I Seminari su "Information Technology Outlook" – Dottorato di Ricerca in Informatica e Matematica

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Real-time Control of Hidden System Variables with Application in Therapeutic Knee Cooling

Various cooling modalities are routinely used in postoperative treatment in orthopedics, traumatology, facial surgery, pain prevention in sport, etc. However, a lack of uniformity in patients' response to the cooling has been confirmed, which raised the need for "smart" cooling devices, i.e., personalized cryotherapy. A framework for real-time control of inner (hidden) body temperature variables is proposed based on computer-controlled cryotherapy. The existing cooling methods are upgraded for automatic control of the inner temperatures by changing the cooling temperature.

A few noninvasive temperature sensors on the body surface provide data about the actual heat flux and physiological response of the patient. The feedback control loop uses predicted instead of measured inner temperatures. A light-weighted predictive model is built with machine learning methods, using data generated from computationally expensive computer simulation of the cryotherapy for various scenarios.

Online Short-term Forecasting of Photovoltaic Energy Production

A short-term online forecasting system enabling proactive prosumer scenarios for microgrid developments will be presented. The system performs up to 6-hour horizon predictions for the electrical current generated in a real PV power plant located in Ljubljana, Slovenia. The input variables of the models are locally collected sensor network data for past values of hourly PV current production, as well as measured weather variables (solar radiation and air temperature). Additionally, external data for calculated sun angles and forecasted weather parameters (solar radiation, air temperature and cloud cover) at the forecast horizon are included as input. Offline and online ANN models have been investigated and the results show that the performance of the best offline model is 6% better from the best online one. This result is beneficial for intelligent and proactive prosumer scenarios that are expected to rely on online learning. Moreover, a proof-of-concept application for microgrid management that integrates online forecasting of PV energy production has been also implemented.

Aleksandra Rashkovska received her Ph.D. degree in Computer Science from the Jožef Stefan International Postgraduate School, Ljubljana, Slovenia in 2013. She is a post-doctoral researcher at the Department of Communication Systems, Jožef Stefan Institute, Ljubljana, Slovenia. Her research interests include advanced bio-signal analysis, computer simulations in biomedicine, biomedical applications of data mining and control theory, and sensor networks data mining. She has collaborated in EU and Slovenian National projects: ProSense - Promote, mobilize, reinforce and integrate WSN research and researchers, CC CLASS - CLoud Assisted ServiceS, OVE@PZ - Renewable energy sources in smart buildings.