

PhD Committee Meeting

Marta Kersten

Previous Research

Mobile Emergency Triage (2002-2005)

Dr. Wojtek Michalowski, Telfer School of Management; Faculty of Medicine, University of Ottawa



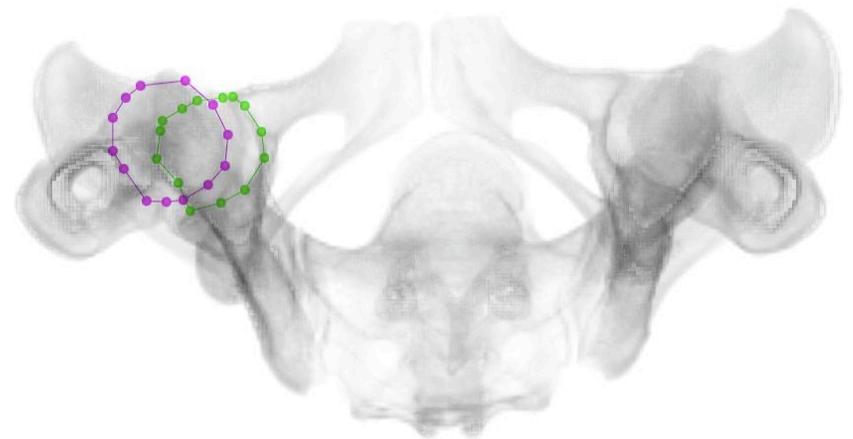
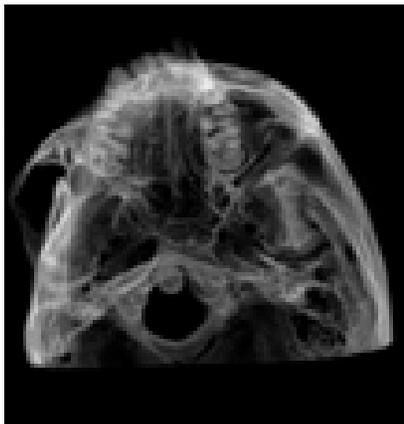
Sz. Wilk, W. Michalowski, K. Farion, and M. Kersten, "Interaction Design for Mobile Clinical Decision Support Systems: the MET System Solutions.", *Foundations of Computing and Decision Sciences*, 32(1):47-62, 2007.

W. Michalowski, M. Kersten, S. Wilk, and R. Slowinski, "Designing man-machine interactions for mobile clinical systems: MET triage support using palm handhelds." *European Journal of Operational Research*, 177(3):1409-1417, March 2007.

Previous Research

Stereoscopic Volume Rendering of Medical Images (Master's Thesis, 2005)

Dr. Randy Ellis & Dr. James Stewart, School of Computing, Queen's Univeristy



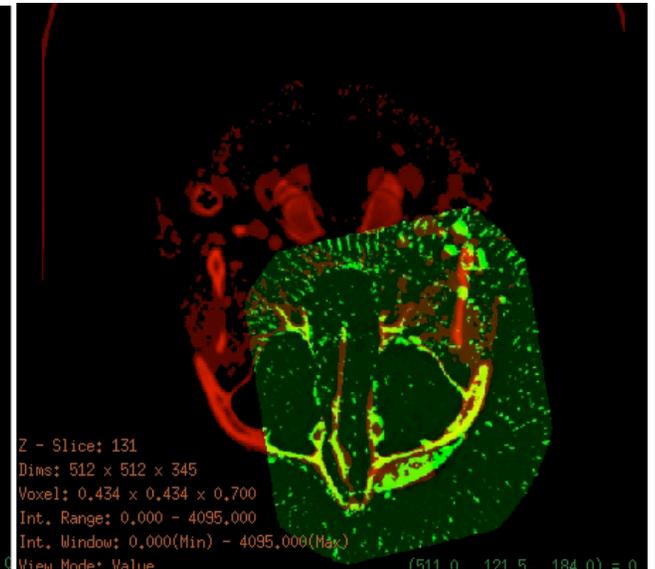
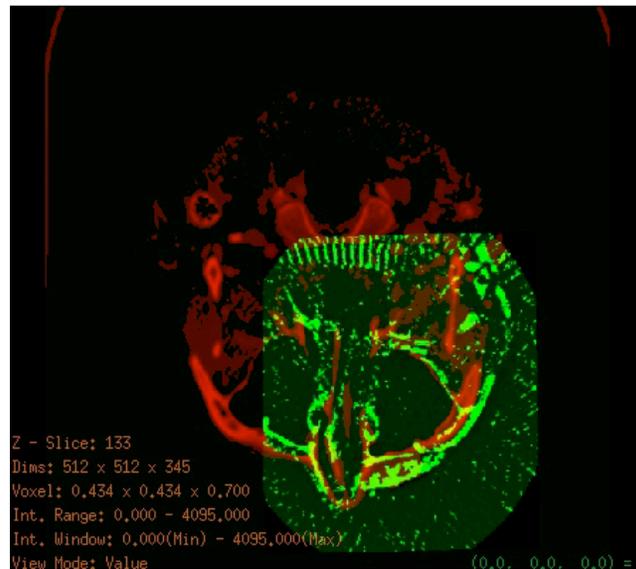
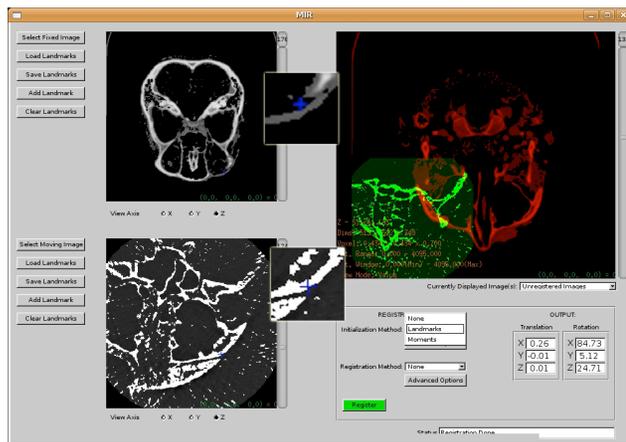
M. Kersten, J. Stewart, N. Troje, and R. Ellis, "Depth Perception in Translucent Volumes". *IEEE Transactions on Visualization and Computer Graphics*, 12(6):1117–1123, September/October, 2006.

J. Inoue, M. Kersten, B. Ma, J. Stewart, J. Rudan and R. Ellis, "Fast assessment of acetabular coverage using stereoscopic volume rendering." *Medicine Meets Virtual Reality (MMVR)*, January 2006.

Previous Research

Angiography to CT/MRI Registration (2006-2007)

Dr. Dirk Bartz, GRIS, University of Tübingen, Germany



M. Kersten, J. Hoffmann, D. Freudenstein, M. Tatagiba, U. Ernemann, D. Bartz. "Registration of 3D rotational angiography to CT (or MR) angiography." Proceedings of the Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie (CURAC), Hannover, Oct. 12 -14, 2007.

Current Research

Visualization of Angiography Data

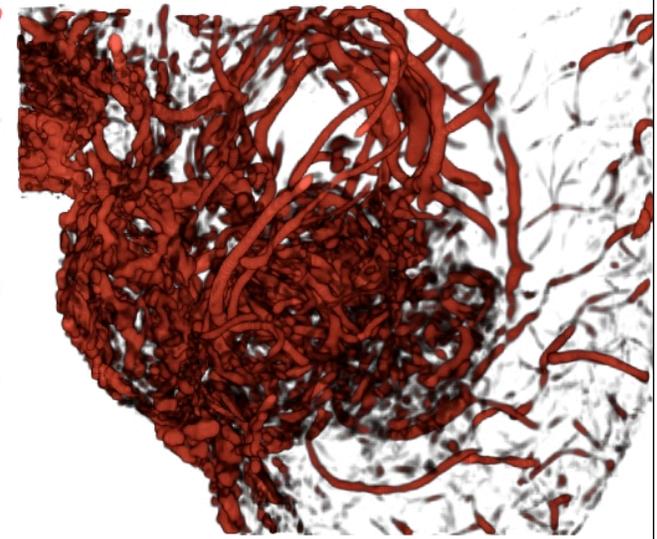
Dr. Louis Collins, BIC, McGill University



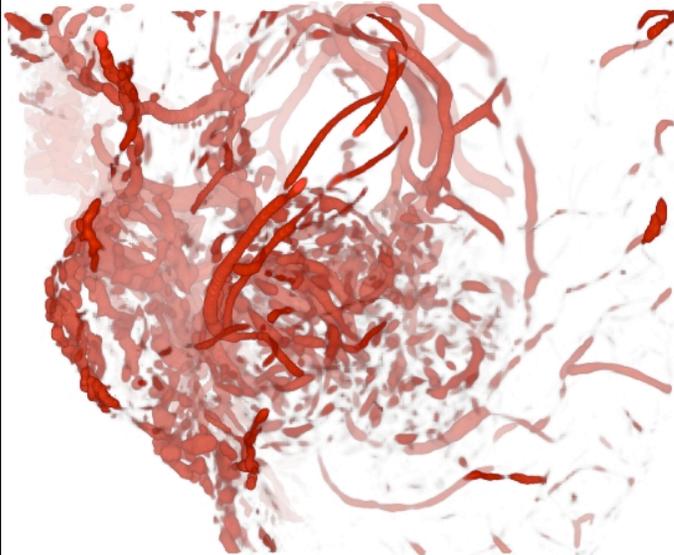
(a) No depth Cues



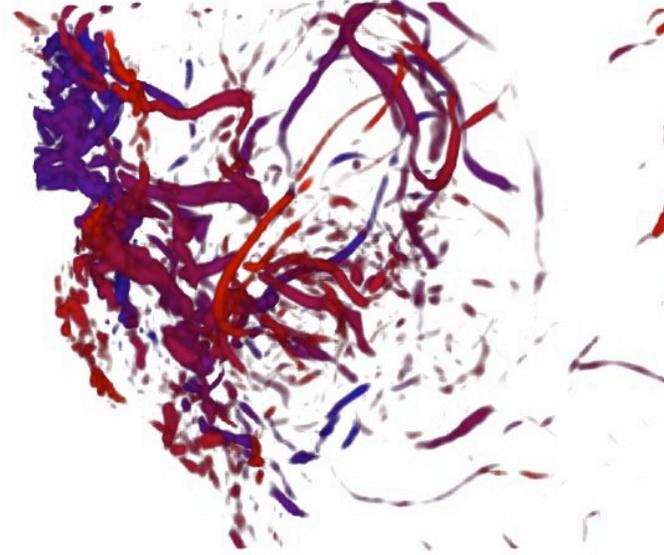
(b) Fog/Simulated Aerial Perspective



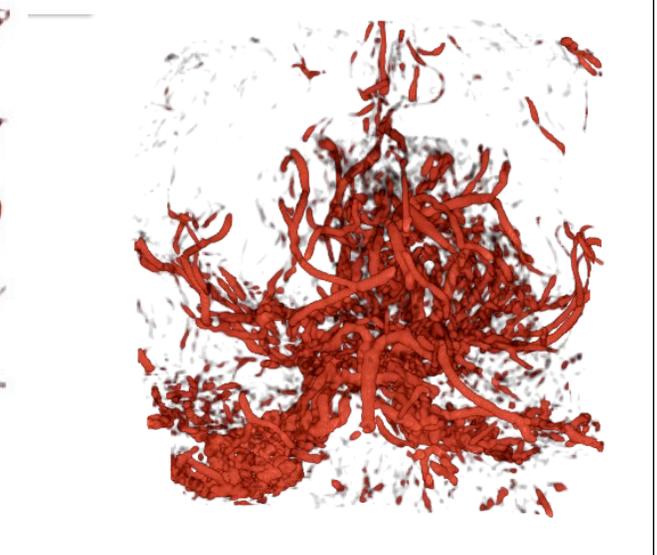
(c) Edge Enhancement



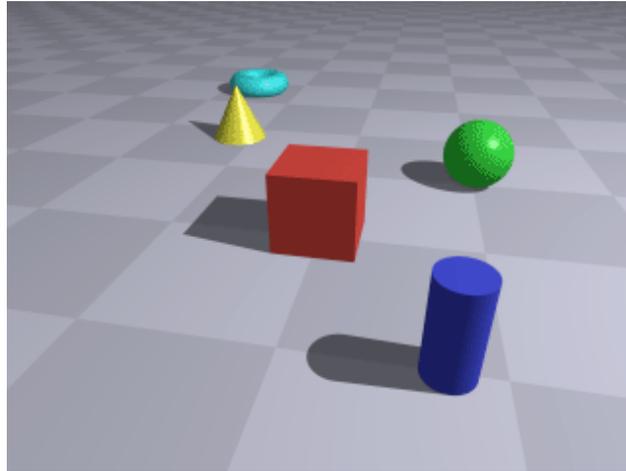
(d) Edge and Fog

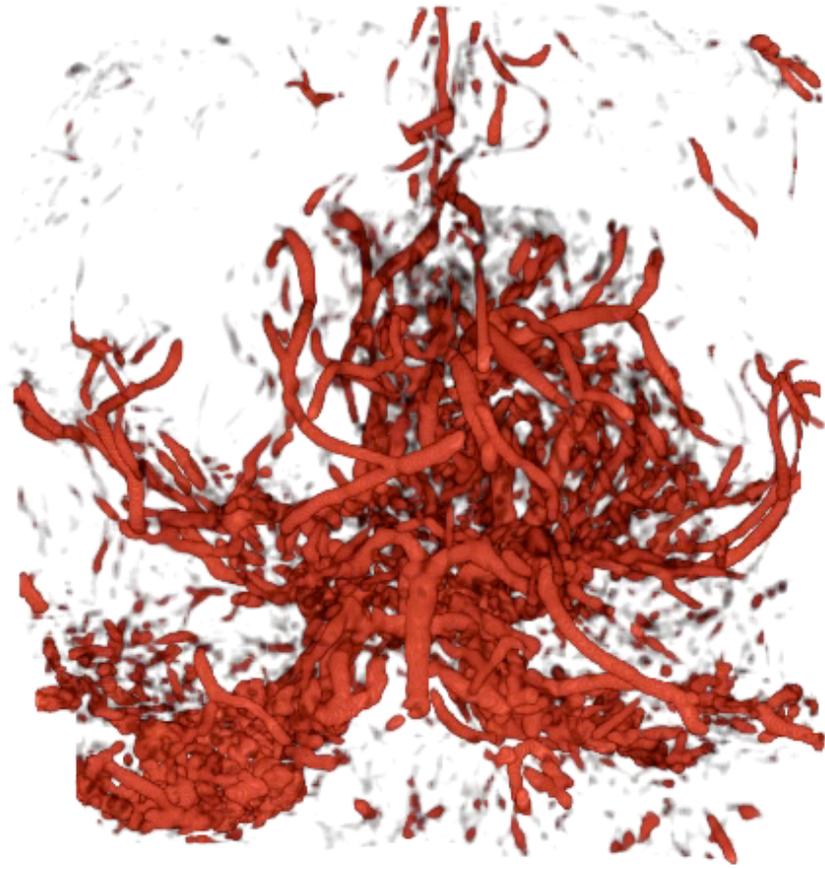


(e) Chromadepth



(f) Wobble Stereo



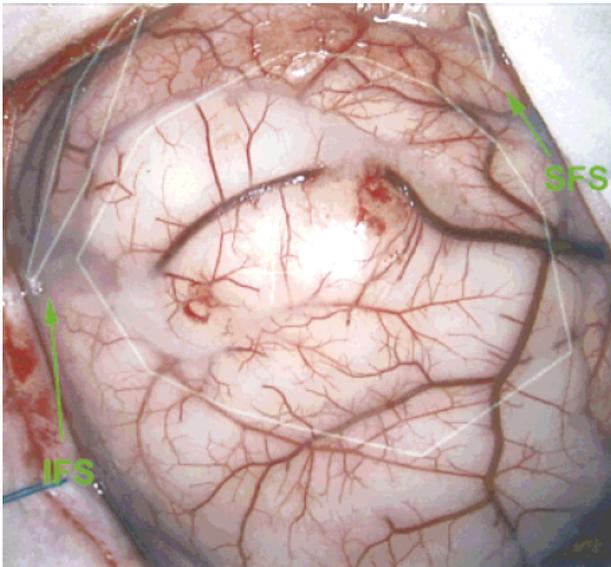


Augmented Reality

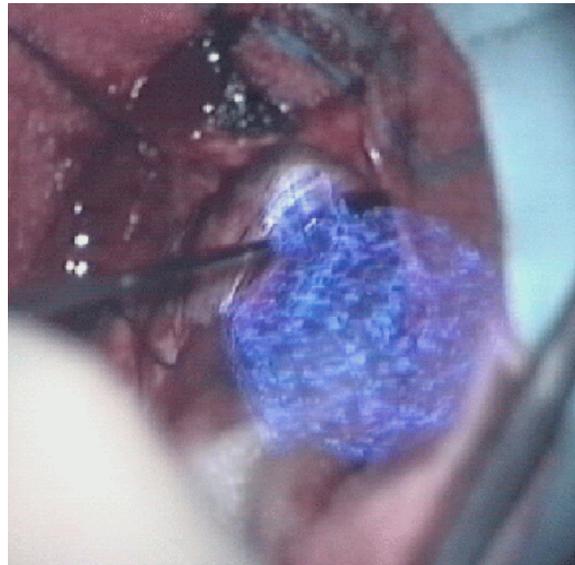
Enhance the real view of the surgeon with preoperatively acquired data from multiple modalities.

Preoperative information displayed within the operative field of view:

- On the oculars of the microscope
- Using head-mounted display
- Onto the patient (half silvered-mirror, projection)



Jannin, P., Fleig, O. J., Seigneuret, E., Grova, C., Morandi, X., and Scarabin, J. M. A data fusion environment for multimodal and multi-informational neuronavigation. *Computer aided surgery* 2000;5(1):1-10.



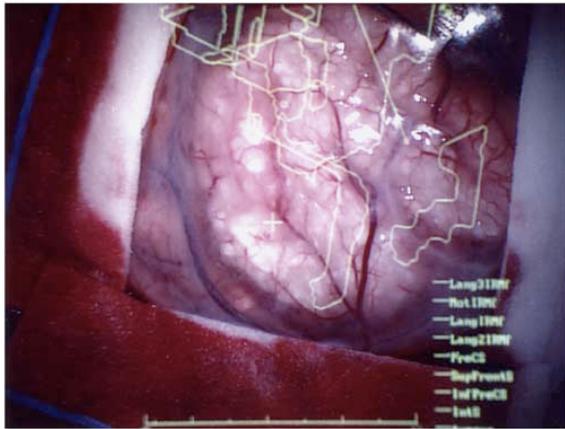
Edwards, P.J., King, A.P., Maurer, C.R., Jr., De Cunha, D.A., Hawkes, D.J., Hill, D.L.G., Gaston, R.P., Fenlon, M.R., Jusczyck, A., Strong, A.J., Chandler, C.L., and Gleeson, M.J. Design and evaluation of a system for microscope-assisted guided interventions (MAGI), *IEEE Transactions on Medical Imaging*, 2000;19(11): 1082-1093.



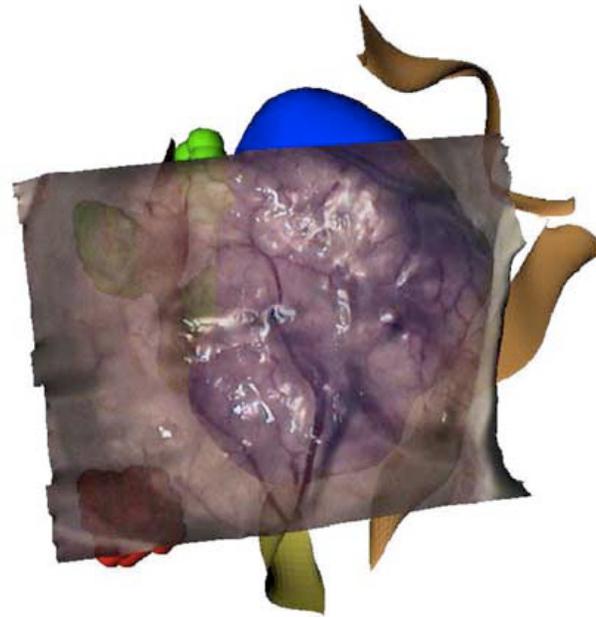
Blackwell, M., Nikou, C., DiGioia, A., Kanade, T.: An Image Overlay system for medical visualization. *Transactions on Medical Image Analysis*, 2000; 4: 67-72

Augmented Virtuality

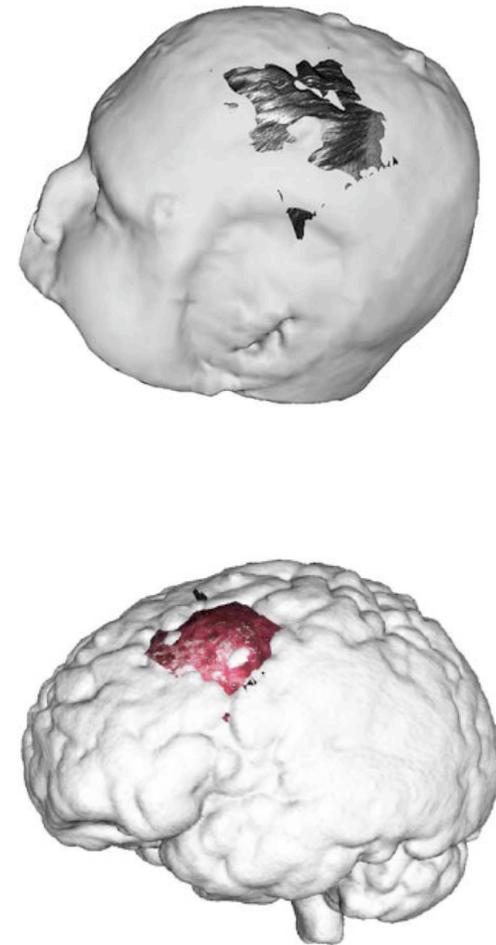
Augment the “virtual world”, i.e., the 3D multi-modal preoperative datasets, with intraoperative views from microscope/camera.



(a) Augmented Reality



(b) Augmented Virtuality



Proposed Research: Motivation

Augmented Reality/Virtuality for Multi-modal Image-Guided Neurosurgery

- Want to overcome the surgeons limited visual perception, restricted view of the region of intervention
- Little research on which methods and techniques are best and how they should be incorporated into the surgical workflow
- Not enough evaluation of current systems from a workflow/human factors/interface perspective
- Need for evaluation of different visualization methods (e.g. Can we get similar perceptual results using other perspective cues than stereo?)

Proposed Research

Augmented Reality/Virtuality for Multi-modal Image-Guided Neurosurgery

- Implementation and evaluation of an augmented reality and augmented virtuality protocol for intraoperative guidance of neurosurgeries
- Evaluation of non-photorealistic rendering (NPR) techniques for Intraoperative Guidance Systems (IGSs)
- Incorporation of psychophysical knowledge (e.g. perception) to drive visualization
- Incorporation of intraoperative (i.e. ultrasound) data into visualizations
- How to best overlay preoperative images into the surgical field of view without disrupting work flow and comprehension of the real world
- Evaluation of these different methods

Courses Taken

McGill:

- PHGY 314 – Integrative Neuroscience
- BMDE 650 – Advanced Medical Imaging
- COMP 764 – Computer Graphics & Animation
- ECSE 626 – Statistical Computer Vision
- ECSE 618 – Haptics
- ECSE 683 – Topics in Vision and Robotics (Audited)

Queen's:

- CISC 850 – Topics in Computer Application & Algorithms
- CISC 857 – Image Processing
- CISC 868 – Computational Geometry
- CISC 874 – Foundations of Neural Networks
- CISC 875 – Bioinformatics (Audited)