
- 2016 Midsouth Computational Biology & Bioinformatics Society (MCBIOS XIII) Travel Award
- 2015 Graduate School Travel Award – University of Arkansas at Little Rock
- 2015 Engineering and Information Technology Travel Award – University of Arkansas at Little Rock
- 2013 Who's Who Among Students in American Universities and Colleges.
- 2013 Dean's List – University of Arkansas at Little Rock
- 2012 Greek Man of the Year – University of Arkansas at Little Rock

## **SKILLS**

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### Programming Languages:

- C, C++, C#, GLSL, HLSL, JavaScript, HTML, CSS, Python, PHP, SQL, Swift, Java, MATLAB, MIPS, x86.

### Technologies:

- OpenGL, WebGL, OpenCL, WebCL, Unity, Arduino, Raspberry Pi, Haptics, Oculus Rift, HTC Vive, IBM SPSS, Photoshop, 3D Studio Max, ZBrush, Blender.

## **REFERENCES**

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- **Name:** Dr. Tansel Halic  
**Title:** Axiom Assistant Professor at University of Central Arkansas and Director of Virtual Reality, Simulation, Imaging and Modeling (ViRaSIM) at University of Central Arkansas.  
**E-mail:** tanselh@uca.edu
- **Name:** Dr. Suvranu De  
**Title:** J. Erik Jonsson '22 Distinguished Professor of Engineering, Head of Department of Mechanical, Aerospace and Nuclear Engineering at Rensselaer Polytechnic Institute and Director of Center for Modeling, Simulation and Imaging in Medicine (CeMSIM), at Rensselaer Polytechnic Institute  
**E-mail:** des@rpi.edu
- **Name:** Dr. Sreenkanth Arikatla  
**Title:** Senior R&D Engineer, Kitware Inc.  
**E-mail:** sreekanth.arikatla@kitware.com
- **Name:** Dr. Sinan Kockara  
**Title:** Assistant Professor at University of Central Arkansas  
**E-mail:** SKockara@uca.edu
- **Name:** Dr. Coskun Bayrak  
**Title:** Chair and Professor at Youngstown State University  
**E-mail:** cbayrak@ysu.edu
- **Name:** Dr. Steven Minsker

**Title:** Professor at University of Arkansas at Little Rock

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