

# Distance Education and Learning for Medical Imaging Informatics



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# OUTLINE

- **Introduction & Overview of USC DEN Program**
- **Introduction to Medical Imaging Informatics**
- **BME 527 & 528 Course Content**
- **Personal Observations**



**Established in 1972, the Viterbi School of Engineering's Distance Education Network (DEN) is a pioneer in the distance learning arena, utilizing the most cutting-edge technology to enable professional engineers to take USC engineering courses for degree and non-credit on and off campus.**

**DEN is part of the Office of Master's and Professional Programs enabling professional engineers the ability to interact with graduate level courses and offerings. DEN currently offers over 35 Master's Programs online in a unique blended and interactive environment with on campus students.**

## DISTANCE EDUCATION NETWORK

- **Online delivery method for the working professional**
- **Pioneer in distance learning since 1970s**
- **Master's degrees & Professional Programs available ONLINE**
- **Curriculum and academic standards are identical to on-campus students, therefore diploma earned is from USC**
- **High-speed Internet access (DSL/Cable minimum), Windows Media Player**
- **DEN courses available on the Internet live & on-demand.**
- **Downloading and podcasting are now available.**
  - **Highly interactive**
  - **Lectures archived**

## TECHNICAL ASPECTS AND CLASSROOM SETUP

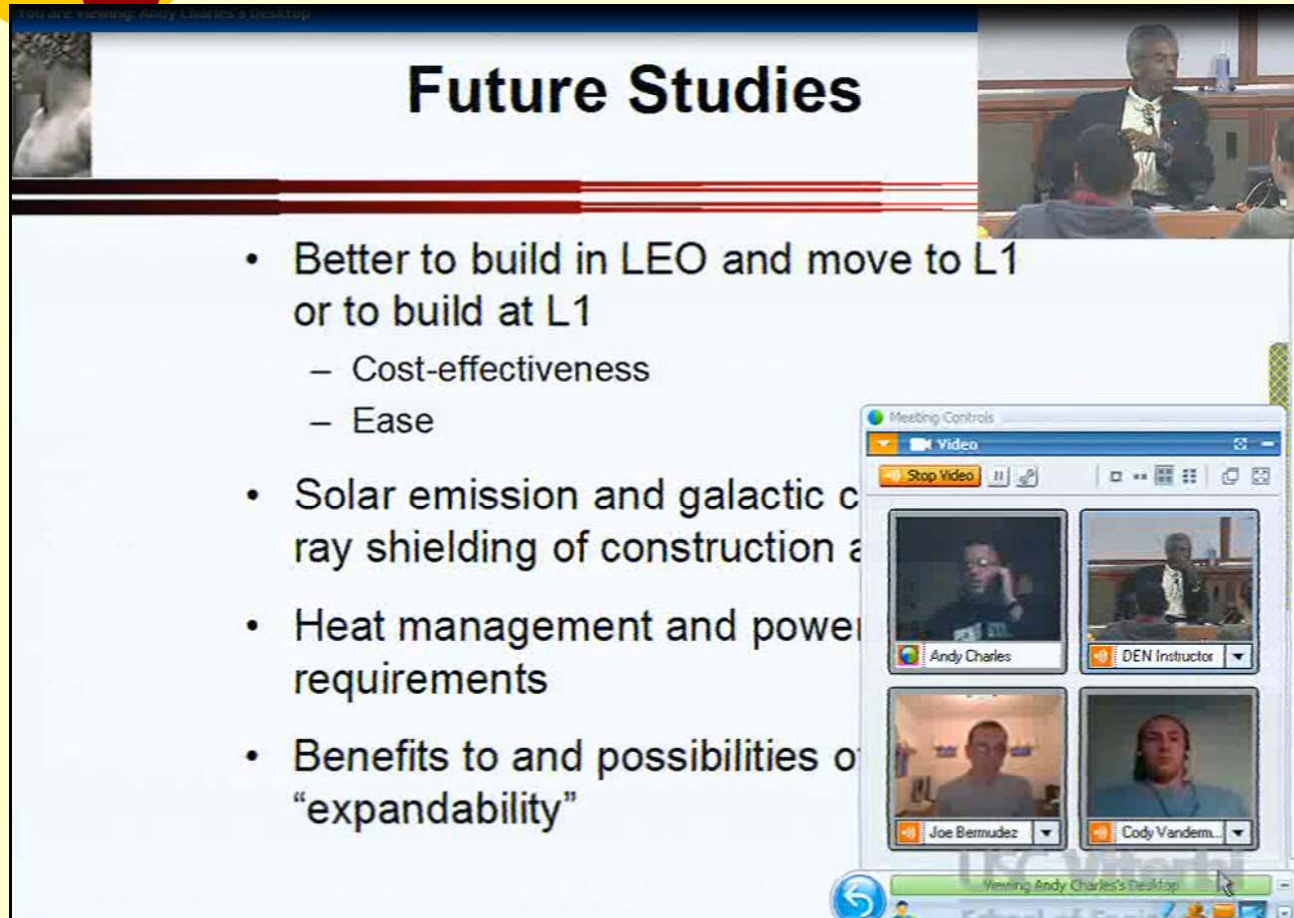
- **Over 140 master's courses available online every fall and spring semester and growing; approximately 50+ courses available in the summer semester.**
- **Interactive classrooms with online and on campus students (seat avg 30-60).**
- **High-speed Internet access (DSL/Cable minimum) for streaming videos and interactive collaboration tools.**
- **Classrooms equipped with cameras to capture instructor video, student facing cameras, overhead cameras, and support full interactivity via web or video conferencing.**
- **Instructional tools include computers, electronic whiteboards, tablet PCs, overhead cameras, and support for remote lecturers and presentations.**
- **Lectures are archived and available for viewing for the entire semester for on campus and online students.**

# HOW DEN WORKS

- **Conventionally delivered course materials are captured and transformed for delivery over the Internet**
  - **Lecture - streaming audio and video**
  - **Written materials are digitized (PDF, Power Point) so students can focus on the lecture**
- **Course notes, handouts and homework – available online**
  - **Course notes written by the professor during class are posted alongside the e-learning video.**
  - **Homework assignments are transmitted to and from DEN electronically.**
- **Exams**
  - **Students who do not live in the Los Angeles area have exams proctored at a nearby testing center to ensure academic integrity.**

# REAL TIME INTERACTIVITY

Students off campus can interact with the classroom in real time through various web and video conferencing systems.



The screenshot shows a video conference interface. The main content is a presentation slide titled "Future Studies" with a bulleted list of points. A "Meeting Controls" window is overlaid on the bottom right, showing four video thumbnails for participants: Andy Charles, DEN Instructor, Joe Bermudez, and Cody Vandem. The slide content is partially obscured by the controls window.

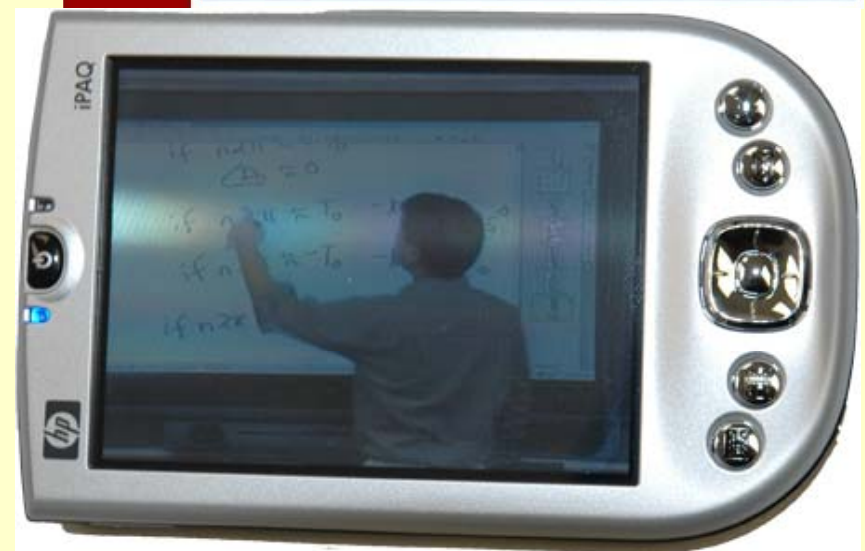
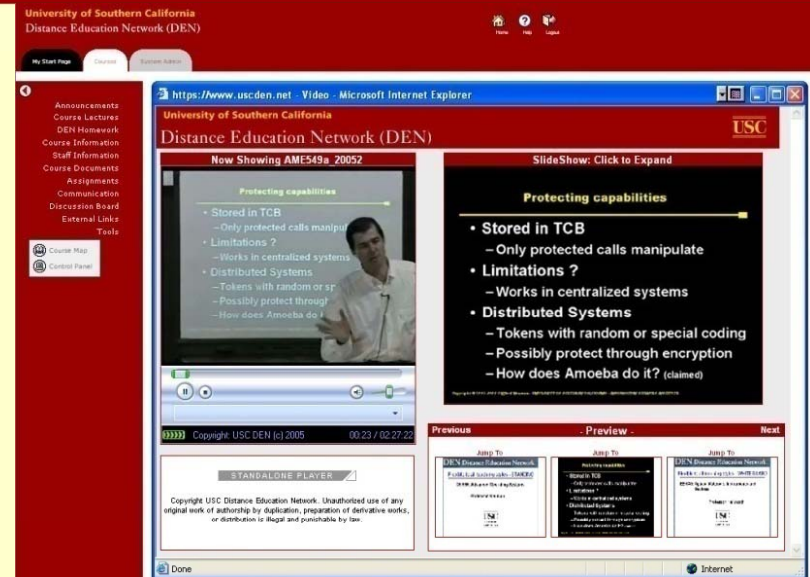
## Future Studies

- Better to build in LEO and move to L1 or to build at L1
  - Cost-effectiveness
  - Ease
- Solar emission and galactic cosmic ray shielding of construction and habitation
- Heat management and power requirements
- Benefits to and possibilities of "expandability"

Screen shot of a presentation provided by an off campus student to the classroom (ASTE 527 Fall 2009)

# ENHANCED E-LEARNING SYSTEMS

- Conventionally delivered course material are captured and transformed for delivery over the Internet
  - Lecture - streaming audio and video, downloadable high resolution video (Windows)
  - Written materials are digitized (.pdf, Power Point) so students can focus on the lecture instead of focusing on taking notes
  - Real Time Interactivity options





# ENHANCED E-LEARNING SYSTEMS

- Tools**
- Announcements
  - Calendar
  - Tasks
  - View Grades
  - Send Email
  - Address Book
  - DEN Tools
  - Google Tools

**My Announcements**

- [DEN Terms of Service](#)

No course announcements have been posted in the last 7 days.

[more.....](#)

- My Calendar**
- Gmail** – With 7GB of storage, built-in IM, innovative search, and IMAP capability, there's no need to worry about email quotas or spam.
  - Google Calendar** – Easily organize schedules and share calendars with others.
  - Google Docs** – Collaborate real time on documents, spreadsheets, and presentations, across campus or around the world.
  - Google Sites** – Publish and share all types of information online, without any coding or technical language, for easy access from any browser.
  - Google Video** – Securely and privately share videos with your school's faculty and students (10GB free).
  - Extensibility APIs** – Easily integrate with your school's existing systems or third party solutions.
  - Help and support** – Access to 24/7 online and phone support assistance.

**My Courses**

**Courses in which you are enrolled:**

- [AME420\\_20101](#)
- [AME451\\_20093](#)
- [DEN101\\_20093](#)
- [DEN102\\_20093](#)

**which you are a TA:**

- [20091](#)

e.

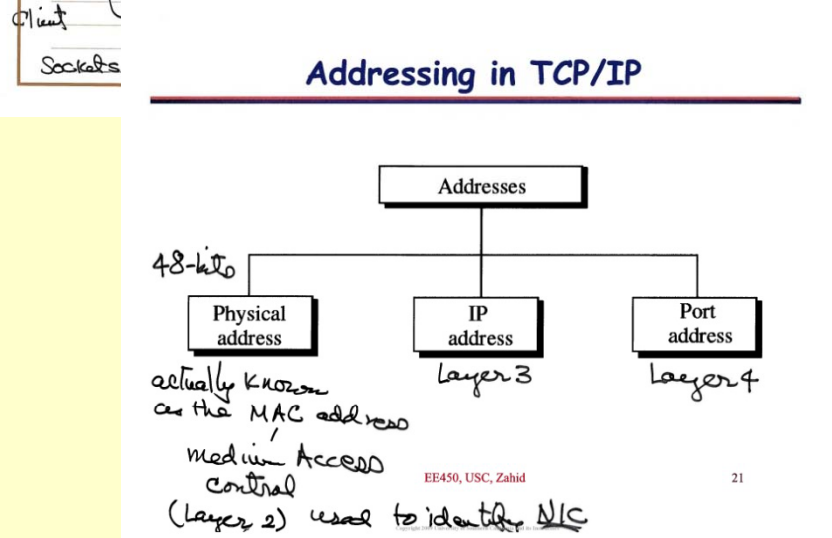
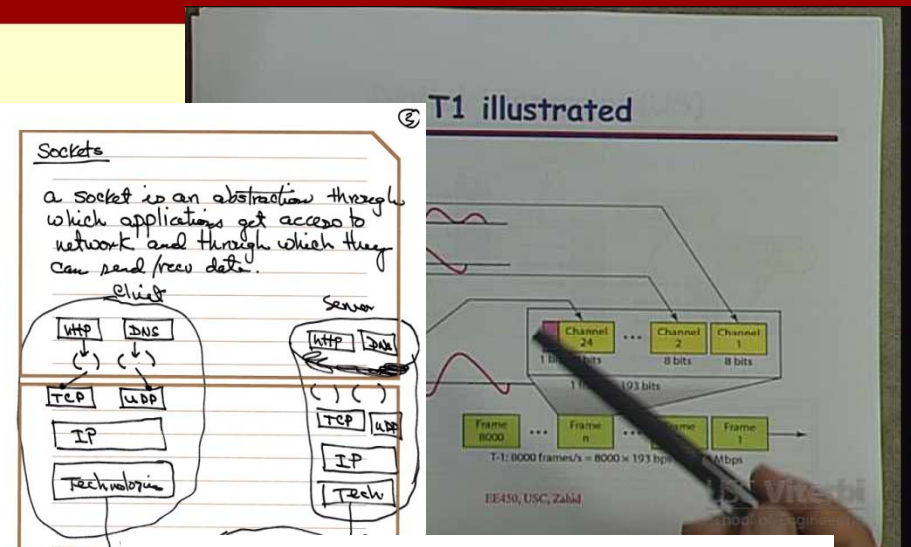
[more.....](#)



- Dedicated collaboration tools for students including discussion boards, chat, and web conferencing systems**

# DOCUMENT SUPPORT SERVICES

- Course notes, handouts and homework – available online
  - Course notes written by the professor during class are posted alongside the e-learning video.
  - Handouts given during class are usually posted online prior to class.
  - Homework assignments are transmitted to and from DEN via e-mail and/or fax via custom cover sheet program



# THE NEED FOR MEDICAL IMAGING INFORMATICS

- **The steady increase of computer techniques within the medical environment**
- **The communication challenge between healthcare providers and computer professionals**
- **Interfaces among and integration of the following: Medicine, allied health science, computer science, medical physics, electrical engineering, statistics, cognitive science, economics, & medical ethics**
- **The challenges of finding that existing one person to be the expert of every one of these subjects**

# MEDICAL IMAGING INFORMATICS

- **Computer Software Technology**
- **Patient Information & History**
- **PACS and other medical image-related data**
- **Infrastructure:**
  - **Networking**
  - **Knowledge Base**
  - **Visualization and Presentation**

# MII INFRASTRUCTURE COMPONENTS AND THEIR LOGICAL RELATIONSHIP

## USER'S APPLICATION SOFTWARE

**RESEARCH TOOLS**  
(large-scale longitudinal  
and horizontal studies)

**CLINICAL SERVICE TOOLS**

**EDUCATION TOOLS**

## DATABASE & KNOWLEDGE BASE MANAGEMENT

### Data Mining

**IMAGE  
PROCESSING,  
CONTENT -BASED  
ANALYSIS**

**VISUALIZATION  
and  
PRESENTATION**

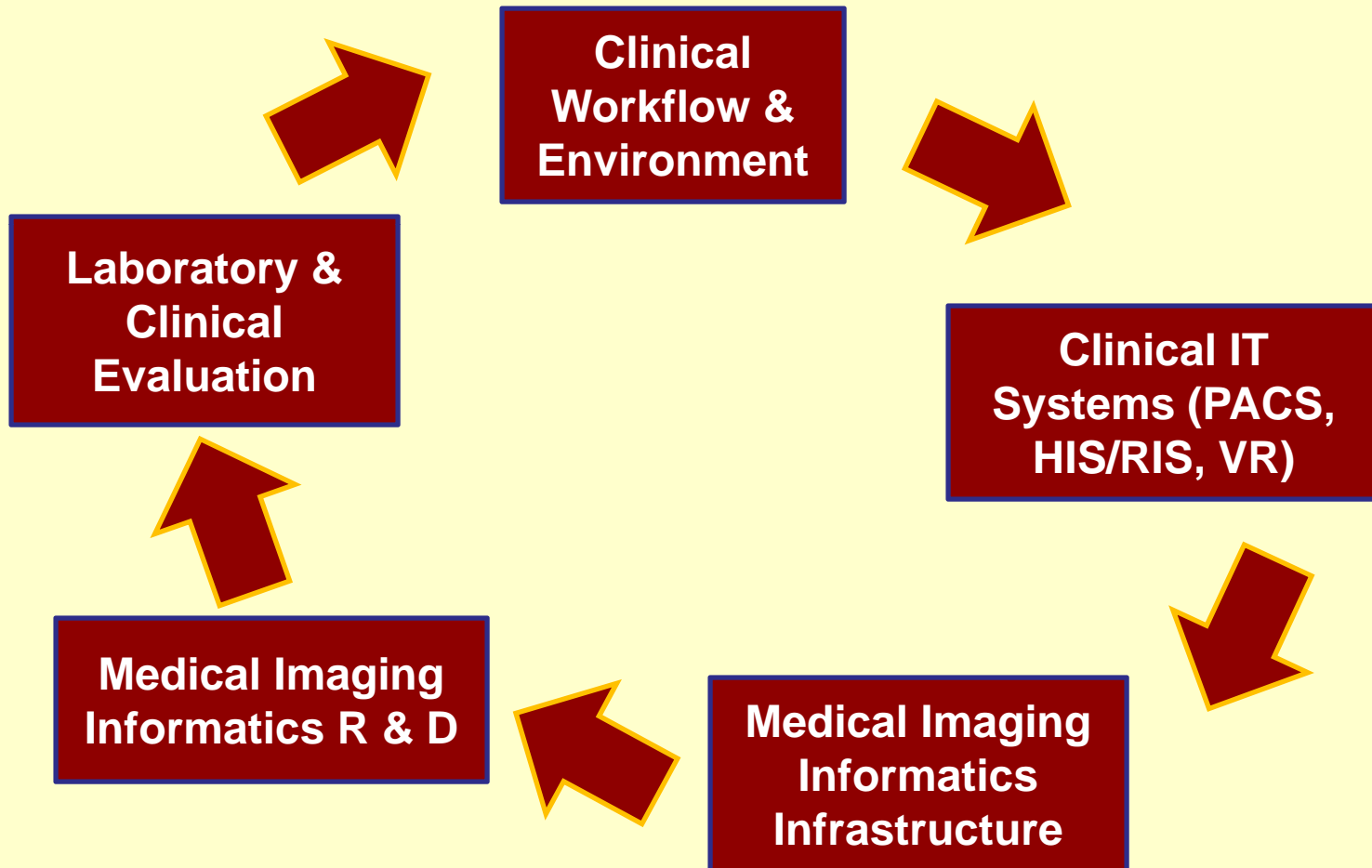
**GRAPHICAL  
USER INTERFACE**

**SECURITY**

**COMMUNICATION  
NETWORKS**

**PACS, MEDICAL IMAGE & RELATED CLINICAL  
DATABASES (eg, HIS, RIS, EMR, etc)**

# MEDICAL IMAGING INFORMATICS “CIRCLE OF LIFE”



# TWO COURSES AVAILABLE FOR MII: BME 527 AND BME 528

The definitive guide to PACS—now with more clinically applicable material

In recent years the field of picture archiving and communications systems—PACS—and image informatics has advanced due to both conceptual and technological advancements. This edition of *PACS and Imaging Informatics: Basic Principles and Applications* addresses the latest in this exciting field. In contrast to the previous edition, this updated text uses the framework of image informatics, not physics or engineering principles, to explain PACS. It is the only resource that thoroughly covers the critical issues of hardware/software design and implementation in a systematic and easily comprehensible manner.

To strengthen and update the book, the author:

- emphasizes clinical applications of PACS and integrates clinical examples throughout the text
- reflects the many changes in the field, with new chapters on web-based PACS, security, integrating the healthcare enterprise, clinical management systems, and the electronic patient record
- uses the framework of image informatics to explain PACS, making the book accessible to those without advanced knowledge of physics, engineering, math, or information technology
- explains how PACS can improve workflow, therapy, and treatment

With the most systematic and thorough coverage of practical applications available, this text is the complete guide for all those involved in designing, implementing, and using PACS. Professionals in medical and allied health imaging informatics; radiologists and their technical staff; surgeons and oncologists and their teams; medical and electronic engineers; medical informaticians; and fellows, graduate students, and advanced undergraduates will all benefit from this valuable resource.

"An excellent book for people involved in the design, implementation, or simply the operations of PACS and an appropriate textbook."  
— from a review of the previous edition in *IEEE Engineering in Medicine and Biology*

"The strength of the book lies in the vast experience of the author, who has implemented PACS at numerous institutions in the United States and abroad."  
— from a review of the previous edition in *Radiology*

**WILEY-BLACKWELL**  
www.wiley.com/wiley-blackwell



Huang

Second Edition

PACS and  
Imaging Informatics

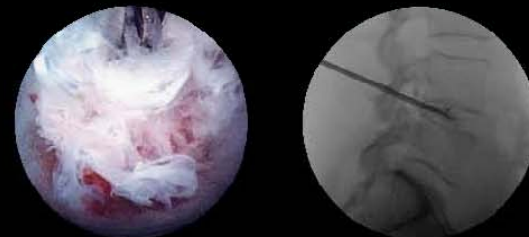
Basic Principles and Applications



Second Edition

# PACS and Imaging Informatics

Basic Principles and Applications



H. K. Huang, D.Sc., FRCR (Hon.), FAIMBE

**WILEY-BLACKWELL**

# BME 527: INTEGRATION OF MEDICAL IMAGE SYSTEMS TECHNOLOGY

## Course Topics:

- Introduction to Medical Images and Fundamentals (eg, Image Quality, Spatial and Frequency Domains, Image Transformation)
- Clinical Workflow
- Medical Image Compression
- Healthcare Information Industrial Standards and Workflow Protocols (eg, DICOM, HL7, IHE)
- PACS and System Components
- Communication Networks
- Integration of HIS, RIS, PACS, and EPR/EMR
- Special Guest Lecturer: Clinical IT Perspective

## Course Materials:

Homework Assignments, ONE Midterm Exam, ONE Final Exam, Handouts, Select Journal Articles



# BME 528: MEDICAL IMAGING INFORMATICS

## Course Topics:

- Introduction to Medical Imaging Informatics
- Review of Integration and Clinical IT Systems
- Hands-On Experience of PACS and Site Visit to an Imaging Informatics Laboratory
- Select Medical Imaging Informatics Clinical Applications in:
  - Radiology
  - Radiation Therapy
  - Surgery
  - Cardiology
  - **Rehabilitation Engineering**

## Course Materials:

- Homework Assignments, ONE Midterm Exam, ONE Final Exam, Handouts, Select Journal Articles

## Special Project:

- Team-based and Goal-Oriented with Project Deliverables

# TEACHING WITH DEN: MY THOUGHTS

- **Five Years Teaching with DEN: I am still learning new things**
- **DEN Student Participation: It varies just like on campus students**
- **The Positives:**
  - **Increases the availability of medical imaging informatics to beyond the four walls of the classroom**
  - **Students have access to my lectures for review and study outside of the classroom**
  - **Special Project Work has not been affected by DEN: Students already know the social networking technology**
- **The Negatives:**
  - **I cannot see my DEN students – but do I really want to?**
  - **Hands-on experiences and site visits are limited for DEN students – solutions are coming but how soon?**
  - **On campus students become DEN students – take attendance?**

**THANK YOU!**

**For More Information:**

**Office of Master's and Professional Programs  
USC Viterbi School of Engineering**

**<http://mapp.usc.edu>**

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**IPILab: [www.ipilab.org](http://www.ipilab.org)**