

Carlos D. Correa

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Summary

My research interests include scientific/information visualization and computer graphics, in particular:

- The design and implementation of a new generation of algorithms, rendering and interaction techniques towards efficient and scalable data retrieval, processing and visualization.
- The development of interactive, artistically-inspired visual representations of complex data and temporal media.
- 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, Lawrence Livermore National Laboratory, Livermore. May 2010 - present.

- Design and test new techniques for visual and quantitative analysis of complex and large data sets.
- Develop mathematical and algorithmic tools for quantifying uncertainty in ensemble simulations.

Postdoctoral Researcher, Visualization and Interface Design Innovation, University of California, Davis. Sept. 2007 - May 2010.

- 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

Book Chapter

1. Carlos D. Correa and Kwan-Liu Ma. Visualizing Social Networks. To appear in: *Social Network Data Analytics*. Ed. Charu Aggarwal, Springer (2011).

Journal Articles

2. Carlos D. Correa, Tarik Crnovrsanin and Kwan-Liu Ma. Visual Reasoning about Social Networks using Centrality Sensitivities. To Appear in: *IEEE Transactions on Visualization and Computer Graphics*, 2011.
3. Carlos D. Correa and Kwan-Liu Ma. Dynamic Video Narratives. In *ACM Transactions on Graphics* Vol. 29, No. 3 (SIGGRAPH 2010).
4. Carlos D. Correa, Deborah Silver and Min Chen. Constrained Illustrative Volume Deformation. *Computers & Graphics*, Vol. 34:4, pp. 370-377, 2010.
5. Jarrett BR, Correa C, Ma KL and Louie AY. In Vivo Mapping of Vascular Inflammation Using Multimodal Imaging. (2010). *PLoS ONE* 5(10): e13254.
6. Anna Tikhonova, Carlos D. Correa, and Kwan-Liu Ma. An Exploratory Technique for Coherent Visualization of Time-Varying Volume Data. *Computer Graphics Forum (also Proceedings of EuroVis 2010)*. Volume 29, Number 3, pp. 789-792, 2010.
7. Carlos D. Correa and Kwan-Liu Ma. Visibility Histograms and Visibility-Driven Transfer Functions, To appear: *IEEE Transactions on Visualization and Computer Graphics*, Preprint: Feb. 9, 2010.
8. Carlos D. Correa, Robert Hero, Kwan-Liu Ma. A Comparison of Gradient Estimation Methods for Volume Rendering on Unstructured Meshes, To appear: *IEEE Transactions on Visualization and Computer Graphics*, Preprint: 21 Sept. 2009.
9. 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.

10. 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. 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.
16. 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

16. Yu-Hsuan Chan, Carlos D. Correa and Kwan-Liu Ma. Flow-based Scatterplots for Sensitivity Analysis. In *Proceedings of IEEE VAST Symposium*, 2010.
17. Anna Tikhonova, Carlos D. Correa and Kwan-Liu Ma. Explorable Images for Visualizing Volume Data. In *IEEE Pacific Visualization 2010*, pp. 177-184.
18. 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.
19. 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.
20. 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.
21. 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 (Art-SIT2009)*, 2009.
22. 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.
23. Carlos D. Correa and Kwan-Liu Ma. Visibility-driven Transfer Functions. In *IEEE Pacific Visualization Symposium*, pp. 177-184, 2009.
24. Carlos D. Correa, Deborah Silver and Min Chen. Volume Deformation via Scattered Data Interpolation. *Eurographics/IEEE VGTC Workshop on Volume Graphics*, Sept. 2007.
25. 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.
26. Carlos D. Correa and Deborah Silver. Programmable Shaders for Deformation Rendering. *Eurographics/SIGGRAPH Workshop on Graphics Hardware*, San Diego, CA, 4-5 August, 2007.
27. Carlos D. Correa, Deborah Silver and Min Chen. Discontinuous Displacement Mapping for Volume Graphics. *Eurographics/IEEE VGTC Workshop on Volume Graphics*, pp. 9-16, 2006.
28. Carlos D. Correa and Deborah Silver. Dataset Traversal with Motion-Controlled Transfer Functions. *Proceedings of IEEE Visualization 2005*. Minneapolis, Min., pp. 359-366, 2005.

29. 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.
30. D. Silver, K. Yaws, C. Correa, W. Hurt, P. Mason and J. Ziriach. Volumetric Manipulation for Dosimetry Simulations. Poster Presentation at: *Bioelectromagnetics 2005*, Dublin, Ireland, June 19-24, 2005.
31. 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.
32. 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.
33. 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, ICMI'04*. Penn State University, State College, PA, October 14 - 15, ACM, 2004.
34. 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

35. Exploiting neighborhood information in the visualization of complex datasets. SCI Seminar, University of Utah. January 2011.
36. Visualizing what Lies Inside. VisFiles, ACM SIGGRAPH Computer Graphics Quarterly, Volume 43, Number 2, May 2009.
37. Making Movies and Presentation Graphics. Invited talk at the CsCADS Summer Workshop on Scientific Data Analysis and Visualization for Petascale Computing. Tahoe City, 2009.
38. Visualizing influence and uncertainty in social networks. Invited talk at the ARO Trustworthy Social Computing workshop. University of California, Davis, July, 2009.
39. 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).
40. 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.
41. Visualizing Complex Datasets via Illustrative Deformation. Biological Sciences Seminar, University of California, Davis, September 2007.
42. Illustrative Deformation for the Visualization of Complex Structures. Computer Science Seminar, Brown University, April 2007.
43. "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, IEEE Visualization Conference 2011.
- International Program Committee, IEEE Pacific Visualization Symposium 2010, 2011.

- International Program Committee, International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications, VISAPP 2011.
- IEEE Transactions in Image Processing, 2010.
- IEEE Transactions in Computer Graphics and Visualization, 2005 - 2011.
- IEEE Computer Graphics & Applications 2007-2009.
- Eurographics/IEEE-VGTC Symposium on Visualization, Eurovis 2008 - 2011.
- Eurographics 2009-2010.
- SIGGRAPH Asia 2008.
- Computer Graphics Forum, 2008 - 2010.
- IEEE Pacific Visualization Symposium 2008 - 2010.
- 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

Grants and Awards

- Co-PI of NSF CCF 1025269: “Modeling the Uncertainty Due to Data/Visual Transformations Using Sensitivity Analysis”, 2010-2012.
- Co-PI of the project “Visual Analytics Tools for Enterprise Information Management”, recognized with a 2008 Innovation Research Award from HP Labs.
- Received VAST Challenge Award for Intuitive Social Network Graphs, 2008.
- Young Researcher program beneficiary from the Colombian National Sciences Institute, January, 2000.
- Received honors in graduation from Computer Science, EAFIT University, December, 1998.
- Full scholarship for B.S. studies for high academic achievement, EAFIT University, 1994.