Controlling Artificial Pancreas Systems through Machine Learning

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Type 1 Diabetes (T1D) is a chronic autoimmune disease which impairs the glucose homeostasis of the body, due to a deficiency in insulin production.[1] External insulin infusion can be identified as the most common treatment method. The Artificial Pancreas System (APS) is a novel improved treatment method focusing on a closed-loop control system where the required amount of insulin is calculated using continuous subcutaneous glucose measurements.[2] However, the glucoregulatory system of the body is a complex dynamical system, which makes glucose regulation a challenging task. The operation of APS's at present, is mainly constrained by complexities arising during meals, exercise, stress, sleep, sensor/insulin acting delays, and cognitive burden on users.[3]

Therefore, this research aims to develop an APS with better glucose regulation, while reducing the cognitive burden. For this purpose, two strategies will be explored. First, Machine Learning (ML) techniques will be investigated in order to develop control algorithms capable of operating under complex dynamics with delayed feedback, uncertainty, and disturbances. Second, additional physiological signals (e.g. heart rate, lactate) captured through wearable sensors will be integrated to the APS to provide further meaningful information for glucose regulation. The proposed ML based multi-input APS is expected to improve T1D treatment.

References

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