MedIX: Medical Informatics Workshop
DePaul Center, room 8005, DePaul University, CTI

May 6th, 2005

Lectures' Abstracts

The afternoon session will consist of three lectures:

Speaker: Richard A. Robb, Ph.D.
Lecture Title: *"Multidimensional Biomedical Imaging Today: Synchronous Fusion of Form and Function"*
Time: 1:00PM – 2:00PM
Abstract
In the past three decades, there has been a remarkable acceleration of advanced technology into the world of medicine and biology, especially biomedical imaging. Current technology permits digital 3-D, 4-D, even 5-D images and beyond obtained from one or more medical and biologic imaging systems to be faithfully transformed into multidimensional representations with physical and functional properties synchronized and melded into unified visualizations. With such representations the viewer can "enter the body or cell", take up any viewpoint (3-D), and observe regional form and function (4-D, 5-D). Applications extend across a vast range of scale from individual molecules and cells through the varieties of tissues and organs to complete organ systems, including functional attributes of these systems, such as biophysical and physiological properties. Medical applications include enhanced diagnosis, treatment planning, surgical rehearsal and intra-operative guidance. Biologic applications include cellular, molecular, genomic and proteomic investigations, leading to characterization of specific phenotypes, both structural and functional. However, even with significant current progress in data processing, challenges remain for routine application. No single imaging modality or image processing procedure can cover the requisite span of temporal and spatial resolution. An integrated approach is needed, including rapid and accurate multimodality image registration, automated image segmentation and classification, dynamic quantitative measurement, and interactive volume visualization and interpretation. With such capabilities, multidimensional and multispectral images of structure and function in the human body obtained over a large range of size and time intervals can be synergistically integrated and fused together, facilitating visualization, understanding, diagnosis and minimally interventional treatment of disease and injury far beyond that currently possible. Future multidimensional imaging systems will permit rapid navigation and detailed exploration of all regions and objects in the body, from entire torso to individual organs to interstitial spaces to single cells and molecules, with instantaneous viewpoint translocation and appropriate time and space scaling provided automatically or as selected by the navigator. Biologic processes may be mapped precisely onto associated anatomy and observed in real-time at systemic, organ and/or cellular levels of detail. This mode of dynamically visualizing anatomy simultaneously incorporated with biology over large differences in structural size and functional time may be referred to as "synchronous fusion of form and function". Such advanced capabilities will provide not only highly specific and integrated clinical diagnosis and therapy, but unprecedented possibilities for anatomy, physiology and biology research and education. We are poised to now enter this exciting domain. The content-based access to growing multimedia information has received considerable attention in recent years. In this talk, an overview of content-based approaches to access multimedia information will be provided. The shortcomings of the existing approaches will be discussed and a case will be made for integrating cues from different modalities in a multimedia environment. A recently developed approach for integrating multiple modalities, termed the cross-modal association, will be described. This approach works by identifying and measuring intrinsic associations between different modalities. Several possible cross-modal association schemes under the linear correlation model will be presented and compared for applications involving audiovisual analysis.

Speaker: Maryellen L. Giger, Ph.D.
Lecture Title: *"Multimodality CAD in the Interpretation of Breast Images"*
Time: 2:00PM – 3:00PM
Abstract
Useful interpretation in mammography depends on the quality of the mammographic images and the ability of the radiologists who interpret those images. Improvements in radiographic technique, as well as mandatory accreditation programs, have made the early signs of breast cancer more apparent on mammograms. However, at times, radiologists still miss cancer on a mammogram. Use of output from a computerized analysis of an image by radiologists may help them in the tasks of detection or diagnostic, and potentially improve the overall interpretation of breast images and the subsequent patient care. Many factors motivate the attempts to aid or automate radiological diagnosis. Inadequacies in interpretation performance may be due to the presence of image noise or normal anatomical structure as well as to known limitations in the human search and perception

process. While current developments in the field of computer analysis of breast images have yielded extremely promising results, computer-aided diagnosis (CAD) is still in its infancy. However, computer-aided diagnosis (CAD) may become an integrated tool in the diagnostic workup of suspect breast lesions using multi-modality images. This presentation reviews my lab's research in computerized analysis of mammographic, sonographic, and magnetic resonance breast images for detection, diagnosis, and cancer risk assessment. It will focus on the characterization of lesions and the estimation of the probability of malignancy for use in the diagnostic workup of suspect lesions. CAD systems in diagnostic workup usually involve having the computer extract the margin of the lesion from the surrounding parenchyma, extract characteristics (features) of the lesions, merge these computer-extracted features into an estimate of the probability of malignancy, and as an option, retrieve automatically similar lesions from an online reference library. The aim of CAD in diagnostic workup is to increase classification sensitivity and specificity as well as to reduce intra- and inter-observer variability. While the breadth and depth of CAD is increasing, continued and expanded efforts are needed for collecting and confirming databases, establishing methods for evaluation, and providing means for clinical evaluation.

Speaker: David S. Channin, MD
Lecture Title: *"Dude, Where's my EMR?: Practical Problems in Medical and Imaging Informatics"*
Time: 3:15PM – 4:15PM
Abstract
This presentation will highlight a number of practical problems in clinical, research, education, and administrative use of healthcare information. The focus will be on the role of standards and interoperability in bringing information from heterogeneous information systems to the point of clinical decision making and how novel graphical user interface techniques can be used to support more advanced decision making. The opportunity for engineering solutions to these problems as well as areas for basic research will be discussed.