Guest Editorial
Nutrition Informatics: From Food Monitoring to Dietary Management

NON-COMMUNICABLE DISEASES (NCD), namely diabetes mellitus, cardiovascular diseases, chronic respiratory diseases and cancer, account for a massively increasing proportion of the global health burden. A number of behavioral and physiological factors are related to the rising onset of NCD worldwide, with unhealthy eating playing a key role among them. In parallel, food allergies and associated acute and sometimes life-threatening reactions are a public health problem. Thus, balanced nutrition with a proper diet is the key to the prevention of diet related diseases.

The recent advances in smartphone technologies, wearable sensors, computer vision and machine learning will bring the applications of nutrition informatics closer to the individuals and enable them to make better decisions regarding their daily nutrition. In this special issue, five papers were accepted for publication.

In the first paper, the authors proposed a new, publically available, benchmark dataset for food recognition methods. The dataset contains images of trays from a real canteen, with multiple dishes and different servings. The foods on the tray images were manually annotated by drawing polygonal boundaries. Baseline methods for the analysis of the provided images were also presented. The pipeline takes a tray image as input, finds the regions of interest, and predicts the corresponding food class for each region. Three different approaches for recognizing the foods were investigated with several visual descriptors. The best performance was achieved with deep convolutional neural networks.

In the second paper, the authors described a study of a wrist motion monitor as a tool for detection and counting of hand-to-mouth gestures during food intake. The study investigated the sensitivity and positive predictive value of the device in a group of 271 individuals with varying demographics consuming a range of cafeteria foods varying in packaging and need of use of utensils during consumption. The wrist motion was monitored by inertial sensors in a watch-like device. The times of hand-to-mouth gestures detected by the device were compared with those established by video observation.

In the third paper, the authors suggested the use of a novel wearable device for chewing detection that combined a chewing sound sensor, an accelerometer and a photoplethysmography sensor placed in the ear concha. The methodology first processes the signal from each of the individual sensors and then performs decision fusion to improve the overall accuracy of food intake detection. The sensor system was evaluated in both controlled and unrestricted conditions, with 14 subjects. The results suggest that the use of a multi-sensor sensor system improved the accuracy of the food intake detection.

In the fourth paper, the authors present an algorithm for meal detection and portion size estimation based on the analysis of continuous glucose monitoring (CGM) signal. A wavelet filter is applied to the CGM signal to reduce the noise level. Then, the filtered signal is transformed to a fuzzy qualitative representation, in order to define periods of time in which the meal is detected. Then a fuzzy system incrementally estimates the carbohydrate content of the meal. The algorithmic approach aims at individuals with type 1 diabetes under artificial pancreas therapy. The algorithm was extensively evaluated in a series of different experiments using the FDA accepted UVa/Padova type 1 diabetes metabolic simulator. The results indicated that the proposed approach was able to detect a meal, estimate its carbohydrate content and appropriately adjust the prandial insulin to achieve post-prandial glucose control.

In the final paper, the authors proposed the assessment of adherence to nutritional interventions. The authors argue that traditional statistics are not sufficient to detect subtle effects of nutritional interventions and thus the evaluation of adherence is generally omitted from the analysis. The paper suggests the use of Trajectory Maps as a visual tool to follow the dietary patterns during the intervention, and to evaluate the adherence to the intervention and its effects. The methodology was tested in a human study showing that some individuals adhere better than the others to the prescribed nutritional regimen and that the intervention effects are individual.

This special issue would not have been possible without the great support of the editorial team of the IEEE J BHI. The editors would like to thank the authors for their great and important manuscripts, and all the reviewers for their professional work and constructive comments. We truly hope that our effort to bring together leading technical experts resulted in a significant special issue focused on technological approaches to dietary assessment and applications of nutrition informatics for food and nutrient monitoring, diet assessment and dietary management.

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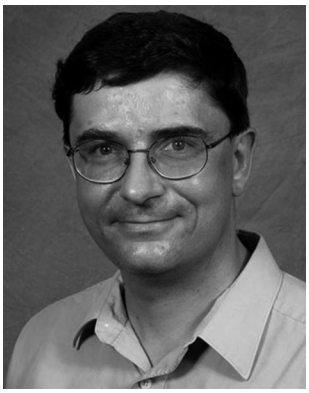

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