MyTreat

Intelligence in the Artificial Pancreas

A Mobile Platform for Personalization of Insulin Delivery based on a Patch Pump and Reinforcement Learning

Scope: To develop a mobile platform for the personalized delivery of insulin for diabetic patients based on the combined use of machine learning algorithms, a highly accurate patch pump, glucose monitoring devices and smartphone technologies.

✓ Algorithms

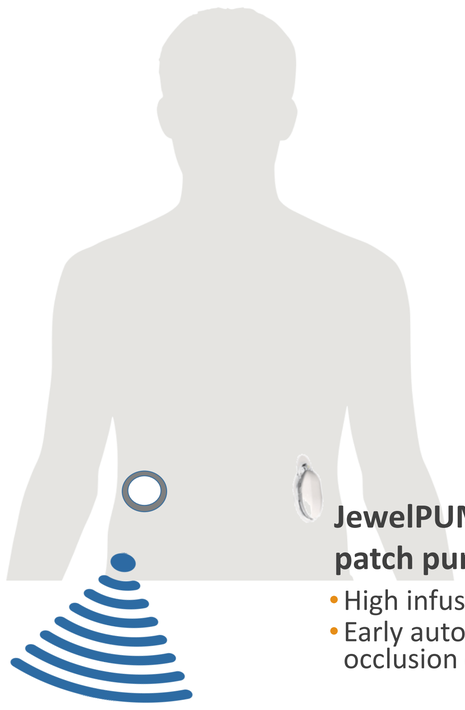
- Model free
- Self-learning strategy
- Low computational cost
- Data-driven alarm generation

✓ Devices

- Insulin infusion using a highly accurate patch pump
- Continuous glucose monitoring (CGM) device
- Self-monitoring blood glucose (SMBG) device

✓ Android Mobile Phone

- User friendly interface
- Dual SIM cards for data security and accesses facilitation
- Integrated SMBG



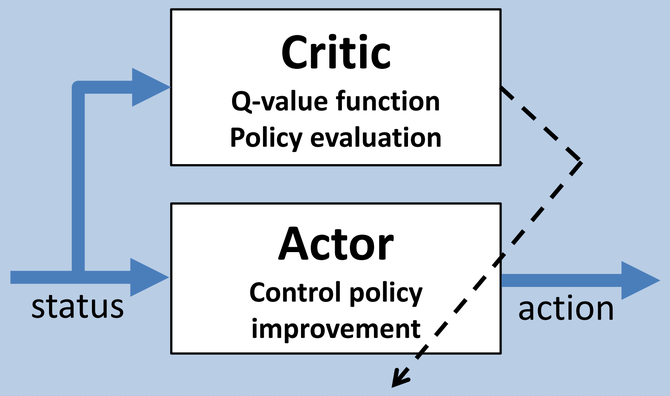
JewelPUMP™ patch pump

- High infusion accuracy
- Early automatic occlusion detection

JewelCom™

Controller: Reinforcement Learning

Actor-Critic Agent



Glucose Monitoring

Continuous **G**lucose **M**onitoring **(CGM)**

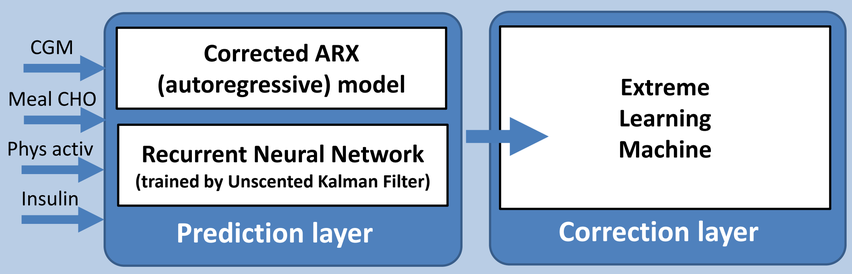
Self **M**onitoring of **B**lood **G**lucose **(SMBG)**

Insulin infusion history

Safety mechanisms

Glucose prediction: Early Warning System

Alarms against hypo-/hyperglycemia events



Insulin constraints

(Insulin-on-board, max. daily amount allowed)

- **Key findings**
  - Personalization on a daily basis of the basal infusion rate and the three main pre-prandial boluses
  - Compensation of meal's effect even with meal size uncertainties in the order of 25%
  - Alarm generator based on the fusion of a number of statistical and machine learning data-driven models for early detection of hypo- and hyperglycemic events (20 min ahead in time)
  - Evaluation using the FDA accepted simulator for individuals with type 1 diabetes (T1D)
- **Integration**
  - Integration into the JewelCOM™ Android smartphone platform
  - A portable platform with dual SIM cards

Daskalaki E, et al. Model-free machine learning in biomedicine, Feasibility study in type 1 diabetes. PLoS One. 2016 (In press; IF: 3.234: Ranking: 0.9).

Daskalaki E, et al. Personalized tuning of a reinforcement learning control algorithm for glucose regulation. 35th IEEE EMBC, 2013.

Daskalaki E, et al. An actor–critic based controller for glucose regulation in type 1 diabetes. Comput Meth Programs Biomed. 2013;109(2):116-25 (IF: 1.093, Ranking: 0.7)

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