

List of lecture titles and abstracts

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prof. Metin Akay

Advanced NeuroTechnologies for Human Brain Initiatives

Abstract: Neural Engineering is a new discipline which unites engineering, computer science, physics, chemistry, and mathematics with cellular, molecular, cognitive and behavioral neurosciences, to understand the organizational principles and underlying mechanisms of the biology of neural systems, and to study the behavior dynamics and complexities of neural systems in nature. Therefore, it deals with many aspects of basic and clinical problems associated with neural dysfunction including the representation of sensory and motor information, the electrical stimulation of the neuromuscular system to control the muscle activation and movement, the analysis and visualization of complex neural systems at multi-scale from the single-cell and to the system levels to understand the underlying mechanisms, the development of novel electronic and photonic devices and techniques for experimental probing, the neural simulation studies, and the design and development of human-machine interface systems and artificial vision sensors and neural prosthesis to restore and enhance the impaired sensory and motor systems and functions from gene to system.

Furthermore, the neuroscience has become more quantitative and information-driven science since emerging implantable and wearable sensors from macro to nano and computational tools facilitate collection and analysis of vast amounts of neural data. Complexity analysis of neural systems provides physiological knowledge for the organization, management and mining of neural data by using advanced computational tools since the neurological data are inherently complex and non-uniform and collected at multiple temporal and spatial scales. The investigations of complex neural systems and processes require an extensive collaboration between biologists, mathematicians, physicists, computer scientists and engineering to improve our understanding of complex neurological process from system to gene.

To highlight this emerging discipline, we devote this talk to the recent advances in neural engineering research and education.

Dr. Giuseppe Fico

A Multidisciplinary reference framework to support implementation and assessment of Diabetes Care in Community Settings through engineering methods and technologies.

Abstract: Diabetes is a disease presenting multifaceted challenges. A holistic approach is needed to properly address it. The Chronic Care Model, worldwide reference for managing chronic disease in community settings, support implementation at micro-meso--macro level. A multi-disciplinary framework that support the uptake of the Chronic Care Model. This framework was tested to support the implementation of an international research project focused on Diabetes Management through personal health systems.

prof. Ralf Seepold

Stress pattern recognition and its influence on healthy sleep

Abstract: Besides several other emotions that have influence on our life and life quality, stress is recognized as a factor with negative impact. Of course, stress may have a positive aspect in case it helps us to come out of dangerous situations but moving towards a more ordinary scenario, stress is a negative sensation recognized as leading to disease. Some well-known consequences of perdurable stress are failure to respond adequately to mental and emotional demands and errors in decision-making. Because of the subjective perception of stress, it is important to develop methods to determine stress objectively, and if

possible, to find methods reducing stress or supporting stress management. A first step into that direction is the recognition of stress patterns in order to avoid stress or at least to decrease the influence of stress. Stress has also influence on our sleep. Poor sleeping quality as well as being short of sleep can lead to psychological and physical health disorders such as depressions, cardiovascular disease, diabetes and others. Many activities executed during the day have influence on our sleep. For example, some people that suffer from a day full of stress may have a 'sleepless' night; others may benefit from sport activities shortly before relaxing and going to bed. Tracking of activities, vital data and a person's context may help to detect patterns that can be used to derive individual proposals leading to a good and healthy sleep.

Dr. Erez Shalom

Enhancing patient safety using guideline based decision support systems

Abstract: Clinical guidelines (GLs) are a powerful method for standardization and uniform improvement of the quality of medical care. Clinicians are overloaded with information, and do not always have the time or the computational means to use GLs during actual patient treatment. Thus, clinical staff could benefit from automated support to the process of GL application at the point of care, as well as patients at home through their mobile devices. In the lecture I will show how using guideline base decision –support can increase patient safety by dramatically increasing physician's compliance to clinical guidelines also reducing redundant actions - an obvious economic benefit.

I will start the lecture by introducing the guideline application life cycle, and continue with several examples of projects in the area of guideline-based decision support systems such as: 1) the Digital Electronic Guideline Library (“DeGeL”); 2) Decision support system for managing pre-eclampsia treatment at hospital which` increased dramatically physicians’ compliance to clinical guidelines; 3) the FP7 EU MobiGuide Project (<http://www.mobiguide-project.eu/>) that aims to provide continuous patient guidance in non-clinically controlled environments, through mobile interfaces; and, 4) DSS application for remote treatment with telemedicine technology for chronic pain patient, that tries to help patients with chronic pain to get recommendation and alerts into their mobile.

prof. Ron Summers

Ideation Methods Applied to Grand Engineering Challenges

Abstract: Ideation can be defined as the process that unlocks creativity in individuals and/or groups that can be applied to engineering challenges so as to uncover innovative solutions. It can be broadened to include entrepreneurship and the necessary business planning that supports technological breakthroughs. Ideation is best taught immersively, with candidates directly participating via group-based participation. The ideation cycle comprises six components: 1) creating the right environment; 2) warm-up group exercise; 3) understand the problem; 4) get creative; 5) team convergence on workable solutions; 6) make a one-page structured plan of the idea to take forward. Groups will then present their plans to each other. The final stage is for students to reflect on their achievements and how they can adopt ideation into their own practice.

prof. Toshiyo Tamura

Seamless Monitoring of Physiological Information in Daily Life: Retrospectives and Perspectives

Abstract: This lecture reviews endeavors over the past decades to achieve seamless monitoring of various types of physiological information by a variety of high user- affinity approaches applicable to the daily life environment. Developments in academic research and commercialization from the early period are reviewed. The latest outcomes are briefly investigated and roughly categorized into three main models: miniature portable monitors for ambulatory application, functional fabric-based wearable monitors for

better comfort, and unobtrusively deployed invisible monitors for optimum usability. Monitors for seamless monitoring of physiological information in the daily life environment differ from conventional devices that are hospital-centered and aimed at short-term use in clinics. Through scrutinizing the current systems and examining their various pros and cons, we identify existing common concerns, provide insight into problem determinants, and suggest research topics for further study. In the near future, we envision that the home will be transformed into an intelligent hub for lifelong healthcare through seamless monitoring of the human body in the daily life environment, which will foster the development of a new discipline “Metrology of Health” or “Healthology” based on a holistic view of health.

The lecture contains

1. Introduction
2. Current achievements
 - 2.1 Portable monitor
 - 2.2 Wearable sensor
 - 2.3 Invisible monitor
3. Tasks and topics for further development

prof. May D. Wang

Biomedical Big Data Analytics for Telemedicine and Outcome-Driven Health Care

Abstract: Rapid advancements in telecommunications have made telemedicine a reality, where modern biotechnologies such as –omic (genomics, proteomics, metabolomics, lipidomics etc.), next generation sequencing, bio-nanotechnologies, multi-modal imaging, and mobile sensors are combined to assist care providers to make proper diagnosis, treatment, and prognosis monitoring remotely. To further develop the telemedicine so that it can deliver personalized, predictive, preventive, participatory and precise (5P) health care that is evidence-based and outcome-driven, nations around the world have been seeking novel effective ways to make sense of the complex biomedical “big data”.

In this talk, I will discuss the challenges in telemedicine data quality; the opportunities in predictive data analytics for decision making; the integration of telemedicine technologies with analytics for outcome-driven personalized healthcare; and the education and training of biomedical big data analytics for all stakeholders.

To explain how to make sense of multi-modal and multi-scale biomedical and health data (i.e. molecular, cellular, whole body, individual, and population) for discovery, development, and delivery in health, I will show examples on discovering biomarkers for personalized care; developing histo-pathological imaging informatics tool for clinical diagnosis decision support; designing hand-held device for minimally-invasive image-guided surgery; analyzing physiological streaming data for real-time clinical decision making; and delivering real-time analytics results to assist in medical and health decision making.

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