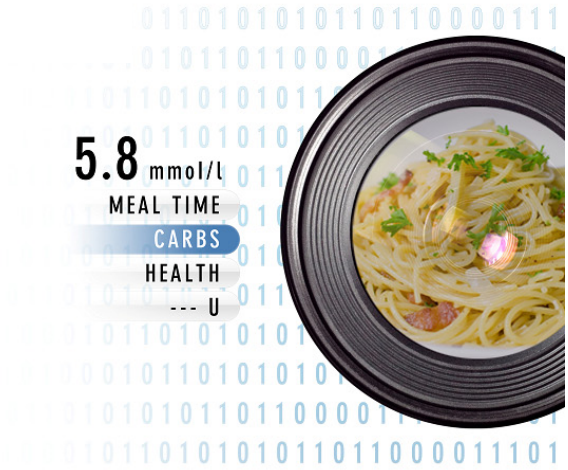
NEWSLETTER

GoCARB

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



ISSUE 2

SEPTEMBER 2014

WHAT'S UP GOCARB?

The above screenshot shows the second prototype version of the GoCARB Homescreen. Individuals with type 1 diabetes involved in the GoCARB pre-clinical study were able to discover the different functionalities of the GoCARB system.

GoCARB is a Marie Curie IAPP project funded by the European Commission's 7th Framework Programme. The project aims to support diabetics in counting carbohydrates and estimating the size of their required insulin dose through advanced computer vison and smartphone technologies. Although studies have shown that planning meals and counting carbohydrates is of great importance for diabetic patients, even well-trained diabetics find it difficult to estimate carbohydrates precisely.

Since the August 2013 Newsletter a lot has happened in the world of GoCARB, you can read more about the team's work in this Newsletter, but highlights from the past year include:

- The team has been updating GoCARB software with the newest versions of the user interface and various algorithms necessary to complete the segmentation and recognition of food, as well as the estimation of the food's volume
- The first GoCARB prototype has now been completed and tested in a laboratory setting using an Android smartphone and 20 real meal images
- An encouraging preclinical study of the GoCARB system with adult Type 1 Diabetic patients from the Bern University Hospital (Inselspital) took place in July and August 2014.

We hope you enjoy this Newsletter.

For more information please take a look at our website:

www.GoCARB.eu

IN THIS ISSUE

INTERVIEWS WITH MARIE CURIE FELLOWS

GoCARB gave us the opportunity to recruit two researchers for 24 months each, both of whom were based at the ARTORG Center in Bern. Dr. Marios Anthimopoulos (Greek) joined the project in May 2012, while Dr. Sergey Shevchik (Russian) joined the team in September of the same year. Both of them were classed as Marie Curie Experienced Researchers (<10 years) and here offer an insight into life working on a Marie Curie Project.

Drs. Anthimopoulos (left) and Shevchik (right) during GoCARB prototype evaluation.

1 Dr. Marios Anthimopoulos

Life before GoCARB

I was a PhD student/research assistant at the Institute of Informatics and Telecommunications (IIT) in the National Center for Scientific Research "DEMOKRITOS". The subject of my PhD thesis was "Text detection and extraction from images and videos" and my research interests were in the broader area of image processing and machine learning, focusing on object detection and recognition.

Dr. Marios Anthimopoulos is still working with the group in Bern.

My work on GoCARB

Was related to the development & evaluation of algorithms for the detection, segmentation and recognition of different food items. Initially, a method for single food image classification was developed, then multiple-food item recognition was investigated, leading to novel algorithms for segmentation and recognition.

My five best moments working on GoCARB

1. Working in a team with nine nationalities was a unique opportunity to get to know different cultures.
2. Collaboration with Roche offered me my first industrial experience in a globally leading health-care company.
3. Applying my knowledge and expertise in a medical application.
4. Traveling around the world and meeting world-class scientists at international conferences and events.
5. The memorable gatherings and dinners with GoCARB colleagues.

Three tips for living & researching in Switzerland

1. Try to learn the language (I didn't).
2. Finding an apartment will take time… more than you expect.
3. Dress warm!

Life after GoCARB

I am continuing to work for the Diabetes Technology Research Group at the ARTORG Center via a contract funded by the Swiss National Science Foundation and the Bern University Hospital – Inselspital.

2 Dr. Sergey Shevchik

Dr. Sergey Shevchik is still working here in Switzerland.

Life before GoCARB

I graduated from Moscow Engineering Physics Institute (MEPhI) with a specialization in control engineering, and defended my PhD in Laser Physics and Biophotonics. From 2009 I worked on human machine interfaces and perception problems at the National Research Center, Kurchatov Institute. In 2011, I worked at Dresden Technical University, Germany as an invited investigator.

My work on GoCARB

Was the development of an algorithmic framework for food volume estimation. After two years a fully operational measuring system has been developed and tested within the framework of the preclinical study.

My five best moments working on GoCARB

1. Working in an international team was extremely interesting in terms of my professional and personal life.
2. Gaining knowledge about practical application development.
3. To be given the chance to work with industrial colleagues, and medical professionals, within a research project was a unique experience.
4. Developing a prototype from its initial research stages is something I always wanted to achieve.
5. Great team, atmosphere and many joyful hours spent with my colleagues outside the office.

Three tips for living & researching in Switzerland

1. Learn the language and traditions of Switzerland, it is a great experience.
2. Enjoy nature, try out some new sports (skiing, yachting etc.).
3. Try to visit as many places, and meet as many people as possible.

Life after GoCARB

I am currently successfully using knowledge acquired on the GoCARB project in other scientific areas at the Federal Laboratories for Material Sciences, Switzerland, where I work in the field of image/signal processing. My research field has changed from biomedical research for the first time in the past 10 years. Though the knowledge acquired during GoCARB helps me in the present research where I am again involved with 3D reconstruction, signal processing and imaging of different physical phenomena. My professional experience was enriched by GoCARB and for the moment I am trying to take that knowledge with me into industry.

NEWS FROM GOCARB

1 Mid-term Review Meeting

In August 2013 the European Commission (through it's managing agency, the Research Executive Agency) undertook a thorough review of the project, the fellows (who are seconded to Bern, Switzerland and Mannheim, Germany), and of the conduct of the consortium.

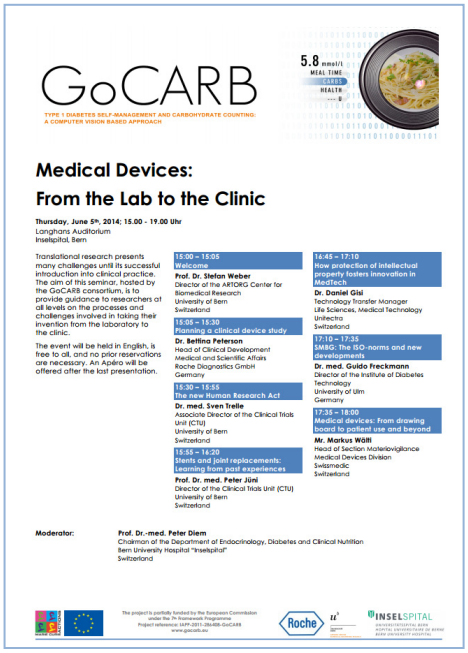
The results were very positive on the whole, with a few areas mentioned by the REA which could be improved upon, which the consortium is keen to put right as soon as is possible.

2 Lectures and Seminars

GoCARB Seminars

Medical Devices: From the Lab to the Clinic

In June 2014 the consortium was pleased to host a seminar on translational research in Bern. Many academics and physicians find the further development of their inventions to be a difficult task. The consortium hosted a variety of speakers from Industry, Academia and from the area of Swiss medical regulation to guide researchers through the world of medical device development.



An Introduction into the Complex World of Patents and Why They are So Important

In July 2014, Roche invited those Marie Curie Fellows seconded to Roche Diagnostics to participate in a seminar held in Mannheim, Germany on patents and intellectual property rights.

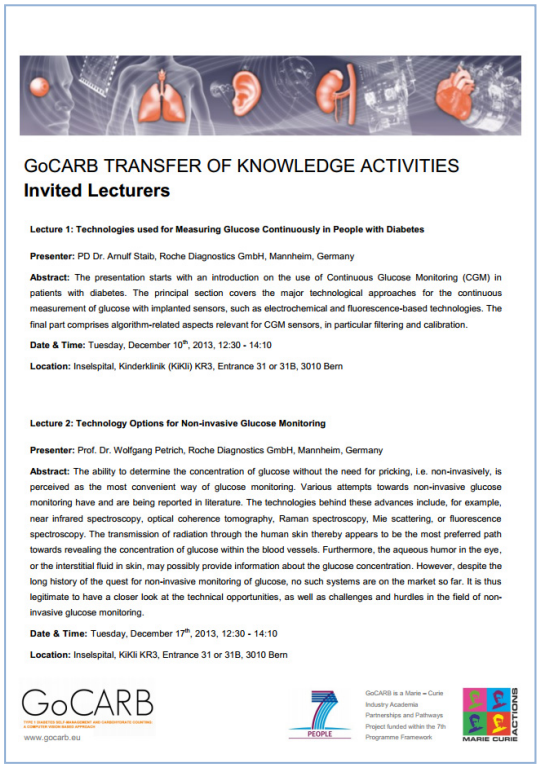
GoCARB Lectures

Two lectures were given as part of the Master of Science in Biomedical Engineering Course "Technology and Diabetes Management" by experienced scientists from Roche Diagnostics (Mannheim, Germany) during the fall semester 2013.

- Lecture on technologies used for measuring glucose continuously in people with diabetes (PD Dr. Arnulf Staib; December 10th, 2013)

- Lecture on technology options for non-invasive glucose monitoring (Prof. Dr. Wolfgang Petrich; December 17th, 2013)

The lectures were attended by MSc students, PhD Candidates, Postdoctoral Researchers, and Junior MDs.



GoCARB TRANSFER OF KNOWLEDGE ACTIVITIES

Invited Lecturers

Lecture 1: Technologies used for Measuring Glucose Continuously in People with Diabetes

Presenter: PD Dr. Arnulf Staib, Roche Diagnostics GmbH, Mannheim, Germany

Abstract: The presentation starts with an introduction on the use of Continuous Glucose Monitoring (CGM) in patients with diabetes. The principal section covers the major technological approaches for the continuous measurement of glucose with implanted sensors, such as electrochemical and fluorescence-based technologies. The final part comprises algorithm-related aspects relevant for CGM sensors, in particular filtering and calibration.

Date & Time: Tuesday, December 10th, 2013, 12:30 - 14:10

Location: Inselspital, Kinderklinik (KiKli) KR3, Entrance 31 or 31B, 3010 Bern

Lecture 2: Technology Options for Non-invasive Glucose Monitoring

Presenter: Prof. Dr. Wolfgang Petrich, Roche Diagnostics GmbH, Mannheim, Germany

Abstract: The ability to determine the concentration of glucose without the need for pricking, i.e. non-invasively, is perceived as the most convenient way of glucose monitoring. Various attempts towards non-invasive glucose monitoring have and are being reported in literature. The technologies behind these advances include, for example, near infrared spectroscopy, optical coherence tomography, Raman spectroscopy, Mie scattering, or fluorescence spectroscopy. The transmission of radiation through the human skin thereby appears to be the most preferred path towards revealing the concentration of glucose within the blood vessels. Furthermore, the aqueous humor in the eye, or the interstitial fluid in skin, may possibly provide information about the glucose concentration. However, despite the long history of the quest for non-invasive monitoring of glucose, no such systems are on the market so far. It is thus legitimate to have a closer look at the technical opportunities, as well as challenges and hurdles in the field of non-invasive glucose monitoring.

Date & Time: Tuesday, December 17th, 2013, 12:30 - 14:10

Location: Inselspital, KiKli KR3, Entrance 31 or 31B, 3010 Bern

GoCARB

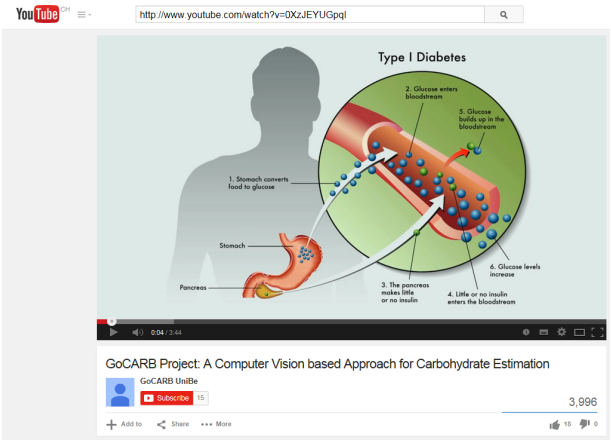
www.gocarb.eu

GoCARB is a Marie Curie Industry Academia Partnerships and Pathways Project funded within the 7th Programme Framework

PEOPLE

MARIE CURIE ACTIONS

3 Watch GoCARB, Online, Anytime



The GoCARB consortium has produced a video which takes viewers through a prototype of the application.

We hope you enjoy discovering more about our ongoing work! The video is available on our website, at the following URL: http://www.youtube.com/watch?v=0XzJEYUGpqI or by simply searching for "GoCARB" on YouTube™.

4 Journal Publications and Conferences

IEEE Journal of Biomedical and Health Informatics

The first technical publication on single food meal recognition is now online…

Marios M. Anthimopoulos, Lauro Gianola, Luca Scarnato, Peter Diem, Stavroula G. Mougiakakou, "A Food Recognition System for Diabetic Patients Based on an Optimized Bag-of-Features Model," *IEEE Journal of Biomedical and Health Informatics*, vol. 18, no. 4, July 2014.

13th IEEE International Conference on BIBE 2013

The latest versions of the main GoCARB computer vision based modules were presented at the **IEEE BIBE 2013** conference, November 10-13, 2013 in Chania, Greece. Two oral presentations were given:

1. Segmentation and Recognition of Multi-Food Meal Images for Carbohydrate Counting
2. Food Volume Computation for Self Dietary Assessment Applications

Results from GoCARB were presented by the two Marie Curie recruited researchers Dr. Marios Anthimopoulos and Dr. Sergey Shevchik

7th International Conference on ATTD 2014

The first GoCARB prototype was presented at the ATTD2014 conference, Feb 5 - 8, 2014 in Vienna, Austria. The presentation included a section on the results generated by GoCARB which captured images of both dummy and real foods (in a laboratory set-up).

Dr. Stavroula Mougiakakou (center) was invited to take part in a panel discussion at ATTD 2014

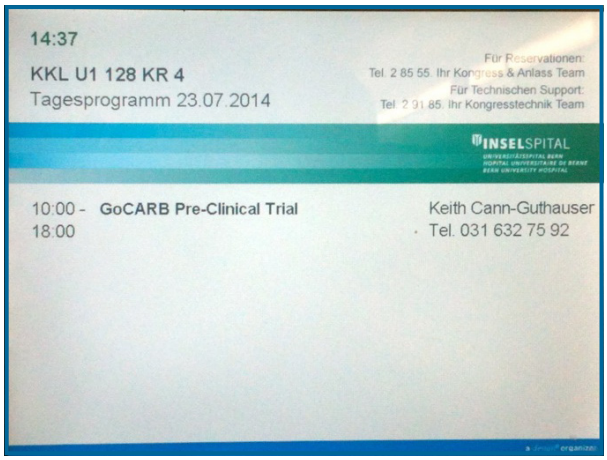
Others

From September 2013 to August 2014 the GoCARB project was presented at the following events:

- World MedTech Forum, 17-19 September, 2013, Lucerne, Switzerland.
- A Clustering Event organized by the REACTION project on Ambient Intelligence Advanced Technologies in Support of Healthcare and Assisted Living, Heraklion, Greece, 26-27th September 2013.
- EASD Diabetes Technology Conference, 26-27 February 2014, Düsseldorf, Germany.

5 The GoCARB Preclinical Study has arrived!

In July and August 2014, engineers, computer scientists and physicians from the GoCARB consortium conducted the first ever study comparing the accuracy of a computer vision based system for carbohydrate estimation versus patients trained in carbohydrate counting. In total, 19 adult type 1 diabetics participated in the preclinical study.



Each volunteer was given an Android smartphone and six meals from the Bern University Hospital's restaurant. Each person was the asked to give their own estimation of the carbohydrate content of each meal, and then repeat the pro-

Initial results indicate that GoCARB was significantly more accurate at estimating the carbohydrate content of each plate of food than the average individual with type 1 diabetes.

The results of the preclinical study have been submitted at an international conference and a peer reviewed high-ranked journal.

swisscom

The GoCARB consortium would like to thank SWISSCOM for generously providing the smartphones used during the preclinical study

NEWSLETTER

GOCARB CONSORTIUM LIST

24 SCIENTISTS, 9 NATIONALITIES, 3 PARTNERS, ONE PROJECT!

1

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SEVENTH FRAMEWORK PROGRAMME

www.gocarb.eu

MARIE CURIE ACTIONS