Clinical Applications of Computational Medicine

From basic science to the market

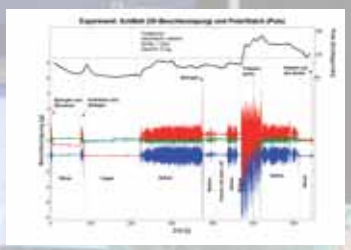
Veranstaltungstyp: Vorlesung, 2 SWS; Lecturer: Dr. Martin Daumer; Time: Thursday 04:15-05:45 pm
Sylvia Lawry Centre, Hohenlindener Str. 1, Meeting Room
(Language: English)

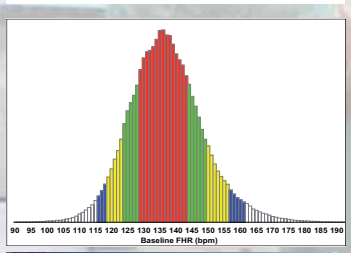
Computational medicine is an interdisciplinary subject that aims at developing innovative solutions for important clinical problems to improve human health. Typical applications are:

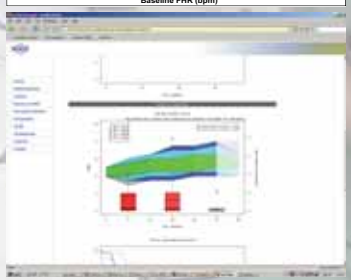
- What is the best method to monitor the fetal heart rate?
- When should one start/stop/switch treatment of patients with multiple sclerosis?
- How can one measure the physical activity – as treatment and outcome - of an ambulant patient?
- Given the status of physical activity
- What is the additional predictive value of genetic/genomic information for patients with coronary artery disease, obesity etc.?

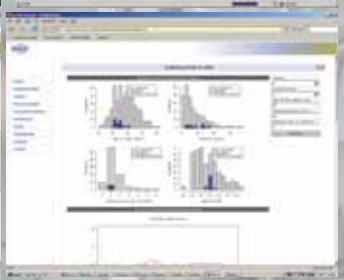
Using a selection of important clinical applications – multiple sclerosis, obstetrics & cardiovascular disease - we go through the process of

- data collection
- modelling
- filtering
- pattern recognition
- prediction
- validation
- development & certification of web-based tools for clinical decision making.









Students will get "hands on" experience, e.g. in the delivery ward, the intensive care unit, the stroke unit, in an MS clinic and a medical device manufacturer.

Keywords
Mathematical models in physiology, signal processing & online monitoring, image processing, genomics, clinical bioinformatics, physical activity, alarm & decision support systems in obstetrics & ICU, validation telemedicine, patents/trademarks/IP, CE certification, modern clinical research.

Background „Computational Medicine"
The term "Computational Medicine" is coined for a new field of science, which embraces mathematics, physics, information technology, biomedical engineering and medicine. The growing need for individuals with a strong background in informatics and understanding of genetics and biology has been identified a while ago and is loosely called "bioinformatics". Cambridge and Munich are world-leading centres for bioinformatics. Bioinformaticians, however, are not really educated to tackle what will become the major challenge in health care over the next decades: to collect, manage, mine, analyze and visualize a very heterogeneous mixture of data, ranging from those obtained from post-genome test platforms, like the personalized genetic and proteomics profiles, bio-signals and the monitoring of movement, advanced imaging, and other relevant phenotype information in such a way, that useful clinical information for improving human health can be extracted. Future improvements in computational medicine and clinical bioinformatics will be a prerequisite to reap the benefits from the human genome project. It will lead to personalized care with intervention tailored to the patient's need. It will reduce the number of iterative cycles of therapeutic intervention, lack of effectiveness and/or side effects of drug prescription. We foresee that the delivery of medical care will increasingly become dependent on the bundling and sophisticated analysis of large patient-specific datas-ets.

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