Overview of the ACM MultiMedia 2016 International Workshop on Multimedia Assisted Dietary Management

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ABSTRACT
This abstract provides a summary and overview of the 2nd international workshop on multimedia assisted dietary management.

CCS Concepts
- Information systems → Multimedia information systems
- Information systems → Mobile information processing systems
- Applied computing → Health informatics

Keywords
Food recognition; food volume estimation; food detection/segmentation; computer vision; machine learning; semantics; wearable technologies; mobile technologies; nutrient estimation; diet assessment.

1. INTRODUCTION
The prevention of onset and progression of diet-related acute and chronic diseases (e.g. diabetes, obesity, cardiovascular diseases and cancer) requires reliable and intuitive dietary management. The need for accurate, automatic, real-time and personalized dietary advice has been recently complemented by the advances in computer vision and smartphone technologies, permitting the development of the first mobile food multimedia content analysis applications. The proposed solutions rely on the analysis of multimedia content captured by wearable sensors, smartphone cameras, barcode scanners, RFID readers and IR sensors, along with already established nutritional databases and often require some user input. In the field of nutritional management, multimedia not only bridges diverse information and communication technologies, but also computer science with medicine, nutrition and dietetics. This confluence brings new challenges and opportunities on dietary management.

The first published attempts towards multimedia content analysis for dietary management took place in 2008. At that time, only some research groups were working in the field from the USA [1]-[3] and Japan [4], [5]. In Europe, the first (and only) related research project was funded in 2011 under the FP7 framework (GoCARB project) [6]. Since then, the field has attracted increasing interest with at least 30 groups from universities and companies around the world proposing portable systems that aim to help users with every-day diet management. This trend was triggered by the escalating prevalence of diet-related chronic diseases and was supported by the recent advances in computer vision and smartphone technologies. To this end, the European Commission announced several related calls for proposals, as well as a € 1 million prize for a non-invasive portable food scanner within the framework of Horizon 2020. Furthermore, according to market analysis reports [7], nutrition apps will become increasingly popular, personalized and integrated.

Although significant progress has already been made in this newborn field, there are plenty of issues that detain its further development and need to be addressed. A closer collaboration between the involved researchers should be promoted that will result in a strict problem definition, a basic categorization of the proposed approaches as well as a collection of widely accepted datasets and evaluation protocols.

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2. AIM OF THE WORKSHOP
The main scope of MADiMa2016 is to bring together researchers from the diverse fields of engineering, computer science and nutrition who investigate the use of information and communication technologies for better monitoring and management of food intake. The combined use of multimedia, machine learning algorithms, ubiquitous computing and mobile technologies permit the development of applications and systems able to monitor the dietary behavior, analyze food intake, identify eating patterns and provide feedback to the user towards healthier nutrition. The researchers will present and demonstrate their latest progress and discuss novel ideas in the field. Besides the technologies used, emphasis will be given to the precise problem definition, the available nutritional databases, the need for benchmarking multimedia databases of packed and unpacked food and the evaluation protocols.

3. TOPICS OF INTEREST
Topics of interest include the following:

- Ubiquitous and mobile computing for dietary assessment
- Computer vision for food detection, segmentation and recognition
- 3D reconstruction for food portion estimation
- Augmented reality for food portion estimation
- Wearable sensors for food intake detection
- Computerized food composition (nutrients, allergens) analysis
- Multimedia technologies for eating monitoring
- Smartphone technologies for dietary behavioral patterns
- Food multimedia databases
- Evaluation protocols of dietary management systems
- Multimedia assisted self-management of health and disease

4. WORKSHOP SUMMARY
The MADiMA2016 workshop attracted in total 14 submissions from America, Europe and Asia. Out of these, 10 papers and two

demo proposals were accepted covering a wide variety of topics related to the theme of the workshop.

Merler et al. in "Snap, eat, repEat: a Food Recognition Engine for Dietary Logging" presented a smartphone-based system to assist users in dietary logging habits, by using food recognition and geolocation information. In "Food Search Based on User Feedback to Assist Image-based Food Recording Systems", Amano et al. proposed a system that combines image recognition and interactive search in order to record users food intake. Ahmad in the paper entitled "A Mobile Food Record For Integrated Dietary Assessment", presents a mobile application that connects to an image-based food nutrient database with additional focus given on the user interfaces. Singla et al. with their paper "Food/Non-food Image Classification and Food Categorization using Pre-Trained GoogLeNet Model" they report the results of a series of experiments on food/non-food classification and food recognition using the GoogleNet CNN model. In "An Automatic Calorie Estimation System of Food Images on a Smartphone", Okamoto et al. propose a novel single-image-based food calorie estimation system which runs on a smartphone as a standalone application without external recognition servers. Ragusa et al. in "Food vs Non-Food Classification" consider the most recent classification approaches employed for food vs non-food classification, and compare them on a publicly available dataset. Hassannejad et al. in "Food Image Recognition with Very Deep Convolutional Networks", evaluated the effectiveness in classifying food images of a deep-learning approach based on the specifications of Google's image recognition architecture Inception. Shimoda et al. in "Foodness proposal for Webly-supervised food detection" propose a method which generates high "food-ness" regions by using fully convolutional networks-based backward approach with training food images gathered from the Web. In "Performance Evaluation Methods of Computer Vision Systems for Meal Assessment" Anthimopoulos et al. present an overview of the datasets and protocols used for evaluating the computer vision stages of the proposed automatic meal assessment systems. In "Food Image Segmentation for Dietary Assessment" Dehais et al. proposed a method to detect and segment the food of already detected dishes in an image by combining region growing/merging techniques with a deep CNN-based food border detection. Finally, Tanno et al. in "DeepFoodCam: A DCNN-based Real-time Mobile Food Recognition System" and Dehais et al. in "GoCARB: a Smartphone Application for Automatic Assessment of Carbohydrate Intake" provided short presentations of two automatic meal assessment systems that will be demonstrated during the workshop.

5. CONCLUSION

We expect that MADiMa2016 will support the expansion of the researcher's community working on multimedia assisted dietary management all over the world, and that it will facilitate cross-disciplinary research collaboration towards innovative solutions in the related fields.

6. REFERENCES

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