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Prestigious grant to use Artificial Intelligence for improved glucose control

The ARTORG Center for Biomedical Engineering Research of the University of Bern is the recipient of a grant from JDRF, the leading global funder for type 1 diabetes research. Thanks to the grant, a team led by Stavroula Mougiakakou will investigate a large, real-world dataset to develop advanced algorithms for automated insulin delivery that are capable of predicting dangerously low or high blood sugar levels. The goal is to optimize and personalize insulin treatment.

People with diabetes have a need to control their blood sugar levels to a normal range at all times. Today, scientifically validated automated insulin delivery (AID) systems are available as tools to enhance self-management. These systems empower people with diabetes to more successfully control their condition to prevent hypoglycemic (low-glucose) and hyperglycemic (high-glucose) events. However, these tools still have some shortcomings, because the algorithms used in these systems do not react adequately to variables influencing the blood sugar fluctuations in individuals, such as food intake or physical activity.

Bernese research group succeeds with advanced algorithms
The laboratory *Artificial Intelligence in Health and Nutrition* of the ARTORG Center for Biomedical Engineering Research of the University of Bern proposes to use big data and deep and reinforcement learning technologies (machine learning tools) to improve the prediction accuracy of AID algorithms. The Artificial Intelligence algorithms will be trained to foresee dangerously low or high blood sugar levels in real life situations. "If we can predict future blood glucose levels, we can provide early warnings and thus improve each patient's safety", explains Prof. Dr. Stavroula Mougiakakou, who leads the laboratory.

Prof. Mougiakakou´s team is one of only eight laboratories to receive the prestigious research grants awarded through a request for applications (RFA) by the US-based diabetes research foundation JDRF. The grant of about 144,000 USD most importantly provides access to big data, containing diabetes-specific patients' information from thousands of glucose monitors and insulin pumps. The de-identified data were collected by Tidepool — a nonprofit organization committed to making diabetes data more accessible, actionable and meaningful for people with diabetes, clinicians, and researchers — through the Tidepool Big Data Donation Project.

"We are honored and proud that JDRF recognizes the potential of and our expertise in applications of Artificial Intelligence in diabetes," says Stavroula Mougiakakou, principal investigator of the project. "This grant gives us a unique opportunity to access big diabetes-related data and use it synergetically with advanced AI algorithms to uncover patterns and trends that bring us closer to more precise and personalized insulin treatment." Prof. Mougiakakou has introduced the use of Artificial Intelligence in insulin treatment optimization in the late 1990s.

Machine learning to gain diabetes insights from big data
The data JDRF and Tidepool will provide access to has been de-identified and combined in meaningful ways for the use of clinicians and researchers. "This data is a big step forward for our research", says Qingnan Sun, PhD student at the ARTORG laboratory working on the JDRF funded project. "The data access will help us to refine the algorithms that are used in AID systems, making it possible to warn a person at least half an hour before they develop hypo- or hyperglycemia."

Personalizing blood sugar predictions
"First the Artificial Intelligence algorithms will analyze glucose data to detect for each person, how age, bodily fitness, insulin treatment, number of years with the disease, as well as daily routines influence his or her glucose control," explains Prof. Mougiakakou. "Subsequently the model uses these findings to predict hypo- or hyperglycemic events early enough so that the person with diabetes can react and prevent their onset. It is important to mention that the model will continue to learn individual's pattern and habits while in use."

Stavroula Mougiakakou
Stavroula G. Mougiakakou is an Associate Professor and holds a Ph.D. degree in computer engineering from the National Technical University of Athens. Since 2008 she is affiliated with the Faculty of Medicine, University of Bern and Head of the AI in Health and Nutrition Laboratory (former Diabetes Technology Research Group) at the ARTORG Center for Biomedical Engineering Research. Her current research interests include Artificial Intelligence, machine learning, computer vision and advanced data analysis to improve health by providing solutions for better diagnosis, personalized treatment and dietary assessment. She has published more than 100 papers in international peer-reviewed scientific journals, book chapters, and conferences proceedings and has served as an Associate Editor in several high-ranked journals in her field, while she is the organizer of the international workshop on multimedia assisted dietary assessment (MADiMa). Prof. Dr. Mougiakakou has supervised more than 16 PhD and MSc students and is a member of the IEEE Engineering in Medicine and Biology Society, the IEEE Computational Intelligence Society, the IEEE Computer Society and the Swiss Society of Biomedical Engineering.

Please find more information and the contact on the following page.

Research group Artificial Intelligence in Health and Nutrition

The ARTORG´s specialized research group has been using Artificial Intelligence (AI) for dietary assessments since 2008. With its long-standing expertise in personalized blood glycose control, the team aims to provide sustainable user-oriented solutions that most effectively exploit the minimum amount of information and provide people with diabetes with easily accessible applications, using a minimum amount of sensing devices. One example is the project MyTreat (www.mytreat.ch), that takes inputs from either a blood glucose meter or a continuous glucose monitor to provide personalized suggestions for the daily basal rate and prandial insulin doses - on the basis of a person's glucose level of the previous day. In 2009 Prof. Mougiakakou was among the first worldwide to introduce the use of AI for the translation of food images or video into carbohydrates, which recently has been extended to calories and macronutrients. A first prototype with this approach was developed to serve individuals with type 1 diabetes, while currently the technology serves a broad spectrum of usage scenarios from lifestyle management, patients suffering from diet-related chronic diseases, hospitalized malnutrition to dietary assessment of the general population (go-food.tech).

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