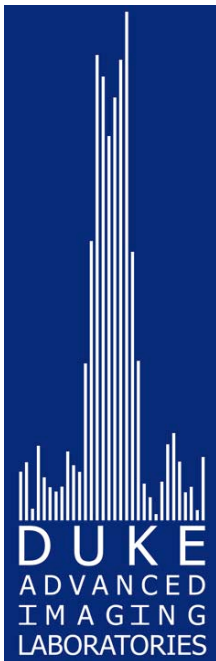


DAI News

A Newsletter of the Duke Advanced Imaging Laboratories



Editors:

Ehsan Samei
Nicole Ranger

Editorial: What is DAI Labs?

It is a pleasure to present to you the first issue of *DAI News*, the bi-annual newsletter of the Duke Advanced Imaging Laboratories (DAI Labs). For those of you who might not be familiar with our group, Duke Advanced Imaging Laboratories is a center for research in advanced digital imaging techniques and applications for improved health care. Originally established in 1991 as the Digital Imaging Research Division, headed by Carey Floyd, the group now consists of over 30 faculty, staff, and research assistants affiliated with the Departments of Radiology, Biomedical Engineering, and Physics at Duke University, Duke University Medical Center, and the Duke Medical Physics Graduate Program. The research initiatives of DAI Labs are primarily supported by federal grants from the National Institutes of Health. The group has also active collaboration with major medical imaging companies. The group prides itself in its focus on quality research with high clinical relevance. It aims to develop effective medical imaging techniques with lasting clinical impact. To date, the research undertaken by the group has been the basis of over 500 scientific papers, hundred of conference presentations, and multiple patents.

Over its history, the group has generated a large body of alumni and collaborated with a notable group of individuals. It is our intention that this newsletter will serve as an efficient means to keep you abreast of developments within the group.

Ehsan Samei, Director

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Research Breakthroughs

As a part of our neutron-stimulated imaging project, our investigators just completed the construction of the **first near-field prototype camera** for imaging of high-energy gamma radiation. They further achieved a milestone in the **quantitative evaluation of elemental composition** in liver specimens.



The number of human subjects in our breast tomosynthesis **clinical trial** just passed 140.

Awards and honors

Devon Godfrey, PhD and co-authors were honored with a cover page acknowledgement for his recent publication in *Medical Physics*: "Optimization of the matrix inversion tomosynthesis (MITS) impulse response and modulation transfer function characteristics for chest imaging."

In May 2006, **Joseph Lo, PhD** and **Ehsan Samei, PhD** each received the Director's Award for Exemplary Service from the Medical Physics Graduate Program at Duke University.

Georgia Tourassi, PhD and co-authors received a Reviewers' Choice recognition for their submission to the American Association of Physicists in Medicine (AAPM) 2006 Annual Meeting, a paper entitled "Information-theoretic CAD system in mammography: investigation of An entropy-based indexing scheme for improved computational efficiency and robust performance."

Group-wide News

DAI Labs will host a special celebration in honor of its most senior faculty member, **Carey Floyd, PhD**. A recognized authority in nuclear medicine image reconstruction, computer aided Diagnosis (CAD), and neutron-stimulated imaging, he will receive a **Lifetime Career Achievement Award** from the Department of Radiology. More than 100 friends, colleagues, and collaborators are expected to attend the celebration which includes addresses by the chairman of radiology, Carl Ravin, MD, Mia Markey, PhD, Gregg Trahey, PhD, and Jim Dobbins, PhD. The celebration will be held at the Nasher Museum of Art at Duke University on July 14, 2006.

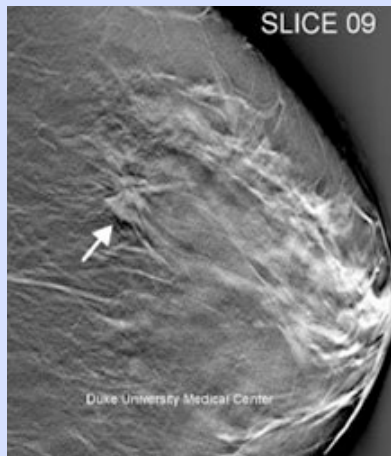


In December 2005, DAI Labs moved to a **new facility** in Hock Plaza at the edge of Duke University Medical Center campus. The state-of-the-art facility includes more than 7000 sq. ft. of space including offices, laboratories, and computer facilities.

This year, DAI Labs had the honor of hosting a number of noted imaging scientists including **Walter Huda, PhD** of SUNY Syracuse, **John Boone, PhD** of UC Davis, and **Bill Hendee, PhD** of the Medical College of Wisconsin and the *Medical Physics* Editor.

Focus on Research: Breast Tomosynthesis

DAILabs investigators have been actively pursuing research in breast tomosynthesis, a novel 3D imaging modality that may one day completely replace mammography as the primary weapon in the screening and diagnosis of breast cancer. This spring marked several milestones in this project. Our industry partner Siemens Medical Solutions provided several crucial upgrades to improve the speed and functionality of our prototype system, which is currently the only one installed in North America. We also hired a full-time clinical trial coordinator. To date we have accrued over 140 human subjects in our on-going clinical trials. The project PI Dr. Lo also received an NIH grant (R01 CA-112437-01) of over 1.3 million in total costs over 4 years. This grant will support multiple investigators in DAILabs as we continue to collaborate with Siemens to optimize breast tomosynthesis and hopefully bring this exciting technology to the market soon.



Sample images are shown here from our clinical trials. On the top is a mammogram showing a very subtle architectural distortion, the corresponding reconstructed tomosynthesis slice image (at center) reveals a spiculated mass, which was later biopsied to reveal invasive ductal carcinoma. A picture of the tomosynthesis acquisition system is presented on the left.

Joseph Lo

Recent Grant Awards

Anya Bilaska-Wolak, PhD, received a multidisciplinary grant from the US Army, entitled Computerized Assessment of the Link between Imaged Breast Density and Breast Cytology: Women at High Risk of Breast Cancer, for an amount of \$576,519.

Amar Chawla, MS, received a pre-doctoral grant from the US Army, entitled Early Detection of Breast Cancer via Multi-plane Correlation Breast Imaging, for an amount of \$136,000 for a period of 3 years.

Ada Chen, MS, received a pre-doctoral grant from the US Army, entitled Optimization and Comparison of Different Digital Mammographic Tomosynthesis Reconstruction Methods, for an amount of \$136,000 for a period of 3 years.

Jonathan Jesneck, MA, received a pre-doctoral grant from the US Army, entitled A Computer-Aided Diagnosis System of Breast Cancer Combining Mammography and Proteomics, for an amount of \$136,000 for a period of 3 years.

Anuj Kapadia, MA, received a pre-doctoral grant from the US Army, entitled Simulations to Evaluate Accuracy and Patient Dose in Neutron Stimulated Emission Computed Tomography for Diagnosis of Breast Cancer, for an amount of \$136,000 for a period of 3 years.

Joseph Lo, PhD, received a R01 grant from the NIH, entitled Tomosynthesis for Improved Breast Cancer Detection, for an amount of \$1,323,573 for a period of 4 years.

Ehsan Samei, PhD, received a grant from the Cancer Research and Prevention Foundation, entitled Stereo Imaging as a New Technique in Early Detection of Breast Cancer, for an amount of \$80,000 for a period of 2 years.

Ehsan Samei, PhD, received a grant from the Komen Foundation, entitled Biplane Correlation Imaging (BCI) for Early Detection of Breast Cancer, for an amount of \$135,000 for a period of 3 years.

Georgia Tourassi, PhD, received a R01 grant from the NIH, entitled Information-Theoretic Based CAD in Mammography, for an amount of \$980,000 for a period of 4 years.

Jessie Xia, MS, received a pre-doctoral grant from the US Army, entitled Image Processing and Computer Aided Diagnosis in Computed Tomography of the Breast, for an amount of \$136,000 for a period of 3 years.

Selected New Publications (early 2006)

1. Bender JE, Floyd CE, Harrawood BP, Kapadia AJ, Sharma AC, Jesneck JL. The effect of detector resolution for quantitative analysis of neutron stimulated emission computed tomography. *Proc. SPIE Medical Imaging* 6142: 1597-1605, 2006.
2. Borasi G, Samei E, Bertolini M, Nitrosi A, Tassoni D. Contrast-detail analysis of two indirect flat panel detectors for digital radiography. *Medical Physics* 33(6): 1707-1719, 2006.
3. Boyce S, Samei E. Imaging properties of digital magnification radiography. *Medical Physics* 33(4): 984-996, 2006.
4. Chawla AS, Samei E. A method for reduction of eye fatigue by optimizing the ambient light conditions in medical imaging reading rooms. *Proc. SPIE Medical Imaging* 6145: 10-21, 2006.
5. Chawla AS, Saunders RS, Samei E. Effect of dose reduction on the detection of mammographic lesions based on mathematical observer models. *Proc. SPIE Medical Imaging* 6146: 141-152, 2006.
6. Chawla AS, Samei E. Are we in the dark about reading medical images? *SPIE News*, 2006.
7. Chen Y, Lo JY, Baker JA, Dobbins III JT. Gaussian frequency blending algorithm with Matrix Inversion Tomosynthesis (MITS) and Filtered Back Projection (FBP) for better digital breast tomosynthesis reconstruction. *Proc. SPIE Medical Imaging* 6142: 122-130, 2006.
8. Chen Y, Lo JY, Baker JA, Dobbins III JT. Noise power spectrum analysis for several digital breast tomosynthesis reconstruction algorithms. *Proc. SPIE Medical Imaging* 6142: 1677-1684, 2006.
9. Cleland EW, Samei E. Performance evaluation of a commercial system for quantitative measurement of display resolution and noise. *Proc. SPIE Medical Imaging* 6141: 256-262, 2006.
10. Dobbins III JT, Samei E, Ranger NT, Chen Y. Inter-comparison of methods for image quality characterization: 2. Noise power spectrum. *Medical Physics* 33(5): 1466-1475, 2006.
11. Floyd CE, Bender JE, Sharma AC, Kapadia AJ, Xia J, Harrawood BP, Tourassi GD, Lo JY, Crowell A, Howell CR. Introduction to neutron stimulated emission computed tomography. *Phys Med Biol* 51: 3375-3390, 2006.
12. Floyd Jr CE, Bender JE, Harrawood B, Sharma AC, Kapadia A, Tourassi GD, Lo JY, Howell C. Breast cancer diagnosis using neutron stimulated emission computed tomography: dose and count requirements. *Proc. SPIE Medical Imaging* 6142: 597-603, 2006.
13. Godfrey DJ, McAdams HP, Dobbins III JT. Optimization of the matrix inversion tomosynthesis (MITS) impulse response and modulation transfer function characteristics for chest imaging. *Medical Physics* 33(3): 655-667, 2006.
14. Habas PA, Zurada JM, Elmaghraby AS, Tourassi GD. Confidence-based stratification of CAD recommendations with application to breast cancer detection. *Proc. SPIE Medical Imaging* 6144: 1759-1766, 2006.
15. Hoe CL, Samei E, Frush DP, DeLong DM. Simulation of liver lesions for pediatric CT. *Radiology* 238: 699-705, 2006.
16. Huda W, Ogden KM, Scalzetti EM, Lavalley RL, Samei E. X-ray tube voltage (kV) and image quality in adult and pediatric CT. *Proc. SPIE Medical Imaging* 6142: 900-910, 2006.
17. Jesneck JL, Nolte LW, Baker JA, Lo JY. The effect of data set size on computer-aided diagnosis of breast cancer: comparing decision fusion to a linear discriminant. *Proc. SPIE Medical Imaging* 6146: 359-364, 2006.
18. Lo JY, Bilska-Wolak AO, Baker JA, Tourassi GD, Markey MK, Floyd CE. Computer-aided diagnosis in breast imaging: where do we go after detection? In: *Recent Advances in Mammography, Breast Imaging, and Computer-aided Diagnosis of Breast Cancer*, Editors: JS Suri, RM Rangayyan. SPIE Press, Bingham, WA, 2006, pp. 875-904.
19. Madhav P, McKinley RL, Samei E, Bowsher JE, Tornai MP. A novel method to characterize the MTF in 3D for computed mammotomography. *Proc. SPIE Medical Imaging* 6142: 697-706, 2006.
20. Majdi Nasab N, Samei E, Dobbins JT. Biplane correlation imaging for lung nodule detection: initial human subject results. *Proc. SPIE Medical Imaging* 6144: 646-653, 2006.
21. Majdi Nasab N, Samei E. The impact of angular separation on the performance of biplane correlation imaging for lung nodule detection. *Proc. SPIE Medical Imaging* 6142: 445-453, 2006.
22. Markey MK, Tourassi GD, Margolis M, DeLong DM. Impact of missing data in evaluating artificial neural networks trained on complete data. *Computers in Biology and Medicine* 36: 516-525, 2006.
23. Samei E, Wright SL. Viewing angle performance of medical liquid crystal displays. *Medical Physics* 33(3): 645-654, 2006.
24. Samei E, Ranger NT, Dobbins III JT, Chen Y. Inter-comparison of methods for image quality characterization: 1. Modulation transfer function. *Medical Physics* 33(5): 1454-1465, 2006.
25. Samei E. The role of image perception in radiology (guest editorial). *Journal of American College of Radiology (JACR)* 3(6): 400-401, 2006.
26. Saunders RS, Samei E, Baker JA. Simulation of mammographic lesions. *Academic Radiology* 13: 860-870, 2006.
27. Saunders RS, Samei E. A Monte Carlo investigation on the impact of scattered radiation on image resolution and noise. *Proc. SPIE Medical Imaging* 6142: 1121-1127, 2006.
28. Saunders RS, Samei E. Resolution and noise measurements of selected commercial medical displays. *Medical Physics* 33(2): 308-319, 2006.

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New Publications (cont.)

29. Sharma AC, Floyd CE, Harrawood B, Tourassi G, Kapadia A, Bender J, Lo J, Howell C. Rotating slat collimator design for high-energy near-field imaging. *Proc. SPIE Medical Imaging* 6142: 405-413, 2006.
30. Singh S, Baydush AH, Harrawood B, Lo JY. Mass detection in mammographic ROIs using Watson filters. *Proc. SPIE Medical Imaging* 6146: 15-21, 2006.
31. Timberg P, Ruschin M, Båth M, Hemdal B, Andersson I, Mattsson S, Chakraborty D, Saunders R, Samei E, Tingberg A. Potential for lower absorbed dose in digital mammography: A JAFROC experiment using clinical hybrid images with simulated dose reduction. *Proc. SPIE Medical Imaging* 6146: 341-350, 2006.
32. Tourassi GD, DeLong DM, Floyd Jr CE. A study on the computerized analysis of screening mammograms for the automated detection of architectural distortion. *Phys Med Biol* 51: 1299-1312, 2006.
33. Tourassi GD. Computer-assisted radiology. In: Wiley Encyclopedia of Biomedical Engineering, J. Wiley & Sons, Hoboken, NJ, 2006.

Promotions

Chee Liang Hoe, MS, completed his MA in Physics.

Jonathan Jesneck, Amy Sharma, and Jessie Xia successfully defended their preliminary exams and achieved the PhD candidacy status.

Ehsan Samei, PhD, was promoted to Associate Professor in Radiology with tenure.

Rob Saunders, MA, successfully completed his PhD in Physics in May 2006. He will continue as a Research Associate with DAI Labs.

Georgia Tourassi, PhD, was promoted to Associate Research Professor in Radiology and Faculty in Medical Physics.

Jessie Xia, MS, completed her MS degree in statistics at Duke.

Departures

Esi Cleland, BS, was admitted to the PhD program in Medical Physics at Duke.

Janelle Bender, BS, joined the laboratory of Nimmi Ramanujam, PhD, at Duke BME department to work on her PhD.

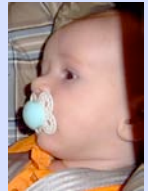
Chee Liang Hoe, MA, joined a venture firm in Atlanta.

Nariman Majdi-Nasab, PhD, joined Eastman Kodak Company as a scientist in its CAD division.

Stanton Stebbins, MD, joined Emory University for a residency in pediatrics.

Personal News

Sarah Boyce, MS, and her husband, Curt, were blessed by the arrival of their son Wesley Jonathan Boyce on March 17, 2006.



DAI Labs faces



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