INSTITUTE OF COMMUNICATION, INFORMATION AND PERCEPTION TECHNOLOGIES

Scuola Superiore Sant'Anna

Retis Real-Time Systems Laboratory

Research Challenges in Healthcare

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Abstract

Patients in the intensive care unit (ICU) are exposed to multiple potentially critical complications such as delirium, acute lung injury, acute renal failure, and sepsis. Those who suffered critical complications and survived often require costly long term care. Early detection and timely intervention is the key to prevent and treat complications. That is, acute care is a cyber-physical-human real-time system. The current doctors-in-the-loop system is in fact too slow for many acute care needs. The course includes 4 lectures.

28 May 2014 10:00 – 13:00	**Lecture 1**: Overview of Acute Care Challenges to Engineering. This lecture will survey the many aspects in the engineering of next generation acute care medical systems.
30 May 2014 10:00 – 13:00	**Lecture 2**: Advanced Robotic Surgery. Da Vinci is the state of the art surgical robotic in the market. However, it is still missing advanced functions, like advanced 3D vision or synthetic 3D vision to allow a surgeon to "see through" an organ. It should also allow a surgeon to plan the surgical plane before surgery. During surgery, the surgical plane shall automatically be recomputed and displayed as a function of the changed shape of the liver.
4 June 2014 10:00 – 13:00	**Lecture 3**: Golden hour care. The "golden hour" is the time within which a seriously ill/wounded patient has a much better chance of survival if the patient can be rapidly stabilized. Melissa Schorr reported that the chances of surviving sudden cardiac arrest outside a hospital are 1 in 20. But the odds improve tenfold if an electronic defibrillator is close at hand. Yet many critical needs remain unfulfilled. This lecture reviews the challenges and opportunities in golden hour care.
6 June 2014 10:00 – 13:00	**Lecture 4**: Computational Medicine. From a computational perspective, communicating automata can capture many aspects of pathophysiological organ states and their interactions, the effects and side effects of treatments, unified monitoring that integrates the conventional clinical data, biomarkers and, in the not distant future, patient's genetic profile. Such a quantitative model will provide key description of characteristic patterns in critical complications, leading to early warning and timely preventive intervention. The success will open a new scientific frontier, computational medicine: ushering in synchronized advancement of medicine, nano-biosensors, machine learning and safety critical system integration architectures.

Brief Bio

Lui Sha is Donald B. Gillies Chair professor of the University of Illinois at Urbana Champaign. He is a fellow of the ACM and the IEEE. He was a member of National Academy of Science's committee on Certifiably Dependable Systems. His work on dependable real-time computing is supported by the open standards and has been cited as an enabling technology to the success of many national high technology projects.