

# Carlos D. Correa

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## Summary

My research interests include Scientific Visualization and Computer Graphics, in particular in:

- The design and implementation of a new generation of algorithms, rendering and interaction techniques towards efficient and scalable data retrieval, processing and visualization.
- GPU-based algorithms, Multi-core and Multi-GPU computing.
- The development of a process-based and uncertainty-aware view of Visualization and Visual Analytics.

## Education

- **Postdoctoral Scholar, University of California, Davis**, Computer Science.  
**Ph.D. Rutgers University, NJ, 2007**, Electrical and Computer Engineering, GPA 4.0/4.0. Dissertation Topic: “Illustrative Deformation of Volumetric Objects and Other Graphical Models”.
- **M.Sc. Rutgers University, NJ, 2003**, Electrical and Computer Engineering. GPA 4.0/4.0.
- **B.Sc. EAFIT University, Colombia, 1998**, Computer Science. Recipient of the Academic Excellence Award for highest GPA.

## Research Experience

**Postdoctoral Researcher**, Visualization and Interface Design Innovation, University of California, Davis. Sept. 2007 - present.

- Develop algorithms and image processing techniques for analyzing extreme-scale data sets.
- Study new imaging algorithms for the analysis of medical images and the diagnosis of cancer tumors and vascular diseases.
- Develop new mathematical models and algorithms to represent data transformations and uncertainty for Visual Analytics.
- Coordinate and assist research projects of undergraduate and graduate students.

**Research Assistant**, Center for Advanced Information Processing, Rutgers University, New Brunswick, NJ

- Created novel rendering techniques for the exploration and deformation of volumetric datasets, using GPU programming on commodity graphics hardware to achieve interactive performance.
- Developed and optimized a volume animation software pipeline for the manipulation of large 3D models, using innovative computer graphics algorithms and exploiting GPU capabilities.
- Authored and co-authored several papers in the area of visualization and computer graphics.
- Created novel algorithms, human computer interaction tools and middleware components for distributed graphics, in a variety of platforms.

**Research Assistant and Consultant**, Virtual Reality Laboratory and Conexiones Project. EAFIT University, Colombia, 1997-2000

- Designed and programmed computer graphics software for a multi-user immersive application called: “Collaborative Virtual Environments applied to Higher Education”.
- Led the creation of a start-up company to provide solutions based in virtual environments and interactive computer graphics.

- Developed software/graphics and networking components for educational multimedia software.

## Teaching Experience

**Teaching Assistant**, Department of Electrical and Computer Engineering, Rutgers University, New Brunswick, NJ, Sept. 2004 - Jan. 2005, Sept. 2006 - May 2007:

- Virtual Reality, Spring 2007. Professor Grigore Burdea.
- Capstone Design in Robotics and Computer Vision, Spring 2007. Professor Kristin Dana.
- Concepts in Robotics and Computer Vision, Fall 2004, Fall 2006. Professor Kristin Dana.
- Concepts in Digital Signal Processing Design, Fall 2006. Professor Richard Mammone.
- Lectures in Programming Methodologies (Spring 2006) and Computer Graphics (Fall 2006). Professor Deborah Silver.

**Instructor**, Computer Science Department, EAFIT University, Colombia.

- Concepts in Programming Languages, Fall 1999, Fall 2000
- Concepts in Compiler Design, Fall 2000

## Publications and Invited Talks

### Journal Articles

- **Carlos D. Correa**, Robert Hero, Kwan-Liu Ma. *A Comparison of Gradient Estimation Methods for Volume Rendering on Unstructured Meshes*, IEEE Transactions on Visualization and Computer Graphics, 21 Sept. 2009. Preprint: IEEE computer Society Digital Library. IEEE Computer Society,
- **Carlos D. Correa** and Kwan-Liu Ma. *The Occlusion Spectrum for Volume Visualization and Classification*. IEEE Transactions on Visualization and Computer Graphics, vol. 15, no.6, pp. 1465-1472, Nov./Dec. 2009.
- Ove Daae Lampe, **Carlos Correa**, Kwan-Liu Ma and Helwig Hauser. *Curve-Centric Volume Reformation for Comparative Visualization*. IEEE Transactions on Visualization and Computer Graphics, vol. 15, no.6, pp. 1235-1242, Nov./Dec. 2009.
- **Carlos D. Correa** and Kwan-Liu Ma. *Size-based Transfer Functions: A New Volume Exploration Technique*. IEEE Transactions on Visualization and Computer Graphics, vol.14, no.6, pp 1380-1387, Nov.-Dec. 2008.
- **Carlos D. Correa**, Deborah Silver and Min Chen. *Illustrative Deformation for Data Exploration*. IEEE Transactions on Visualization and Computer Graphics, 13(6), pp. 1320-1327, Nov.-Dec. 2007.
- M. Chen, **C. Correa**, S. Islam, M.W. Jones, P.Y. Shen, D. Silver, S.J. Watson and P.J. Willis. *Manipulating, Deforming and Animating Sampled Object Representations*, Computer Graphics Forum, 26 (4), pp. 824-852, 2007.
- **Carlos D. Correa**, Deborah Silver and Min Chen. *Feature Aligned Volume Manipulation for Illustration and Visualization*. IEEE Transactions on Visualization and Computer Graphics, 12(5), pp. 1069-1076, Sept.-Oct. 2006.
- **C. D. Correa**, I. Marsic, and X. Sun. *Exact and Heuristic Algorithms for Dynamic Tree Simplification*, Journal of Mathematical Modelling and Algorithms (JMMA), 4(4), pp. 331 - 353, Dec. 2005.
- **C.D. Correa** and I. Marsic, *Software Framework for Managing Heterogeneity in Mobile Collaborative Systems*. Computer-Supported Cooperative Work: The Journal Of Collaborative Computing. Kluwer Academic Publishers, 13(5-6): 603-638 (2004)

### Refereed Conference Proceedings

- Anna Tikhonova, **Carlos D. Correa** and Kwan-Liu Ma. *Explorable Images for Visualizing Volume Data*. To Appear: IEEE Pacific Visualization 2010.

- **Carlos D. Correa**, Yu-Hsuan Chan and Kwan-Liu Ma. *A Framework for Uncertainty-Aware Visual Analytics*. In IEEE VAST 2009 Symposium, pp.51-58, 2009.
- Tarik Crnovrsanin, Christopher Muelder, **Carlos Correa** and Kwan-Liu Ma. *Proximity-based Visualization of Movement Trace Data*. In IEEE VAST 2009 Symposium, pp. 11-18, 2009.
- Nelson Max, **Carlos Correa**, Chris Muelder, Shi Yan, Cheng-Kai Chen and Kwan-Liu Ma. *Flow visualization in science and mathematics*. Journal of Physics: Conference Series (SciDAC 2009 Conference) 180 012087, 2009
- Wei-Hsien Hsu, Jianqiang Mei, **Carlos D. Correa** and Kwan-Liu Ma. *Depicting Time Evolving Flow with Illustrative Visualization Techniques*. In International Conference on Arts and Technology (ArtsIT2009) , 2009
- Tarik Crnovrsanin, **Carlos D. Correa** and Kwan-Liu Ma. *Social Network Discovery based on Sensitivity Analysis*. In ASONAM '09. International Conference on Advances in Social Networks Analysis and Mining, pp. 107-112, 2009.
- **Carlos D. Correa** and Kwan-Liu Ma. *Visibility-driven Transfer Functions*. In IEEE Pacific Visualization Symposium, pp. 177-184, 2009
- **Carlos D. Correa**, Deborah Silver and Min Chen. *Volume Deformation via Scattered Data Interpolation*. Eurographics/IEEE VGTC Workshop on Volume Graphics 2007, Sept. 2007
- **Correa, C. D.** and Silver, D. 2007. *Visualizing collision effects between penetrating and non-penetrating objects*. In ACM SIGGRAPH 2007 Sketches, San Diego, California, August 05 - 09, 2007.
- **Carlos D. Correa** and Deborah Silver. *Programmable Shaders for Deformation Rendering*. To Appear: Eurographics/SIGGRAPH Workshop on Graphics Hardware 2007, San Diego, CA, 4-5 August, 2007.
- **Carlos D. Correa**, Deborah Silver and Min Chen. *Discontinuous Displacement Mapping for Volume Graphics*. Eurographics/IEEE VGTC Workshop on Volume Graphics 2006, VG'06, Boston, MA, 30-31 July, 2006, pp. 9-16.
- **Carlos D. Correa** and Deborah Silver. *Dataset Traversal with Motion-Controlled Transfer Functions*. Proceedings of IEEE Visualization 2005. Minneapolis, Min. 23-28 Oct. 2005, pp. 359-366.
- M. Chen, **C. Correa**, S. Islam, M.W. Jones, P.-Y. Shen, D. Silver, S. J. Watson, P.J. Willis (In Alphabetical Order). *Deforming and Animating Discretely Sampled Object Representations*. Eurographics 2005, State of the Art Reports (STAR), August 29 - September 2, 2005, pp. 113-140.
- D. Silver, K. Yaws, **C. Correa**, W. Hurt, P. Mason and J. Ziriak. *Volumetric Manipulation for Dosimetry Simulations*. Poster Presentation at: Bioelectromagnetics 2005, Dublin, Ireland, June 19-24, 2005.
- **C.D. Correa** and I. Marsic, *An Optimization Approach to Group Coupling in Heterogeneous Collaborative Systems*. ACM International Conference on Supporting Group Work (GROUP'05), Sanibel Island, FL, November 6-9, pp. 274-283, 2005.
- **C. D. Correa** and I. Marsic, *A Simplification Architecture for Exploring Navigation Tradeoffs in Mobile VR*. Proceedings of the IEEE Virtual Reality Conference (VR2004), pages 133- 140, Chicago, IL, March 27-31, 2004.
- Ashutosh Morde, Jun Hou, S. Kicha Ganapathy, **Carlos Correa**, Allan Krebs, Lawrence Rabiner. *Collaboration in Parallel Worlds*, Proceedings of the 6th International Conference on Multimodal Interfaces, ICMF'04. Penn State University, State College, PA, October 14 - 15, ACM, 2004.
- A. Morde, **C. Correa**, J. Hou, S. K. Ganapathy, A. Krebs, I. Marsic, M. Bouzit, L. Rabiner. *Asymmetric collaboration through tele-presence*. ETP '04: Proceedings of the 2004 ACM SIGMM workshop on Effective telepresence, pp. 57-58, New York, 2004.

#### Tutorials, Invited Papers and Talks

- *Visualizing what Lies Inside*. VisFiles, ACM SIGGRAPH Computer Graphics Quarterly, Volume 43, Number 2, May 2009.

- *Making Movies and Presentation Graphics*. Invited talk at the CsCADS Summer Workshop on Scientific Data Analysis and Visualization for Petascale Computing. Tahoe City, 2009.
- *Visualizing influence and uncertainty in social networks*. Invited talk at the ARO Trustworthy Social Computing workshop. University of California, Davis, July, 2009.
- *Illustrative Deformation of Volume Data*. In Eurographics 2008, Tutorial 8: Interactive Tools for Scientific and Medical Illustration Composition (with Bill Andrews, Stefan Bruckner, Wei Chen, David S. Ebert, Mario Costa Sousa and Ivan Viola).
- *Illustrative Deformation of Volumetric Data*. In IEEE Visualization 2007 Tutorial 7: Illustrative Display and Interaction in Visualization (with Ivan Viola, Stefan Bruckner, Mario Costa Sousa and David S. Ebert), Sacramento, CA, Oct. 2007.
- *Visualizing Complex Datasets via Illustrative Deformation*. Biological Sciences Seminar, University of California, Davis, September 2007
- *Illustrative Deformation for the Visualization of Complex Structures*. Computer Science Seminar, Brown University, April 2007
- *"Hands-in" Visualization: An Active Approach for Interactive Manipulation of Volumetric Objects*. IBM Graphics and Visualization Student Symposium (Invited Talk). Dec 6, 2005.

## Activities and Service

### Memberships

- IEEE, Computer Society
- ACM SIGGRAPH

### Peer Reviewing:

- International Program Committee Member of the IEEE Pacific Visualization Symposium 2010.
- IEEE Transactions in Computer Graphics and Visualization, 2005 - 2009
- IEEE Computer Graphics & Applications 2007-2009
- Eurographics/IEEE-VGTC Symposium on Visualization, Eurovis 2008 - 2009.
- Eurographics 2009
- SIGGRAPH Asia 2008
- Computer Graphics Forum, 2008 - 2009
- IEEE Pacific Visualization Symposium 2008 - 2009.
- IEEE Workshop on Wearable Computers 2006, ACM CHI 2006, 2005

### Student Volunteer at:

- IEEE Visualization 2006, IEEE Visualization 2005, Volume Graphics 2006, International Workshop on Virtual Rehabilitation, IWVR 2006, 2003, ACM CHI 2003

## Awards and Nominations

- Received VAST Challenge Award for Intuitive Social Network Graphs, 2008.
- Co-PI of the project "Visual Analytics Tools for Enterprise Information Management", recognized with a 2008 Innovation Research Award from HP Labs.
- Nominated for best paper award for IEEE Visualization 2006.
- Young Researcher program beneficiary from the Colombian National Sciences Institute, January, 2000.
- Finalist of Stockholm Challenge Award in Education, 2000, as part of the research group "Proyecto Conexiones".
- Received honors in graduation from Computer Science, EAFIT University, December, 1998.
- Full scholarship for B.S. studies for high academic achievement, EAFIT University, 1994.