University of Pavia Ph.D. School in Electrical and Electronics Engineering and Computer Science Ph.D. School in Bioengineering and Bioinformatics

SEMINAR

Learning to Predict and Control in the Next Generation of Automated Insulin Delivery Systems for People with Diabetes

Abstract:

Diabetes is a global health problem increasing at an alarming rate worldwide. Regulation of blood glucose in the acceptable range is imperative in order to avoid the severe complications associated with this chronic condition and is achieved by exogenous insulin replacement. In particular, in the management of Type 1 Diabetes (T1D), automated insulin delivery systems, also known as Artificial Pancreas (AP), are steadily becoming the standard of care. However, the current reach of such closed-loop systems is still limited to a selected population due to insufficient adoption of insulin pumps and continuous glucose monitors (CGMs), inadequate understanding of the underlying pathophysiology and challenges in the management of daily life stressors that impact blood glucose homeostasis. In the age of connected devices, in which the behavior and habits of patients can be registered on their smartphone and data gathered in cloud-based platforms, there are unprecedented opportunities to collect objective measurements on a growing number of patients in the free-living setting and design solutions suitable and accessible to a larger population of people with diabetes. This talk will be focused on leverage automatic control and machine learning toward the development of medically inspired internet-of-things systems addressing glucose regulation in a larger fraction of people with diabetes. First, iterative algorithms to automate traditional clinical therapies for people that use multiple-daily-injections (MDIs) are presented followed by a finite number of capillary blood glucose measurements. Second, methods are introduced to estimate aspects of physical activity and sedentary behavior from three-axis

accelerometer data collected with a wrist-worn device, with the goal of incorporating this information in closed-loop systems.