Doctoral school:
Doctoral School of Electrical Engineering

Thesis supervisor:
Balázs BENYÓ

For interdisciplinary topics, co-supervisor from the other field:

Consultant (helper at university):
Ákos SZLÁVECZ

Title of research topic:
Model based medical diagnostic and treatment methods

Detailed description of topic:

Background:
Healthcare systems worldwide are increasingly unable to meet the growing demand for and cost of healthcare. In the healthcare system an average 10% of healthcare costs are for acute and intensive care, which equates ~1% of GDP in many EU countries. Demand for intensive care is increasing demographically along with cost, while productivity is effectively flat. Highly trained doctors and nurses are the scarce and costly resource in critical and acute care. Thus, improving care and productivity in intensive and acute care units (ICUs) by merging engineering, technology and medicine presents a significant research and economic opportunity and challenge.

Problem:
While acute and critical care doctors have a range of technology and sensors at their disposal, their ability to provide the more consistent, patient-specific care required to improve productivity and patient outcomes is limited. In particular, they are unable to take full advantage of the wealth of data they are presented to provide the best care. As a result, care is often variable and not patient-specific or as effective as it could be. More specifically, the mental models and experience these doctors use to process clinical data and make critical decisions about patient care are unable to bridge the gap to better productivity, patient-specific care and improved outcomes.

Solution:
The application of validated computer models of patient physiology that can be made patient-specific using data at their bedside can integrate patient data into a clear physiological picture of patient-specific condition and response to treatment, as well as provide suggestions and protocols to guide therapy. These computer models can be combined with automation technology to improve the productivity and quality of care and help alleviate demand. Specifically, Model-based Therapeutics which combines computer models of human physiology, clinical data and automation to solve clinical problems in diagnosis and treatment selection, as well as enabling the (hardware + software) automation of basic elements in the delivery of that care.

The applicant will be able to join to the model based medical diagnostic and treatment related research of the Biomedical Engineering Laboratory at the Department of Control Engineering and Information Technology. Potentially, the applicant will also have an access to the international partners in the eTIME: Engineering Technology-based Innovation in Medicine FP7-PEOPLE-2012-IRSES research project (etime.iit.bme.hu/) of the research group.

Number of students who can be accepted:
1-2

Location of studies (name of department):
BME Department of Control Engineering and Information Technology
Abbreviation of location of studies in Hungarian: IIT

**Required language skills:**
proficient speaking and writing in English

**Suggested language skills:**
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**Further requirements:**
- experiences with symbolic or numeric mathematical computation environments (e.g. Mathematica, matlab, Maple, etc.)
- programming experience (e.g. C++, Java, C#, etc.)