

# G. Elisabeta (Liz) Marai

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## Research

### Overview

Interdisciplinary research in computational modeling, medical imaging, data visualization, and computer graphics.

## Education

Ph.D., Computer Science, Brown University, 2007.

### *Data-Driven Predictive Modeling of Diarthrodial Joints*

Researched biological applications of computer graphics. Created novel computational modeling, visualization and analysis tools that are needed to model anatomical joints and their variation with disease progression.

Sc.M., Computer Science, Brown University, 2001.

### *Estimating Ligament Lengths from Bone Kinematics and Surfaces*

M.S., Computer Science & Electrical Engineering, Politehnica University, Romania, 1998.

### *KQML - Communication among Intelligent Agent Systems*

B.S., Computer Science & Electrical Engineering, Politehnica University, Romania, 1997.

### *Time-delay Neural Network System for Speech Recognition*

## Experience

**Assistant Professor of Computer Science, University of Pittsburgh, 2007 to present.**

Interdisciplinary research into robust and effective computer science and visualization tools to solve problems in biology, medical imaging, and other disciplines.

**Adjunct Assistant Professor of Computer Science, Carnegie Mellon University (Robotics Institute), 2007 to present.**

Interdisciplinary research to solve problems in robotics and computer animation.

**Research Assistant, Brown University, 2000 to 2007.**

Member of interdisciplinary team (CS, Bioengineering, Orthopedics, Evolutionary Biology).

**Coordinator of the Scientific Visualization Seminar, Brown Visualization Research Lab, 2004 to 2006.**

Organized weekly inter-departmental talks and meetings of 25-30 researchers.

**CS Faculty-Graduate Liaison, Brown University, 2003 to 2005.**

Lobbied and raised funding for grad student interests.

**Instructor, Brown University, 2004.**

“Interactive Computer Graphics”, full class responsibility together with fellow graduate students M. McGuire and T. Moscovich

**Teaching Assistant, Brown University, 2003.**

“Interactive Computer Graphics”. Led seminars and help-sessions, guest-lectured, mentored final projects.

**Research intern, Philips Research, Netherlands, Summer 1998.**

Designed and implemented a geometry compression engine for video-games.

**Lab instructor, Politehnica University, Romania, 1997 to 1999.**

Introductory Programming, Data Structures and Algorithms, Scientific Computing, Parallel Processing. Taught seminars and labs, designed and graded assignments and independent-study projects.

**Intern, Electromagnetica Ltd, Romania, Summers 1992, 1994.**

Programmed parts of a VLSI-circuit design project.

## Honors

- 2009 Pitt Provost's Advisory Council on Instructional Excellence: Innovation in Education award
- 2008 Pitt CS Teaching Award, Graduate seminar level
- 2004 Brown University Travel Grant
- 2004 ACM Travel Awards
- 2004 ACM SIGGRAPH Student Research Competition semifinalist - twice, first nomination with students Peter Sibley and Phil Montgomery; and second with students Ethan Bromberg and Arni Jonsson.
- 2001 Pixar Fellowship
- 2000 Microsoft Fellowship
- 1999 Brown University Fellowship
- 1997,1996 Romanian National 'Scholar Merit' Fellowship
- 1996 Best Paper award at the Politehnica Bioengineering'96 Scientific Session

## Journal

- Publications** 5. J.S. Albrecht, R. Hwa, G.E. Marai, "The Chinese Room: Visualization and Interaction to Understand and Correct Ambiguous Machine Translation". Computer Graphics Forum (*also in 2009 Eurographics/IEEE Symposium on Visualization, Proceedings of*), June 2009 (in press).

4. G.E. Marai, C.M. Grimm, D.H. Laidlaw, “Arthroial Joint Markerless Cross-Parameterization and Biomechanical Visualization”, IEEE Transactions on Visualization and Computer Graphics 13(5):1095-1104, Sep/Oct 2007 ([pdf](#)).
3. J.J. Crisco, D. Moore, G.E. Marai, D.H. Laidlaw, E. Akelman, A.C. Weiss, S.W. Wolfe, “Effects of Distal Radius Malunion on Distal Radioulnar Joint Mechanics—An In Vivo Study”, Journal of Orthopedic Research 25(4):547-555, Jan. 2007 ([pdf](#)).
2. G.E. Marai, D.H. Laidlaw, J.J. Crisco, “Super-Resolution Registration Using Tissue-Classified Distance Fields”, IEEE Transactions on Medical Imaging, 25(2):177-187, Feb. 2006 ([pdf](#)).
1. G.E. Marai, D.H. Laidlaw, C. Demiralp, S. Andrews, C.M. Grimm, J.J. Crisco, “Estimating Joint Contact Areas and Ligament Lengths from Bone Kinematics and Surfaces”, IEEE Transactions on Biomedical Engineering, 51(5):790-799, May 2003 ([pdf](#)).

## Book

### Chapter

1. D.H. Laidlaw, G.E. Marai, K.E. Fleischer, A. Barr, “Partial Volume Segmentation and Boundary Distance Estimation with Voxel Histograms”, in Handbook of Medical Imaging: Processing and Analysis, 2nd edition, I.N. Bankman (editor), Academic Press, 2009 (in press).

## Peer-

### reviewed

### Conference

### Papers and

### Abstracts

15. G.E. Marai, J.J. Crisco, D.H. Laidlaw. “Development of a Kinematic 3D Carpal Model to Analyze In Vivo Soft-Tissue Interaction Across Multiple Static Postures”. IEEE 31st Conf. of the Engineering in Medicine and Biology Society (EMBC'09), Sept. 2009 (in press).
14. G.E. Marai. “MyWorld4D: Introduction to Computer Graphics with a Modeling and Simulation Twist”. ACM SIGGRAPH 2009 Education Track, Aug. 2009 (in press).

13. J. Albrecht, R. Hwa. G. E. Marai. "Correcting Automatic Translations through Collaborations between MT and Monolingual Target-Language Users". *EACL 2009, 12th Conference of the European Chapter of the Association for Computational Linguistics*, pp. 60-68, Mar. 2009 ([pdf](#)).
12. J.S. Albrecht, R. Hwa, G.E. Marai. "The Chinese Room - Understanding and Correcting Machine Translation". IEEE Information Visualization 2008 Poster Compendium, Oct. 2008 ([pdf](#)).
11. G.E. Marai, J.J. Crisco, D.H. Laidlaw, "A Kinematics-Based Method for Evaluating the Stabilizing Role of Ligaments in the Carpal Joint", 16th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, Mar. 2008 ([pdf](#)).
10. G.E. Marai, J.J. Crisco, D.H. Laidlaw, "A Kinematics-Based Method for Generating Cartilage Maps and Deformations in the Multi-Articulating Wrist Joint From CT Images", IEEE 28<sup>th</sup> Conf. of the Engineering in Medicine and Biology Society (EMBC'06), pp.2079-2082, Sept. 2006 ([pdf](#)).
9. G. E. Marai. D. H. Laidlaw. "Markerless inter-subject bone shape matching using 2D projections", MICCAI short papers, 2005.
8. G. E. Marai, C. Demiralp, S. Andrews, D. H. Laidlaw. "JointViewer – an interactive system for exploring orthopedic data", IEEE Visualization Poster Compendium, 2004.
7. E. Bromberg, A. Jonsson, G.E. Marai, M. McGuire, "Hybrid Billboard Clouds for Model Simplification", ACM SIGGRAPH Poster Compendium, 2004. *ACM SRC semifinalist*.
6. P. Sibley, P. Montgomery, G.E. Marai, "Wang Cubes for Video Synthesis and Geometry Placement", ACM SIGGRAPH Poster Compendium, 2004. *ACM SRC semifinalist*.
5. J. J. Crisco, G. E. Marai, D. H. Laidlaw, D. Moore, E. Akelman. "Kinematic and mechanical changes in the distal radioulnar joint (DRUJ) of patients with malunited distal radius fractures", 49th Annual Meeting of the Orthopaedic Research Society, 2003.

4. G. E. Marai, D. H. Laidlaw, J. J. Coburn, M. A. Upal, J. J. Crisco. "A 3D Method for Segmenting and Registering Carpal Bones from CT Volume Images", Annual Meeting of the American Society of Biomechanics, 2003.
3. G. E. Marai, D. H. Laidlaw, C. Demiralp, C. Grimm, J. J. Crisco, D. Moore, and E. Akelman, "Contact Areas and Ligament Lengths are Abnormal in Patients with Malunited Distal Radius Fracture Despite Normal Radioulnar Kinematics", 4<sup>th</sup> World Congress Biomechanics, 2002.
2. C. Demiralp, G. E. Marai, S. Andrews, D. H. Laidlaw, J. J. Crisco, C. Grimm, "Modeling and Visualization of Inter-Bone Distances in Joints", IEEE Visualization Work in Progress Proceedings, 2001.
1. G. E. Marai, A. Ivan, "Neural Networks versus Fuzzy Logic", Politehnica Bioengineering Scientific Session, Politehnica University of Bucharest, May 1996. *Best paper award.*

## Other

### Publications

5. G.E. Marai, "Data-driven Predictive Modeling of Diarthrodial Joints", Ph.D. Dissertation, Brown University, May 2007. ([pdf](#))
4. G.E. Marai, C. Demiralp, S. Andrews, D.H. Laidlaw, C. Grimm, J.J. Crisco, "Visualization of Contact Areas and Ligament Paths in Joints", Technical Report CS-02-15, Brown University, Computer Science Department, August 2002.
3. G.E. Marai, "Geometry Compression of DirectX Files", Technical Report 322/98, Philips Research, September 1998 (company-restricted distribution).
2. G.E. Marai, "KQML - Communication among Intelligent Agent Systems", M.S. dissertation, Politehnica University of Bucharest, June 1998 (in Romanian).

1. G.E. Marai, "Time-delay Neural Network System for Speech Recognition", B.S. Honors Thesis, Politehnica University of Bucharest, June 1997 (in Romanian).

## Popular Press

"Making moves: Pitt experiment tracks body shifts", M. Cronin, Pittsburgh Tribune-Review, March 2, 2009 ([html](#))

"Transformational Research through Modeling and Simulation: Pitt Researchers Tackle Some of the Most Complex Issues of Our Times in New Center", R. Frazier, Pitt Center for Simulation and Modeling Inaugural Brochure, October 2008 ([pdf](#))

"CS224 Final Projects Win @ ACM SIGGRAPH '04", S. Howe, Conduit Vol 13(1), Aug 2004 ([pdf](#))

## Invited Presentations

2009 ACM SIGGRAPH Education, August

**Dagstuhl** Tensor Symposium, July

Eurographics/IEEE Symposium on Visualization, Berlin, June

University of Pittsburgh, Center for Simulation and Modeling, January

2008 Carnegie Mellon University, Graphics Group Meeting, March

San Francisco University, Pre-Orthopaedic Research Society Symposium, March

University of Pittsburgh – Carnegie Mellon University, Bioengineering and Bioinformatics Summer Institute, June

Pitt CS Technology Leadership Initiative, July

2007 University of Pittsburgh – Carnegie Mellon University, Comput. Biology Program, November

Carnegie Mellon University, Robotics Institute Faculty Lunch Meeting, November

University of New Hampshire, Computer Science, April

## **Grants**

“Geriatric Research in Ambulatory and Cognitive Excellence (GRACE)”, University of Pittsburgh Research Council's Multidisciplinary Small Grant Program, Co-PI (C. Rosano PI), \$60K out of \$150K, July 2009 – June 2012.

“Immersive Software Engineering”, Pitt Provost’s Advisory Council on Instructional Excellence (ACIE) Innovation in Education grant, PI, \$16,164, May 2009 -- April 2010.

## **Professional Service**

2009 Paper reviewing for IEEE VIS

Travel Scholarship Reviewer for the Grace Hopper Celebration of Women in Computing

2008 Paper reviewing for ACM SIGGRAPH, Journal of Biomechanics

Proposal reviewing for NSF

Travel Scholarship Reviewer for the Grace Hopper Celebration of Women in Computing

2007 Travel Scholarship Reviewer for the Grace Hopper Celebration of Women in Computing

Paper reviewing for IEEE Trans. on Medical Imaging, IEEE Trans. on Visualization and Computer Graphics, ACM SIGGRAPH, Journal of Biomechanics

pre-2007 Paper reviewing for IEEE Trans. on Medical Imaging, IEEE Trans. on Visualization and Computer Graphics, ACM SIGGRAPH (Sketches and Posters), Journal of Biomechanics

ACM International Programming Competition'97, S-E European Regional Organizing Committee

### Teaching and Research Advising

2009 [Interdisciplinary Modeling and Visualization \(CS2620\)](#) I developed and taught this graduate course for the first time in this lecture/assignments/final project format. The course emulates the process of scientific research, from a peer-reviewed proposal to a final report and presentations. Several projects resulted in publications and/or long term interdisciplinary collaborations.

[Introduction to Computer Graphics \(CS1566\)](#) I updated this undergraduate course to further emphasize modeling and simulation. The final projects were so compelling, I was asked to talk about this course at SIGGRAPH 2009.

Graduate Research Advising: Abed Haque, David Krebs, Sriranjani Mandayam

Adrian Maries, Yao Sun, Wenting Xiong

Undergraduate Research Advising: Stephen Lauck, Victor Powell (Computer Engineering)

Examiner/Reader: Michal Valko, Ricardo Villamarin, Tomas Singliar

2008 [Advanced Topics in Computer Graphics \(CS 3610\)](#) I developed and taught this graduate course for the first time this year. In it, students learned the basics of scientific modeling and visualization and emulated the process of doing interdisciplinary research by working in multi-disciplinary teams on scientific problems. The groups for each project were required to have participants from multiple disciplines, exposing them to many of the skills required for multi-disciplinary collaborative work.

[Introduction to Computer Graphics \(CS 1566\)](#) I gave this undergraduate course a much needed re-haul. Updates include a completely new syllabus with sections on photorealism, video game design, image processing, color perception, and user interfaces.

Graduate Research Advising: Yinglin Sun, Michael Lipschultz

Undergraduate Research Advising: Matthew Czarnek (Computer Engineering), John Conomikes

Examiner/Reader: Tomas Singliar, Qinglan Li

2007 Undergraduate Research Advising: Matthew Czarnek (Computer Engineering)

Examiner/Reader: Tomas Singliar

pre-2007 Interactive Computer Graphics (Brown University CS 224, 2004). I co-designed and co-taught the 2004 edition of this research-oriented graduate level class. Full class responsibility, shared with fellow graduate students Morgan McGuire and Tomer Moscovich.

Graduate Research Advising: Peter Sibley (Brown University), Phil Montgomery (Brown University)

Undergraduate Research Advising: Ethan Bromberg (Brown University), Arni Jonsson (Brown University)

## Curriculum Development

2009 Proposed *Immersive Software Engineering*, Provost's ACIE award.

2008 Designed and proposed *Interdisciplinary Modeling and Visualization* (CS 2620), approved.

2007 Co-designed and co-proposed *Principles of Computer Game Design and Implementation* (CS 1666) together with Bob Daley, approved.

## University Service

2009 Center for Simulation and Modeling (SAM) Advisory Board

CS Graduate Admissions and Financial Aid Committee

CS-Day Committee; co-organizer Digital Media Contest

CS Outreach (ad hoc) Committee; helped with international recruiting and departmental website redesign

Women in Computer Science (WiCS) faculty-coordinator; bimonthly meetings including industry guests, and outreach activities

Hosted seminar-speakers: M. Renieris (Google), M. Friedman (Public Health), M. Hanwell (Chemistry), J. Faeder (Computational Biology), G. Mustata (Drug Discovery Institute), M. Wood-Vassey and J. Newman (Astronomy).

2008 Center for Simulation and Modeling (SAM) Organizational Committee

Women in Computer Science (WiCS) Coordinator; reviving the organization

Bioengineering and Bioinformatics Summer Institute (BBSI) Mentor

CS Outreach (ad hoc) Committee

Hosted seminar-speakers: M. Renieris (Google), S. Tashman (Pitt Medical School Orthopaedics), S. Leuba (Pitt Biophysics), G. Hutchison (Chemistry), J. Faeder (Computational Biology), and N. Ebenreuter (CMU Design)

CS Graduate Admissions and Financial Aid Committee; excellent admissions record

2007 CS Graduate Admissions and Financial Aid Committee

CS Faculty Search Committee

CS-Day Committee; co-organizer Digital Media Contest

CS Outreach (ad hoc) Committee; helped with international recruiting and departmental website redesign

## **Memberships**

ACM, SIGGRAPH, IEEE.

## Trivia

Fluent in Romanian and French; intermediate Greek and Spanish; ZDaF certificate German.

8 years violin & music theory lessons; 4 years in chamber orchestra.

Avid kickboxer; gardener; won't eat meat.

prepared July 2009