Distance Education and Learning for Medical Imaging Informatics

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• 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
• 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.

Future Studies

- Better to build in LEO and move to L1 or to build at L1
  - Cost-effectiveness
  - Ease
- Solar emission and galactic ray shielding of construction and 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
• Dedicated collaboration tools for students including discussion boards, chat, and web conferencing systems
• 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

<table>
<thead>
<tr>
<th>RESEARCH TOOLS</th>
<th>CLINICAL SERVICE TOOLS</th>
<th>EDUCATION TOOLS</th>
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<tbody>
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<td>(large-scale longitudinal and horizontal studies)</td>
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### DATABASE & KNOWLEDGE BASE MANAGEMENT

**Data Mining**

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<tr>
<th>IMAGE PROCESSING, CONTENT-BASED ANALYSIS</th>
<th>VISUALIZATION and PRESENTATION</th>
<th>GRAPHICAL USER INTERFACE</th>
<th>SECURITY</th>
<th>COMMUNICATION NETWORKS</th>
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**PACS, MEDICAL IMAGE & RELATED CLINICAL DATABASES** (eg, HIS, RIS, EMR, etc)
MEDICAL IMAGING INFORMATICS
“CIRCLE OF LIFE”

Clinical Workflow & Environment

Laboratory & Clinical Evaluation

Clinical IT Systems (PACS, HIS/RIS, VR)

Medical Imaging Informatics R & D

Medical Imaging Informatics Infrastructure
TWO COURSES AVAILABLE FOR MII: BME 527 AND BME 528
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
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:

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