Diabetes Mellitus and Carbohydrate Counting

Diabetes is one of the most common chronic diseases caused by insufficient secretion or action of insulin.

- 366 million adult people worldwide suffer from diabetes[1]
- 78.000 children develop type 1 diabetes every year[1]

The treatment of diabetes involves frequent monitoring of glucose levels and therapy through external insulin intake. Insulin dose has to match carbohydrate intake.

Recent studies have shown that

- Even well trained diabetics find it difficult to estimate carbohydrates precisely[2]
- Imprecise counting of carbohydrates can lead to either under- or overdosing of prandial insulin, resulting in out-of-range post-prandial glucose fluctuations
- ±20 g variation in carbohydrate counting significantly impacts the postprandial glycaemia[3]

GoCARB Framework

GoCARB addresses the needs of people with diabetes for a more effective, automated and precise way to estimate the grams of carbohydrates in food, as well as the better self-management of the disease, the enhancement of quality of life, the prevention of long-term complications and reduction of cost for diabetics, insurance companies and the society as a whole.

[1] IDF Diabetes Atlas, 5th Edition, 2011

[2] Ahola AJ et al. Many patients with type 1 diabetes estimate their prandial insulin need inappropriately. J Diabetes. 2010 Sep;2(3):194-202. (doi: 10.1111/j.1753-0407.2010.00086.x)

[3] Smart CE et al. In children using intensive insulin therapy, a 20-g variation in carbohydrate amount significantly impacts on postprandial glycaemia. Diabet Med. 2012 Jan. (doi: 10.1111/j.1464-5491.2012.03595.x)

Project Facts

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GoCARB

TYPE 1 DIABETES SELF-MANAGEMENT AND CARBOHYDRATE COUNTING: A COMPUTER VISION BASED APPROACH

5.8 mmol/l

MEAL TIME

CARBS

HEALTH

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www.gocarb.eu

GoCARB

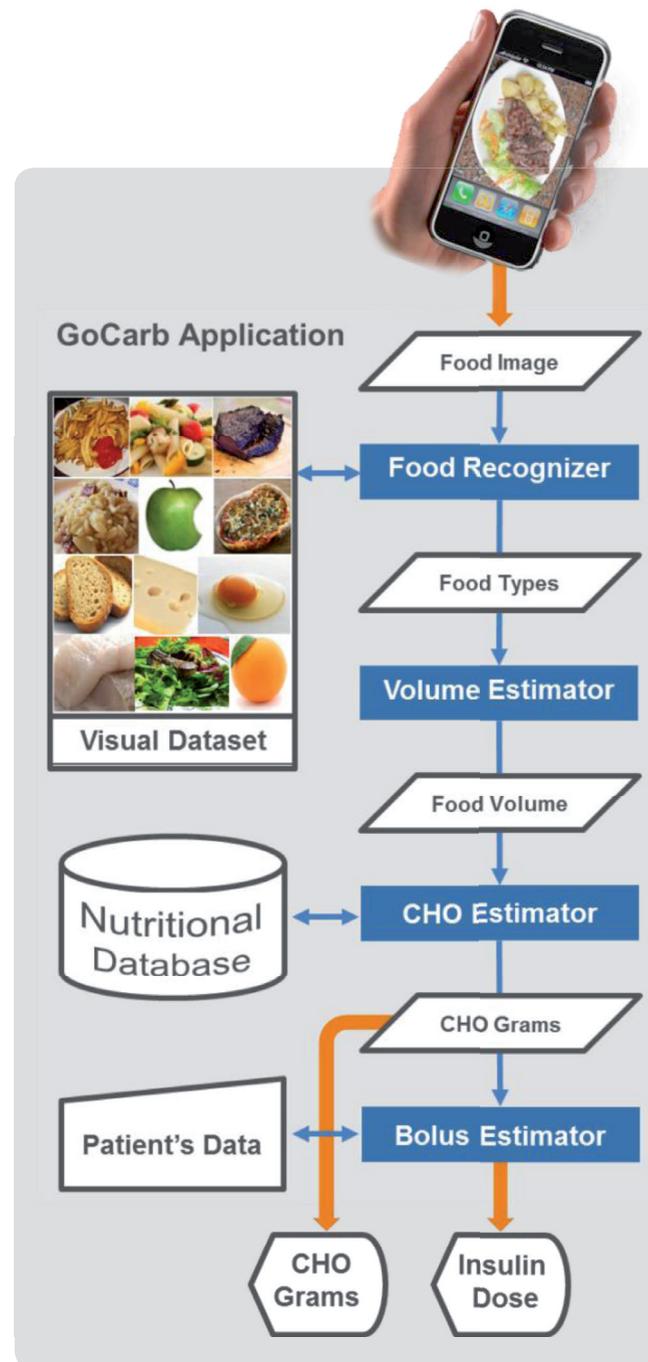Aim of GoCARB is the development of a prototype system for the

- automatic, near real-time recognition of the different types of foods on a plate and estimation of their content of carbohydrates
- optimization of the bolus insulin dose calculation

The ultimate goal is to have a mobile phone application which can be used in everyday life to support the diabetic patient during carbohydrate counting and insulin dose estimation.

Technical Challenges

GoCARB will run on a smart phone and will be based on

- A visual dataset with broad spectrum of European food and meals of interests for diabetic patients
- Advanced computer vision methods, machine learning and, artificial intelligence algorithms for better image analysis
- Simulation and modeling methods for better estimation of insulin dose
- Mobile phone technologies for a patient-centric application

GoCarb Application

Food Image

↕ Food Recognizer

Visual Dataset

Food Types

Volume Estimator

Food Volume

Nutritional Database ↔ CHO Estimator

CHO Grams

Patient's Data ↔ Bolus Estimator

CHO Grams   Insulin Dose

Modules

Food Recognizer

The module is dedicated to the automatic, near-real time recognition of the type of food on a plate based on a picture acquired by a mobile phone. Advanced computer vision and machine learning algorithms will be applied.

Volume Estimator

Knowing the type of food on the plate the next step is to reconstruct the 3D model of the food, in order to estimate the corresponding volume.

Carbohydrate (CHO) Estimator

Based on the volume, nutrient databases will be used for the estimation of the carbohydrate content of the meal.

Insulin Bolus Estimator

Model-based and heuristic approaches will be applied for the optimization of the insulin bolus dose using the carbohydrate information. The additional collection of patient specific parameters will permit the personalization of the bolus estimation in order to compensate on the inter-patient variability.