

## Christopher G. Healey

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### PROFESSIONAL CAREER

- 2016– Goodnight Distinguished Professor of Analytics, Institute for Advanced Analytics, North Carolina State University, Raleigh, North Carolina.
- 2013– Professor, Department of Computer Science, North Carolina State University, Raleigh, North Carolina.
- 2013– Adjunct Professor, Department of Computer Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
- 2003–2013 Associate Professor, Department of Computer Science, North Carolina State University, Raleigh, North Carolina.
- 2006–2013 Adjunct Associate Professor, Department of Computer Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
- 2005–2006 Visiting Associate Professor, Department of Computer Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
- 1998–2003 Assistant Professor, Department of Computer Science, North Carolina State University, Raleigh, North Carolina.

### EDUCATION

- 1996–1998 Postdoctoral Fellow in computer graphics, University of California at Berkeley, Berkeley, California.
- 1992–1996 Ph.D. in computer graphics, “Effective Visualization of Large, Multidimensional Datasets,” University of British Columbia, Vancouver, Canada.
- 1990–1992 M.Sc. in computer graphics, “Visualization of Multivariate Data Using Preattentive Processing,” University of British Columbia, Vancouver, Canada.
- 1985–1990 B.Math in computer science, University of Waterloo, Waterloo, Canada.

### HONORS

- 2016 Goodnight Distinguished Professor of Analytics.
- 2007 Senior Member, Association of Computing Machinery (ACM).
- 2007 Senior Member, Institute of Electrical and Electronics Engineers (IEEE).
- 2007 Member, Sigma Xi Scientific Research Society.
- 2003 University Outstanding Teacher Award and membership to the Academy of Outstanding Teachers, North Carolina State University.
- 2001 National Science Foundation CAREER Early Faculty Development Award.
- 1996–1998 University of California at Berkeley, National Science and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship.

### SPONSORED RESEARCH GRANTS

1. Goodwin, J., Healey, C. G., and Lee, N. 2017–2018. NSF NSRP, “NSRP: Test Drive of the Crimson Hexagon Social Media Analytics Platform” (\$15,000).
2. Healey, C. G. 2016–2017. NSF CHMPR, “Visualizing Wildfire Narratives” (\$60,000).

3. Healey, C. G. and St. Amant, R. 2016–2017. National Security Agency DO6/DO7, “Visualizing Streaming Data: Techniques and Performance Models” (\$122,290).
4. Healey, C. G. 2016–2017. SAS Institute, “Visualizing Deep Neural Nets for Text Understanding” (\$118,275).
5. Healey, C. G. 2014–2016. SAS Institute, “Visualization of Narrative Threads for Large Document Collections” (\$200,011).
6. St. Amant, R. and Healey, C. G. 2014–2017. CISE-CHS-1420159, “Direct Physical Grasping, Manipulation, and Tooling of Simulated Objects” (\$496,858).
7. Healey, C. G. and Young, R. M. 2014. National Security Agency Laboratory for Analytic Science, “Visualizing Narrative Structure” (\$356,875).
8. Healey, C. G. and St. Amant, R. 2014. US Air Force SBIR, “Mixed-Initiative Visualization and UI Modeling for Cyber-Physical Data” (\$36,834).
9. Ning, P. and Healey, C. G. 2012–2015. Army Research Office Multidisciplinary University Research Initiative, “Computer Aided Human Centric Cyber Situation Awareness” (\$979,463).
10. Healey, C. G. and St. Amant, R. 2012–2013. Soar Technology, “Proactive Cyber Defense Through Graph-Based Evidence Threads” (\$80,734).
11. Healey, C. G. 2012. National Security Agency, “Shared Perceptual Visualizations for System Security” (\$83,215).
12. Healey, C. G. 2011–2012. Army Research Office Secure Open Systems Initiative, “Visualization for Cyber Situational Awareness” (\$126,896).
13. Healey, C. G. 2010–2012. Sandia National Laboratory, “Ensemble and Comparative Visualization of Scientific Datasets” (\$131,213).
14. Healey, C. G. 2010–2012. Department of Homeland Security NCB-Prepared Collaboration, “Web-Based Visualization for North Carolina Bio-Preparedness” (\$64,080).
15. Healey, C. G. 2008–2012. IBM Fellowship, “Analyzing, Mining, and Visualizing Tivoli Common Reporting Data” (\$132,000).
16. Watson, B. A., Healey, C. G., Young, R. M., and FitzGerald, P. 2006–2009. CISE-CCF-0552802, “REU Site: Design Tech—Sparkling Research in Interactive Visual Design” (\$268,783).
17. Healey, C. G. 2006–2008. Center for Advanced Computing and Communication, “Visualizing Network Traffic and Data” (\$80,000).
18. Mitchell, T., Cohen, J., Gumpertz, M., Healey, C. G., Keltie, R., and Scroggs, J. 2004–2006. National Science Foundation CISE-DUE-0422454, “Enhancing Transfer Student Graduation Success in Computer Science, Mathematics and Statistics” (\$400,000).
19. Healey, C. G. and St. Amant, R. 2004–2005. Department of Defense Army STTR A04-T002, “Human-Computer Visualization” (\$29,998).
20. Healey, C. G. 2003–2004. Microsoft Corporation, “Extending Interface and Display in a Low-Capability Environment” (\$25,000).
21. Ning, P., Healey, C. G., and St. Amant, R. 2002–2005. National Science Foundation CISE-ANI-0219315, “ITR: Integrating Intrusion Detection with Intelligent Visualization and Interaction Strategies” (\$415,099).
22. Healey, C. G. 2001–2006. National Science Foundation CAREER Award CISE-ACI-0092308, “Assisted Navigation in Large Visualization Spaces” (\$370,402).
23. Healey, C. G. 2000–2003. National Science Foundation CISE-ACI-0083421, “A Perceptual Visualization Architecture” (\$354,029).
24. Healey, C. G., St. Amant, R., and Young, R. M. 2000–2003. National Science Foundation CISE-IIS-9988507, “On the Effective Generation of Text and Graphics for the Exploration of Complex Datasets” (\$569,338).
25. St. Amant, R. and Healey, C. G. 1999–2000. angelsstreet, Inc., “Online Financial Investment Via Interactive Search and Visualization” (\$209,750).

26. Healey, C. G. 1998. Hewlett-Packard, Inc., University Grants equipment gift: 25 HP Kayak graphics workstations (\$117,145).

## JOURNAL ARTICLES

1. Simmons, S. J., Bastin, K., LaBarr, A, and Healey, C. G. (2023). “A Comparison of the Prediction Capabilities of Large Scale Time Series Algorithms.” *European Society of Medicine* 11, 2, <https://doi.org/10.18103/mra.v11i2.3620>.
2. Villanes, A. and Healey, C. G. (2023). “Domain Specific Text Dictionaries for Text Analytics.” *International Journal of Data Science and Analytics* 15, 105–118.
3. Healey, C. G., Simmons, S. J., Manivannan, C., and Ro, Y. (2022). “Visual Analytics for the COVID-19 Pandemic.” *Big Data* 10, 2, 95–114.
4. Healey, C. G., Dinakaran, G., Padia, K., Nie, S., Benson, J. R., Ciara, D., Shaw, D., Catalfu, G., and Devarajan, R. (2021). “Visual Analytics of Text Conversation Sentiment and Semantics.” *Computer Graphics Forum* 40, 6, 484–499.
5. Padia, K., Banda, K. H., and Healey, C. G. (2019). “A System for Generating Storyline Visualizations Using Hierarchical Task Network Planning.” *Computer & Graphics* 78, 64–75.
6. Marrs, A., Watson, B., and Healey, C. G. (2018). “View-Warped Multi-View Soft Shadows for Local Area Lights.” *Journal of Computer Graphics Techniques* 7, 3, 1–28.
7. Kozik, P., Tateosian, L. G., Healey, C. G., and Enns, J. T. (2018). “Impressionism-Inspired Data Visualizations are Both Functional and Liked.” *Psychology of Aesthetics, Creativity, and the Arts*, <http://dx.doi.org/10.1037/aca0000175>.
8. Villanes, A., Griffiths, E., Rappa, M., and Healey, C. G. (2017). “Dengue Fever Surveillance in India Using Text Mining in Public Media.” *American Journal of Tropical Medicine & Hygiene*, 98, 1, 181–191.
9. Kozik, P., Tateosian, L., Healey, C. G., and Enns, J. (2016). “Applying Impressionist Painterly Techniques to Data Visualization.” *Journal of Vision (Abstract Issue, Vision Science Society 16th Annual Meeting, St. Pete Beach, Florida)* 16, 12, 188.
10. Hao, L., Healey, C. G. and Bass, S. A. (2015). “Effective Visualization of Temporal Ensembles,” *IEEE Transactions on Visualization and Computer Graphics* 22, 1, 787–796.
11. Canary, H., Taylor II, R. M., Quammen, C., Pratt, S., Gomez, F., O’Shea, B., and Healey, C. G. (2014). “Visualizing Likelihood Density Functions via Optimal Region Projection,” *Computers & Graphics* 41, 62–71.
12. Healey, C. G. and Sawant, A. P. (2012). “Resolution and Visual Angle Limits in Visualization,” *ACM Transactions on Applied Perception* 9, 4, article 20.
13. Healey, C. G. and Dennis, B. M. (2012). “Interest Driven Navigation in Visualization,” *IEEE Transactions on Visualization and Computer Graphics* 18, 10, 1744–1756.
14. Bass, S. A., Petersen, H., Quammen, C., Canary, H., Healey, C. G., and Taylor II, R. M. (2012) “Probing the QCD Critical Point With Relativistic Heavy-Ion Collisions,” *Central European Journal of Physics* 10, 6, 1278–1281.
15. Healey, C. G. and Enns, J. T. (2012). “Attention and Visual Memory in Visualization and Computer Graphics,” *IEEE Transactions on Visualization and Computer Graphics* 18, 7, 1170–1188.
16. Hsiao, J. P.-L. and Healey, C. G. (2011). “Visualizing Combinatorial Auctions,” *The Visual Computer* 27, 6–8, 633–643.
17. Healey, C. G., Kocherlakota, S., Rao, V., Mehta, R., and St. Amant, R. (2007). “Visual Perception and Mixed-Initiative Interaction for Assisted Visualization Design,” *IEEE Transactions on Visualization and Computer Graphics* 14, 2, 396–411.
18. Hagh-Shenas, H., Kim, S., Interrante, V., and Healey, C. G. (2007). “Weaving Versus Blending: A Quantitative Assessment of the Information Carrying Capacities of Two Alternative Methods for Conveying Multivariate Data with Color,” *IEEE Transactions on Visualization and Computer Graphics* 13, 6, 1270–1277.
19. Dennis, B. M., Kocherlakota, S. M., Sawant, A. P., Tateosian, L. G., and Healey, C. G. (2005). “Designing a Visualization

- Framework for Multidimensional Data,” *IEEE Computer Graphics & Applications (Visualization Viewpoints)* 25, 6, 10–15.
20. Healey, C. G., Enns, J. T., Tateosian, L. G., and Remple, M. (2004). “Perceptually-Based Brush Strokes for Nonphotorealistic Visualization,” *ACM Transactions on Graphics* 23, 1, 64–96.
  21. Liu, G., Healey, C. G., and Enns, J. T. (2003). “Target Detection and Localization in Visual Search: A Dual Systems Perspective,” *Perception & Psychophysics* 65, 5, 678–694.
  22. Kosara, R., Healey, C. G., Interrante, V., Laidlaw, D. H., and Ware, C. (2003). “Thoughts on User Studies: Why, How, and When,” *IEEE Computer Graphics & Applications (Visualization Viewpoints)* 23, 4, 20–25.
  23. Healey, C. G. and Enns, J. T. (2002). “Perception and Painting: A Search for Effective, Engaging Visualizations,” *IEEE Computer Graphics & Applications (Visualization Viewpoints)* 22, 2, 10–15.
  24. Healey, C. G. and Wurman, P. R. (2001). “Visualizing Market Data,” *IEEE Internet Computing* 5, 2, 88.
  25. Healey, C. G. (2000). “Building a Perceptual Visualisation Architecture,” *Journal of Behaviour & Information Technology* 19, 5, 349–366.
  26. Healey, C. G. and Enns, J. T. (1999). “Large Datasets at a Glance: Combining Textures and Colors in Scientific Visualization,” *IEEE Transaction on Visualization and Computer Graphics* 5, 2, 145–167.
  27. Healey, C. G., Booth, K. S., and Enns, J. T. (1996). “High-Speed Visual Estimation Using Preattentive Processing,” *ACM Transactions on Computer-Human Interaction* 3, 2, 107–135.
  28. Healey, C. G., Booth, K. S., and Enns, J. T. (1995). “Real-Time Multivariate Data Visualization Using Preattentive Processing,” *ACM Transactions on Modeling and Computer Simulation* 5, 3, 190–221.
  29. Thompson, K. A., Ingraham, W. J., Healey, M. C., LeBlond, P. H., Groot, C., and Healey, C. G. (1994). “Computer Simulations of the Influence of Ocean Currents on Fraser River Sockeye Salmon (*Oncorhynchus nerka*) Return Times,” *Canadian Journal of Fisheries and Aquatic Sciences* 51, 2, 441–449.
  30. Thompson, K. A., Ingraham, W. J., Healey, M. C., LeBlond, P. H., Groot, C., and Healey, C. G. (1992). “The Influence of Ocean Currents on the Latitude of Landfall and Migration Speed of Sockeye Salmon Returning to the Fraser River,” *Fisheries Oceanography* 2, 1, 163–179.

## CONFERENCE PAPERS

31. Cheng, K., Wu, T., and Healey, C. G. (2022). “Revisiting Non-Parametric Matching Cost Volumes for Robust and Generalizable Stereo Matching.” *36th Conference on Neural Information Processing (NeurIPS 2022)*, [https://proceedings.neurips.cc/paper\\_files/paper/2022/hash/6794f555524c9069e26970a408d353cc-Abstract-Conference.html](https://proceedings.neurips.cc/paper_files/paper/2022/hash/6794f555524c9069e26970a408d353cc-Abstract-Conference.html).
32. Marrs, A., Watson, B., and Healey, C. G. (2019). “View-Warped Soft Shadowing for Local Area Lights.” *Proceedings of the ACM SIGGRAPH Interactive 3D Graphics and Games Symposium (I3D 2019)*.
33. Padia, K., Banda, K. H., and Healey, C. G. (2018). “Yarn: Generating Storyline Visualizations Using HTN Planning.” *Proceedings Graphics Interface 2018 (GI 2018)*, Toronto, Canada, pp. 26–33.
34. Nie, S., Healey, C. G., Padia, K., Munk, S.-L., Benson, J. R., Ciara, D., Sethi, S., and Devarajan, R. (2018) “Visualizing Deep Neural Networks for Text Analytics,” *Proceedings Pacific Visualization (PacVis 2018)*, Kobe City, Japan, pp. 180–189.
35. Chen, Z., Nie, S., Wu, T., and Healey, C. G. (2017) “High Resolution Face Completion with Multiple Controllable Attributes via Fully End-To-End Progressive Generative Adversarial Networks,” arXiv: 1801.07632, 201 (<https://arxiv.org/abs/1801.07632>).
36. Tateosian, L., Amidarbari, R., Healey, C. G., Kozik, P., and Enns, J. (2017). “The Utility of Beautiful Visualizations,” *Proceedings Free and Open Source Software for Geospatial Conference (FOSS4G 2017)*, Boston, Massachusetts, 157–162.
37. Marrs, A., Watson, B., and Healey, C. G. (2017). “Real-Time View Independent Rasterization for Multi-View Rendering,” *Proceedings 38th Annual Conference of the European Association for Computer Graphics (EuroGraphics 2017)*,

Lyon, France, 17–20.

38. Chen, Z., Healey, C. G., and St. Amant, R. (2017). “Performance Characteristics of a Camera-Based Tangible Input Device for Manipulation of 3D Information,” *Proceedings Graphics Interface 2017 (GI 2017)*, Edmonton, Canada, 74–81.
39. Chen, Z. and Healey, C. G. (2016). “Large Image Collection Visualization Using Perception-Based Similarity with Color Features,” *Proceedings 12th International Symposium on Visual Computing (ISVC '16)*, Las Vegas, Nevada, 379–390.
40. Hao, L., Healey, C. G., Bass, S., and Yu, H.-Y. (2016). “Visualizing Static Ensembles for Effective Shape and Data Comparison,” *Visualization and Data Analytics (VDA 2016)*, San Francisco, California, 1–10 (10).
41. Hao, L., Healey, C. G., and Hutchinson, S. E. (2015). “Ensemble Visualization for Cyber Situation Awareness of Network Security Data,” *Visualization for Cyber Security (VizSec 2015)*, Chicago, Illinois, 25–32.
42. Hao, L., Healey, C. G. and Hutchinson, S. E. (2013). “Flexible Web Visualization for Alert-Based Security Analytics,” *Visualization for Cyber Security (VizSec 2013)*, Atlanta, Georgia, 33–40.
43. Phadke, M. N., Pinto, L., Alabi, O. S., Harter, J., Taylor II, R. M., Wu, X., Petersen, H., Bass, S. A., and Healey, C. G. (2012). “Exploring Ensemble Visualization,” *Visualization and Data Analysis (VDA 2012)*, San Francisco, California, vol. 8294, paper 0B, 1–12.
44. Alabi, O. S., Wu, X., Harter, J. M., Phadke, M. N., Pinto, L., Petersen, H., Bass, S. A., Keifer, M., Zhong, S., Healey, C. G., and Taylor II, R. M. (2012). “Comparative Visualization of Ensembles Using Ensemble Surface Slicing,” *Visualization and Data Analysis (VDA 2012)*, San Francisco, California, vol. 8294, paper 0U, 1–12.
45. Kocherlakota, S. M. and Healey, C. G. (2009). “Interactive Visual Summarization of Multidimensional Data,” *Proceedings IEEE International Conference on System, Man, and Cybernetics (SMC 2009)*, San Antonio, Texas, 362–369.
46. Sawant, A. P. and Healey, C. G. (2008). “Visualizing Multidimensional Query Results Using Animation,” *Visualization and Data Analysis (VDA 2008)*, San Jose, California, vol. 6809, paper 04, 1–12.
47. Sawant, A. P., Raina, R., and Healey, C. G. (2007). “ChipViz: Visualizing Memory Chip Test Data,” *Proceedings 3rd International Symposium on Visual Computing (ISVC 2007)*, Lake Tahoe, Nevada, 711–720.
48. Tateosian, L. G., Healey, C. G., and Enns, J. T. (2007). “Engaging Viewers Through Nonphotorealistic Visualizations,” *Proceedings Fifth International Symposium on Non-Photorealistic Animation and Rendering (NPAR 2007)*, San Diego, California, 93–102.
49. Sawant, A. P., Vanninen, M., and Healey, C. G. (2007). “PerfViz: A Visualization Tool for Analyzing, Exploring, and Comparing Storage Controller Performance Data,” *Proceedings Visualization and Data Analysis (VDA 2007)*, San Jose, California, vol. 6495, paper 07, 1–11.
50. Tateosian, L. G., Dennis, B. M., and Healey, C. G. (2006). “Stevens Dot Patterns for 2D Flow Visualization,” *Proceedings ACM Symposium on Applied Perception in Graphics and Visualization (APGV 2006)*, Boston, Massachusetts, 93–100.
51. Qi, W., Taylor II, R. M., Healey, C. G., and Martens, J-B. (2006). “A Comparison of Immersive HMD, Fish Tank VR and Fish Tank with Haptics Displays for Volume Visualization,” *Proceedings ACM Symposium on Applied Perception in Graphics and Visualization (APGV 2006)*, Boston, Massachusetts, 51–58.
52. Healey, C. G. and Snoeyink, J. (2006). “VisTRE: A Visualization Tool to Evaluate Errors in Terrain Representation,” *Proceedings Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT 06)*, Chapel Hill, North Carolina.
53. Huber, D. E. and Healey, C. G. (2005). “Visualizing Data with Motion,” *Proceedings IEEE Visualization 2005*, Minneapolis, Minnesota, 527–534.
54. Zaiantz, J. D., Holt, L. S., Wood, S. D., Healey, C. G., and St. Amant, R. (2005). “Enhancing Decision-Making by Explicitly Training Battlefield Visualization Skills,” *Proceedings Interservice/Industry Training, Simulation & Education Conference (IITSEC 2005)*, Orlando, Florida.
55. Ning, P., Dingbang, X., Healey, C. G., and St. Amant, R. (2004). “Building Attack Scenarios Through Integrating Complementary Alert Correlation Methods,” *Proceedings 10th Annual Network and Distributed Security Systems Symposium*

(*NDSS 2004*), San Diego, California, 97–111.

56. Dennis, B. M. and Healey, C. G. (2002). “Assisted Navigation of Large Information Spaces,” *Proceedings IEEE Visualization 2002*, Boston, Massachusetts, 419–426.
57. Walter, J. D. and Healey, C. G. (2001). “Attribute Preserving Dataset Simplification,” *Proceedings IEEE Visualization 2001*, San Diego, California, 113–120.
58. Healey, C. G. (2001). “Formalizing Artistic Techniques and Scientific Visualization for Painted Renditions of Complex Information Spaces,” *Proceedings International Joint Conference on Artificial Intelligence (IJCAI 2001)*, Seattle, Washington, 371–376.
59. St. Amant, R. and Healey, C. G. (2001). “Usability Guidelines for Interactive Search in Direct Manipulation Systems,” *Proceedings International Joint Conference on Artificial Intelligence (IJCAI 2001)*, Seattle, Washington, 1179–1184.
60. Healey, C. G., St. Amant, R., and Chang, J. (2001). “Assisted Visualization of E-Commerce Auction Agents,” *Proceedings Graphics Interface 2001*, Ottawa, Canada, 201–208.
61. St. Amant, R., Healey, C. G., Riedl, M., Kocherlakota, S., Pegram, D. A., and Torhola, M. (2001). “Intelligent Visualization in a Planning Simulation,” *Proceedings Intelligent User Interfaces 2001*, Santa Fe, New Mexico, 153–160.
62. Weigle, C., Emigh, W. G., Liu, G., Taylor II, R. M., Enns, J. T., and Healey, C. G. (2000). “Oriented Texture Slivers: A Technique for Local Value Estimation of Multiple Scalar Fields,” *Proceedings Graphics Interface 2000*, Montréal, Canada, 163–170.
63. Healey, C. G. and St. Amant, R. (1999). “ViA: A Perceptual Visualization Assistant,” *Proceedings 28th Workshop on Advanced Imagery Pattern Recognition (AIPR-99): 3D Visualization for Data Exploration and Decision Making*, Washington, DC, 2–11.
64. Healey, C. G. and Enns, J. T. (1998). “Building Perceptual Textures to Visualize Multidimensional Datasets,” *Proceedings IEEE Visualization '98*, Research Triangle Park, North Carolina, 111–118.
65. Healey, C. G. (1998). “On the Use of Perceptual Cues and Data Mining for Effective Visualization of Scientific Datasets,” *Proceedings Graphics Interface '98*, Vancouver, Canada, 177–184.
66. Tam, R. Healey, C. G., Flak, B., and Cahoon, P. (1997). “Volume Visualization of Aortic Aneurysms,” *Proceedings IEEE Visualization '97*, Phoenix, Arizona, 43–50.
67. Healey, C. G. (1996). “Choosing Effective Colours for Data Visualization,” *Proceedings IEEE Visualization '96*, San Francisco, California, 263–270.
68. Healey, C. G., Booth, K. S., and Enns, J. T. (1993). “Harnessing Preattentive Processes for Multivariate Data Visualization,” *Proceedings Graphics Interface '93*, Toronto, Canada, 107–117.

## BOOKS

69. Healey, C. G. (2016). *Disk-Based Algorithms for Big Data*, Boca Raton, Florida: CRC Press.

## BOOK CHAPTERS

70. Healey, C. G., Hao, L., and Hutchinson, S. E. (2017). “Lessons Learned: Visualizing Cyber Situation Awareness in a Network Security Domain,” in *Human-Centric Cyber Situation Awareness*, M. Albanese, N. Cooke, C. González, D. Hall, C. Healey, S. Jajodia, P. Liu, M. McNeese, P. Ning, D. Reeves, V. S. Subrahmanian, C. Wang, J. Yen, Eds. New York, New York: Springer Publishing Company Lecture Notes on Computer Science 10030, to appear.
71. Healey, C. G., Hao, L., and Hutchinson, S. E. (2014). “Visualizations and Analysts,” in *Cyber Defense and Situation Awareness*, A. Kott, C. Wang and R. Erbacher, Eds. New York, New York: Springer Publishing Company, pp. 145–165.
72. Qi, W., Taylor, R. M., Healey, C. G., and Martens, J.-B. (2008). “3D Interaction With Scientific Data Through Virtual Reality and Tangible Interfacing,” in *User Centered Design for Medical Visualization*, F. Dong, G. Ghinea, and S. Y. Chen, Eds. Hershey, Pennsylvania: IGI Global Press, pp. 136–173.

## PATENTS

73. Healey, C. G., Padia, K., Nie, S., Devarajan, R., Sethi, S., Ciara, D., Benson, R., Leeman-Munk, S. P., Cox, J., and Lewis, L. E. (2019). “Interactive Visualizations for a Recurrent Neural Network”, U.S. Patent No. 10,324,983.
74. Healey, C. G., Padia, K., Nie, S., Devarajan, R., Sethi, S., Ciara, D., Benson, R., Leeman-Munk, S. P., Cox, J., Lewis, L. E., and Kabul, M. O. (2019). “Visualizing Convolutional Neural Networks”, U.S. Patent No. 10,192,001.
75. Healey, C. G., Padia, K., Nie, S., Devarajan, R., Sethi, S., Ciara, D., Benson, R., Leeman-Munk, S. P., Cox, J., Lewis, L. E., and Kabul, M. O. (2018). “Interactive Visualizations of a Convolutional Neural Network”, U.S. Patent No. 10,048,826.
76. Healey, C. G., Padia, K., Nie, S., Leeman-Munk, S., Devarajan, R., Sethi, S., Ciara, D., Benson, R., and Cox, J. (2018). “Visualizing Deep Neural Networks”, U.S. Patent No. 9,934,462.
77. Healey, C. G., Dinakaran, G., Padia, K., Devarajan, R., Sethi, S., Ciara, D., Benson, R., and Cox, J. (2017). “Automatically Constructing Training Sets for Electronic Sentiment Analysis”, U.S. Patent No. 9,704,097.

## WORKSHOPS, COURSES, PANELS, AND POSTERS

78. Villanes, A. A., Griffiths, E., Healey, C. G., and Rappa, M. (2016). “Dengue Fever Surveillance in Asia Using Text Mining Cluster Analysis,” *ACM Richard Tapia Celebration of Diversity in Computing (TAPIA 2016)*, Austin, Texas.
79. Ramaswamy, S. S. and Healey, C. G. (2011). “Visualization of the Sentiment of Tweets,” *SAS Analytics 2011 Conference*, Orlando, Florida (Best Student Poster winner).
80. McNamara, A., Mania, K., Banks, M., and Healey, C. G. (2010). “Perceptually Motivated Visualization,” *SIGGRAPH 2010 Course: Perceptually-Motivated Graphics, Visualization, and 3D Displays*, Los Angeles, California, 37–45.
81. Sawant, A. and Healey, C. G. (2006). “Visualizing Abstract Data Using Animation,” *IEEE Visualization 2006 Poster Session*, Baltimore, Maryland, 2006.
82. Hagh-Shenas, H., Interrante, V., Healey, C. G., and Kim, S. (2006). “Weaving Versus Blending: A Quantitative Assessment of the Information Carrying Capacity of Two Alternative Methods for Conveying Multivariate Data with Color,” *Proceedings ACM Symposium on Applied Perception in Graphics and Visualization (APGV 06)* and *SIGGRAPH 2006 Poster Session*, Boston, Massachusetts, 164.
83. St. Amant, R., Blair, J. E., Barry, P., Bendor, Y., and Healey, C. G. (2002). “A Visual Interface to a Music Database,” *Proceedings 6th International Working Conference on Advanced Visual Interfaces (AVI 2002)*, Trento, Italy, 85–88.
84. Rhyne, T-M., Duke, D., Healey, C. G., Interrante, V., and Laidlaw, D. (2001). “Realism, Expressionism, and Abstractionism: Applying Art Techniques to Visualization,” *IEEE Visualization 2001 Panel Session*, San Diego, California, 523–526.
85. Liu, G., Enns, J. T., Healey, C. G., and Spetch, M. L. (2001). “An Advantage of Direct Action in Localization,” *Psychonomic Society 42nd Annual Meeting, Poster 447*, Orlando, Florida.
86. Healey, C. G., Interrante, V., Kremers, D., Laidlaw, D., and Rheingans, P. (2001). “Combining Perception and Impressionist Techniques for Nonphotorealistic Rendering of Multidimensional Data,” *SIGGRAPH 2001 Course 32: Nonphotorealistic Rendering in Scientific Visualization*, Los Angeles, California, 20–52.
87. Liu, G., Enns, J. T., and Healey, C. G. (2000). “Sensitivity to 3D Orientation in Textured Surfaces,” *Psychonomic Society 41st Annual Meeting, Poster 599*, New Orleans, Louisiana.
88. Healey, C. G., Interrante, V., and Rheingans, P. (1999). “Perceptual Techniques for Scientific Visualization,” *SIGGRAPH 99 Course 6: Issues of Visual Perception for Effective Image Generation*, Los Angeles, California, 1–42.
89. Interrante, V., Ferwerda, J., Gossweiler, R., Healey, C. G., and Rheingans, P. (1998). “Low-Level Human Vision and its Impact on Information Display,” *SIGGRAPH 98 Course 32: Applications of Visual Perception in Computer Graphics*, Orlando, Florida, 205–241.

## OTHER PUBLICATIONS

90. Liu, S. and Healey, C. G. (2023). “Abstractive Summarization of Large Document Collections Using GPT,” arXiv: 2310.05690, <https://arxiv.org/abs/2310.05690>.
91. Cheng, K. and Healey, C. G. and Wu, T. (2021). “Towards Adversarially Robust and Domain Generalizable Stereo Matching by Rethinking DNN Feature Backbones,” arXiv: 2108.00335, <https://arxiv.org/abs/2108.00335>.
92. Chen, Z., Nie, S., Wu, T. and Healey, C. G. (2018). “High Resolution Face Completion With Multiple Controllable Attributes via Fully End-to-End Progressive Generative Adversarial Networks,” arXiv: 1801.07632, <https://arxiv.org/abs/1801.07632>.
93. Dennis, B. M. and Healey, C. G. (2005). “A Survey of Preference Elicitation,” *Technical Report TR-2005-41*, Department of Computer Science, North Carolina State University.
94. Kocherlakota, S. M. and Healey, C. G. (2005). “Summarization Techniques for Visualization of Large, Multidimensional Datasets,” *Technical Report TR-2005-35*, Department of Computer Science, North Carolina State University.
95. Sawant, A. P. and Healey, C. G. (2005). “A Survey of Display Device Properties and Visual Acuity for Visualization,” *Technical Report TR-2005-32*, Department of Computer Science, North Carolina State University.
96. Tateosian, L. G. and Healey, C. G. (2004). “NPR: Art Enhancing Computer Graphics,” *Technical Report TR-2004-17*, Department of Computer Science, North Carolina State University.
97. St. Amant, R., Blair, J. E., Healey, C. G., Park, S., Barry, P., and Rogers, D. (2001). “Visualization and Selection in a Music Database: A Case Study,” *Technical Report TR-2001-04*, Department of Computer Science, North Carolina State University.
98. Healey, C. G. (1996). “Effective Visualization of Large, Multidimensional Datasets,” Ph.D. Thesis, Department of Computer Science, University of British Columbia.
99. Healey, C. G. and Enns, J. T. (1996). “A Perceptual Colour Segmentation Algorithm,” *Technical Report TR-96-09*, Department of Computer Science, University of British Columbia.
100. Healey, C. G. (1992). “Visualization of Multivariate Data Using Preattentive Processing,” M.Sc. Thesis, Department of Computer Science, University of British Columbia.

## SELECTED INVITED PRESENTATIONS

- |      |   |
|------|---|
| 2016 | VisSoft 2016 Keynote Presentation (Raleigh, North Carolina)   |
| 2015 | VisCenter Distinguished Lecture, University of North Carolina at Charlotte (Charlotte, North Carolina)  |
| 2014 | Southern Association for Public Opinion Research Annual Conference (Raleigh, North Carolina)  |
| 2013 | SCI Institute, University of Utah (Salt Lake City, Utah)  |
| 2013 | SAMSI-FODAVA Workshop on Interactive Visualization and Analysis of Massive Datasets (Durham, North Carolina)  |
| 2011 | Department of Physics, Michigan State University (East Lansing, Michigan).  |
| 2010 | Scalable Analysis and Visualization Department, Sandia National Laboratory (Albuquerque, New Mexico).   |
| 2008 | Computational Sciences and Engineering Division, Oak Ridge National Laboratory (Oak Ridge, Tennessee).<br>Center for Critical Inquiry, University of North Carolina at Greensboro (Greensboro, North Carolina). |
| 2007 | Renaissance Computing Institute (RENCI) (Chapel Hill, North Carolina).  |
| 2006 | Département d’Informatique et de Recherche Opérationnelle, Université de Montréal (Montréal, Canada).<br>Business Intelligence Group, Cisco Systems (Raleigh, North Carolina).                                  |
| 2005 | Department of Computer Science and Engineering, University of Minnesota (Minneapolis, Minnesota).<br>Department of Computer Science, University of North Carolina at Chapel Hill (Chapel Hill, North Carolina). |
| 2002 | Department of Computer Science, Virginia Polytechnic Institute and State University (Blacksburg, Virginia).<br>Business Intelligence Usability Research Group, SAS Institute (Cary, North Carolina).            |
| 2000 | Department of Psychology, University of Arizona (Tucson, Arizona).  |



- 1998 NASA Ames Research Laboratory (Mountain View, California).  
Center for Cognitive Science, Rutgers University (New Brunswick, New Jersey).  
Department of Computer Science, Columbia University (New York, New York).  
EECS Department, University of California at Berkeley, (Berkeley, California).
- 1997 Department of Computer Science, University of Alberta (Edmonton, Canada).  
Department of Computer Science, Simon Fraser University (Vancouver, Canada).  
Department of Computer Science, Queen’s University (Kingston, Canada).
- 1996 Department of Computer Science, University of Washington (Seattle, Washington).  
Department of Computer Science, York University (Toronto, Canada).  
Department of Computer Science, University of Ottawa (Ottawa, Canada).

## STUDENT SUPERVISION

### CURRENT

- 2023– Angela Zhang, PhD  
2021– Nisan Chhetri, PhD  
2021– Shengjie Liu, PhD

### PHD

- 2019–2023 Kelvin Cheng. “Towards Robust, Generalizable, and Explainable Stereo Matching for Autonomous Driving” (Rivian).
- 2019–2023 Kornelia Bastin, “Summarizing and Visualizing NASCAR Driver–Pit Crew Communication for Post-Race Analysis” (Truist Bank).
- 2019–2022 Shailaja Mallick, “Spread of Opinion in a Social Network.” (Assistant Professor, Providence College).
- 2014–2019 Andrea Villanes, “Epidemiological Disease Surveillance Using Public Media Text Mining” (Teaching Assistant Professor, Institute for Advanced Analytics, North Carolina State University).
- 2012–2019 Kalpesh Padia, “Storyline Visualization Techniques for Linear, Non-Linear, and Diabetic Narratives” (eBay).
- 2015–2019 Shaoliang Nie, “Visualizing Deep Neural Networks in the Text Domain” (Facebook).
- 2014–2019 Zeyuan Chen, “High Resolution and Fast Face Completion with Multiple Controllable Attributes via Progressively Attentive Generative Adversarial Networks” (Salesforce).
- 2012–2016 Adam Marrs, “Real-Time GPU Accelerated Multi-View Point-Based Rendering” (NVIDIA).
- 2011–2014 Lihua Hao, “Octree and Clustering Based Hierarchical Ensemble Visualization” (Facebook).
- 2006–2010 Ping-Lin Hsiao, “Visualizing Large Document Collections” (Align)
- 2002–2007 Amit Sawant, “Perceptual Display Hierarchies for Visualization” (Riverbed Technology).
- 2002–2006 Brent Dennis, “Integrating Preference Elicitation into Visualization” (MIT Lincoln Laboratory).
- 2002–2006 Laura Tateosian, “Investigating Aesthetic Visualizations” (Research Assistant Professor, Geographic Information Systems program, North Carolina State University).
- 2002–2006 Sarat Kocherlakota, “Interactive Visual Summarization for Visualizing Large Multidimensional Datasets” (Red Hat).

### MS

- 2022–2023 Jinam Shah, “Author Name Disambiguation in Academic Records” (College of Agricultural and Life Sciences, NC State University).
- 2019–2021 Yoonchul Ro, “Multi-State and Individual State Time Series Model Comparison” (Amazon).
- 2018–2019 Debosmita Das, graduated with MSA without thesis. (Fidelity Investment).
- 2016–2018 Debosmita Das, “Time Series Analysis and Visualization: Forecasting and Detection of the Abnormal Changes in Data” (also graduated with MSA 2019)
- 2014–2016 Pallavi Deo, “DataSlicer: A Recommendation System for Visual Data Exploration” (Tableau).
- 2014–2016 Nupur Mallik, “Classification and Visualization of Wildfire Tweets” (Amazon).
- 2013–2015 Gowtham Dinakaran, “Visualizing Narrative Threads in a Large Collection of Documents” (OSISoft).

- 2012–2014 Adam Marrs, graduated with MS during PhD, (NVidia).
- 2011–2013 Hilay Khatri, “Data Visualization Using Web Technologies” (Cisco Systems).
- 2009–2011 Lifford Pinto, “Visualizing Ensembles Using Screen Door Tinting” (i-Cubed).
- 2009–2011 Geoffrey Rogers, “Combining Glyph Based and Topographical Techniques to Visualize United States Congressional Earmarks” (Citigroup).
- 2009–2011 Siddarth Ramaswamy, “Visualization of the Sentiment of Tweets” (Microsoft Corporation).
- 2009–2011 Madhura Phadke, “Combining Ensembles for Effective Data Visualization” (Microsoft Corporation).
- 2009–2011 Sriprabha Gopalan, “Visualizing Performance and Usage Patterns for Large Distributed Environments” (Walmart eCommerce).
- 2009–2010 Jayashree Venkatesh, “Pairwise Document Similarity Using an Incremental Approach to TF-IDF” (Intel Corporation).
- 2009–2010 Nazli Dokuzoglu, graduated with MS without thesis. (Intel Corporation).
- 2008–2009 Karthik Ramachandran, “Visualizing and Comparing Multivariate Scalar Data Over a Geographic Map” (Sabre Design & Analysis).
- 2006–2007 Andrew Whitehorne, “Telescope: A Multidimensional Visualization Framework in Support of the Development of a Perceptual Display Hierarchy” (Werum Software and Systems).
- 2004–2006 Ping-Lin Hsiao, “Visualization for Combinatorial Auctions” (also graduated with PhD 2010).
- 2003–2005 Jyron Baxter, graduated with MCS (Department Chair, Information Technology Department, York Technical College).
- 2002–2004 Reshma Mehta, “Visualization Search Strategies” (Microsoft Corporation).
- 2002–2004 Dan Huber, “Simple Motion in Glyph-Based Visualization” (Northrop Grumman).
- 2001–2003 Amit Sawant, “Dynamic Visualization of the Relationship Between Multiple Representations of an Abstract Information Space” (also graduated with PhD 2007).
- 2001–2003 Vivek Rao, “Mixed-Initiative Techniques for Assisted Visualization” (Google).
- 2000–2003 Mike Romeo, “Multi-Dimensional Dataset Visualization for Portable Computing Environments.”
- 2000–2002 Brent Dennis, “Assisted Navigation of Large Information Spaces” (also graduated with PhD 2006).
- 2000–2002 Laura Tateosian, “Nonphotorealistic Visualization of Multidimensional Datasets” (also graduated with PhD 2006).
- 1999–2002 Sarat Kocherlakota, “Perception Driven Search Strategies for Effective Multidimensional Visualization” (also graduated with PhD 2006).
- 1999–2001 Jiae Chang, “A Perceptual Visualization Assistant for Multidimensional Data Visualization.”
- 1999–2001 Jason Walter, “Appearance Preserving Dataset Simplification” (Alias/Wavefront).

## TEACHING EXPERIENCE

- ◆ CSC 210, Data Structures in C++
- ◆ CSC 216, Data Structures in Java
- ◆ CSC 246, Operating Systems
- ◆ CSC 431, File Structures
- ◆ CSC 461, Computer Graphics
- ◆ CSC 462, Game Engine Design
- ◆ CSC 463, Visual Interfaces for Mobile Apps
- ◆ CSC 541, Graduate File Structures
- ◆ CSC 561, Graduate Computer Graphics
- ◆ CSC 562, Graduate Game Engine Design
- ◆ CSC 563, Graduate Visual Interfaces for Mobile Apps
- ◆ CSC 591, Data and Visual Analytics
- ◆ CSC 600, Introduction to Graduate Research
- ◆ CSC 761, Readings in Computer Graphics

- ◆ IAA 501, Introduction to Visualization
- ◆ IAA 501, Introduction to Programming in Python
- ◆ IAA 501, Text Analytics
- ◆ IAA 501, Visualization Tools
- ◆ IAA 501, Linear Algebra
- ◆ IAA 502, Geographic Information Systems with Google Maps
- ◆ IAA 502, Deep Learning

## PROFESSIONAL SERVICE

- ◆ Associate editor, ACM Transactions on Applied Perception.
- ◆ Conference co-chair, Visualization and Data Analysis 2013 (San Francisco, California).
- ◆ Program co-chair, Graphics Interface 2007 (Montréal, Canada).
- ◆ Program committee, IEEE Information Visualization (2006, Baltimore, Maryland; 2007, Sacramento, California; 2008, Columbus, Ohio; 2011, Providence, Rhode Island; 2012, Seattle, Washington; 2013, Atlanta, Georgia; 2015, Chicago, Illinois; 2016, Baltimore, Maryland; 2017, Phoenix, Arizona).
- ◆ Program committee, ACM Symposium on Applied Perception in Graphics and Visualization (2004, Los Angeles, California; 2005, A Coruña, Spain; 2006, Boston, Massachusetts; 2007, Tübingen, Germany; 2008, Los Angeles, CA; 2009, Crete, Greece; 2010, Los Angeles, California).
- ◆ Program committee, SIBGRAPI: Brazilian Symposium on Computer Graphics and Image Processing (2000, Gramado, Brazil; 2008, Campo Grande, Brazil; 2009, Rio de Janeiro, Brazil; 2011, Marceió, Brazil; 2012, Ouro Preto, Brazil; 2013, Arequipa, Peru; 2014, Rio de Janeiro; 2015, Salvador).
- ◆ Program committee, EuroVis (2008, Eindhoven, Netherlands; 2009, Berlin, Germany; 2010, Bordeaux, France).
- ◆ Program committee, IEEE Visualization (2004, Austin, Texas; 2005, Minneapolis, Minnesota; 2006, Baltimore, Maryland; 2009, Atlantic City, New Jersey; 2010, Salt Lake City, Utah).
- ◆ Program committee, Graphics Interface (2000, Montréal, Canada; 2002, Calgary, Canada; 2006, Québec City, Canada; 2009, Kelowna, Canada).
- ◆ Conference committee, IEEE Visualization (2000, Salt Lake City, Utah; 2001, San Diego, California; 2012, Seattle, Washington).
- ◆ Member, National Science Foundation proposal review panel (2000; 2001 ×2; 2002; 2003; 2007 ×2; 2008; 2011).
- ◆ Member, Department of Energy proposal review panel (2010).
- ◆ Reviewer, National Science Foundation, National Research Council.
- ◆ Reviewer, ACM TAP; ACM TOG; ACM TOIS; Computers & Graphics; Computer Graphics Forum; Data & Knowledge Engineering; IEEE CG&A; IEEE TVCG; Information Visualization Journal; Journal of Experimental Psychology; Psychological Science; Perception
- ◆ Reviewer, AAAI; ACM APGV; ACM SIGCHI; ACM SIGGRAPH; Eurographics; EuroVis; Graphics Interface; IEEE Visualization; IEEE InfoVis Symposium; IJCAI; Intelligent User Interfaces; ISVC; Knowledge-Assisted Vis; PacificVis; SIBGRAPI; UIST; VDA; VR
- ◆ Member, Sigma Xi Scientific Research Society
- ◆ Senior Member, Association of Computing Machinery (ACM)
- ◆ Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

## DEPARTMENT SERVICE

- ◆ Member, Department Head search committee
- ◆ Chair, Department graduate admissions committee
- ◆ Member, Department Head review committee
- ◆ Chair, Department strategic planning committee
- ◆ Chair, Computer Graphics faculty search committee

- ◆ Chair, Operating Systems faculty search committee
- ◆ Member, Department Head search committee
- ◆ Chair, graduate student recruiting program
- ◆ Co-chair, Accelerated Undergraduate Research in Computer Science program.
- ◆ Chair, Computer Science undergraduate scholarship committee
- ◆ Course curriculum additions: CSC 462, Game Engine Design; CSC 463, Visual Interfaces for Mobile Apps; CSC 561, Graduate Computer Graphics; CSC 562, Graduate Game Engine Design; CSC 563, Graduate Visual Interfaces for Mobile Apps; CSC 591, Data and Visual Analytics; CSC 600, Introduction to Graduate Research in Computer Science; CSC 761, Readings in Computer Graphics; IAA 501, Introduction to Visualization; IAA 501, Introduction to Programming in Python; IAA 501, Text Analytics; IAA 501, Visualization Tools; IAA 502, Geographic Information Systems with Google Maps

## REFERENCES

- ◆ Dr. Michael Rappa, Director, Institute for Advanced Analytics  
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612.625.3543
- ◆ Dr. Robert St. Amant  
Program Manager, US Army DEVCOM ARL  
Office of Strategic Communications  
2800 Power Mill Road, Adelphi, MD, 20783-1197  
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## STATEMENT OF RESEARCH

My primary research areas are visualization and visual analytics, text analytics, and machine learning. Initial research focused on the development of methods for visualizing large, multidimensional datasets to support rapid and accurate *exploration, analysis, validation, and discovery*. The need to address the *size* and *dimensionality* of these types of datasets is an important area of current research. My investigations focus on issues at the forefront of visualization, in particular, the application of perception, artificial intelligence, and data analytics to improve the effectiveness of techniques to visualize “big data.” Past and current work on human vision, assisted visualization, and intelligent data management targets exactly these areas.

Visualization research is built on a fundamental investigation of how our visual system perceives the world around us. Understanding what we see and how we see it is critical to any attempt to harness, enhance, predict, or simulate human vision. Datasets are collections of strings and numbers, usually representing measurements or results. Visualization converts this information into a picture that a viewer can use to “see” values, relationships, and structure. Examples of large, multidimensional datasets include scientific simulation ensembles, situation awareness environments, and massive document collections. The amount and type of information stored in these datasets make them difficult to analyze using traditional mathematical or statistical algorithms. Moreover, the possibility of real-time data generation, for example, in network security monitoring or military command and control, introduces the need for rapid and accurate visual analytics.

More recent work has focused on machine learning and text analytics. We have published work in sentiment analysis, voice-to-text analytics, time series analytics, and abstractive summarization of large document collections. More specifically, we are extending existing solutions offered by LLMs and related systems to manage issues of scale, noise, and domain that current approaches have not considered or fully solved. By carefully managing the input and analysis of the output of LLMs, and by integrating different solutions (*e.g.*, sentiment analysis to subdivide large document collections into smaller “semantic chunks”) we can replace or extend existing approaches to handle larger and more complex data.

Active research projects include:

- ◆ **Perception in Visualization.** A critical visualization goal is the presentation of data in ways that are informative and meaningful, on the one hand, yet intuitive and accessible on the other. This project investigates how the low-level human visual system directs attention to acquire and recall information. Results are used to design visualization tools that allow *rapid, accurate, and effortless* visual exploration.
- ◆ **Assisted Visualization Design.** This project studies ways to integrate perceptual guidelines from psychophysical experiments into ViA, an automated “visualization assistant.” Perceptual rules are converted into evaluation engines that critique a visualization and offer hints on how it might be improved. ViA asks viewers a set of simple, application-independent queries about their dataset and the analysis tasks they want to perform. This information is used in combination with the evaluation engines and mixed-initiative search algorithms from artificial intelligence to identify and improve promising visualization designs. ViA returns a collection of visualizations identified as most appropriate for the dataset and task at hand.
- ◆ **Assisted Navigation.** The size of a typical multidimensional dataset will often overwhelm our ability to visualize it in a single display. This project studies methods to assist with navigation inside large collections of data. A detailed local display is combined with a high-level global overview of “areas of interest” that are semi-automatically extracted and updated using preference elicitation techniques from artificial intelligence. The local display applies perceptual cues to harness the abilities of the low-level human visual system. The global overview presents a spatial layout of the areas of interest and provides automatic navigation within these areas using graph traversal and camera planning algorithms.
- ◆ **Ensemble Visualization.** Many domains construct *ensembles*, large collections of related *member* datasets that need to be explored, analyzed, and compared. We are studying ways to visualize ensembles, with a specific focus on: (1) visualizing member datasets that are large, high-dimensional, and temporal; and (2) visualizing ensembles that contain a large number of member datasets.
- ◆ **Text Analytics & Visualization.** A recent area of significant interest is text analytics, the analysis of large, unstructured document collections. This project studies ways to derive features from a text collection, for example, sentiment, topic clusters, and summaries. These features, together with properties like grade reading level, publication date, and document length, are visualized using document glyphs. This allows viewers to explore an overview of the collection, organized in different ways, and then request details on demand for subsets of documents that contain interesting or important

text. Other text analytics projects in progress include abstractive summarization of large document collections, speech-to-text analysis of NASCAR driver-pit crew communication, and efficient methods of upsampling and downsampling in rare-event datasets.

- ◆ **Time Series Analytics.** The need for predictive time series models is acute. We are comparing the capabilities of a wide range of time series methods (*e.g.*, ESM, ARIMA, ARIMAX, Bayesian) across a range of data domains, including epidemiology and meteorology.
- ◆ **Deep Learning & Generative AI.** Recent work has focused on the use of different forms of deep learning, large language models (LLMs), and stable diffusion. For example, we developed a CNN-based approach for stereo matching in autonomous driving that recognized white-box attacks. We are also building an abstractive summarizer for large document collections that works for in both static and dynamic environments, using semantic chunking and topic modelling to leverage and scale ChatGPT and other LLMs' abstractive summarization engines to document collections of any size.

## STATEMENT OF TEACHING

One of my primary motivations for pursuing a position at an academic institution was the chance to teach. I enjoy the challenge of trying to impart my knowledge in a manner that is both effective and enjoyable for the undergraduate and graduate students I instruct. My personal belief is that students will best understand and retain material if a clear path is defined from the basic fundamentals to more complex, abstract concepts. This allows students to start by solidifying knowledge with which they are most comfortable. They use this knowledge to attack new problems as they arise. Rarely will I say "I can't explain this fully now, because you don't have the background you need yet," rather, I am careful to schedule material in a manner that flows smoothly. In cases where multiple topics depend on one another, I present each in its entirety; I have found it is better to explain everything, including information that might not be immediately obvious, rather than breaking the discussion into disconnected vignettes that jump back and forth.

I do not expect students to completely master the fundamentals in a single session. Rather, I make a concerted effort to refer back to this material during the course, since this will: (1) reinforce important ideas and refresh a student's memory; (2) demonstrate a practical application of an idea through its relationship to more advanced problems, and (3) hopefully convince the students that there is value in fully understanding certain ideas, or at least in having the ability to recall and reexamine the ideas if necessary.

This general framework has extended well to many types of courses (*e.g.*, undergraduate and graduate level material). The difference lies only in what constitutes the fundamentals, which itself depends on prerequisite courses, and on the instructional goals the course is designed to meet. Student evaluations and personal contact suggest that this style of teaching works well for most of the students I have instructed. I use student feedback to continually refine my techniques and experiment with promising new ideas that might improve the effectiveness of my lectures.

My teaching has been recognized as outstanding, both at different institutions, and at different levels of instruction. I received eight Department Teaching Awards for outstanding evaluations while I was a graduate teaching assistant at the University of British Columbia. I received a Department Outstanding New Teacher Award following my first year of instructing at North Carolina State University. In 2003 I received the University Outstanding Teacher Award and membership to the North Carolina State University Academy of Outstanding Teachers, one of the highest teaching honors awarded by the university. In 2014 I was one of two College of Engineering nominees for the Alumni Distinguished Undergraduate Professor award. In 2015 I was chosen by the department's students as an ACM/AITP award recipient. This feedback encourages me to continue to refine my basic methodology in ways that will further improve the level of instruction I can provide to my students.