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Healthy Diet Monitoring System

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Abstract: The correct balance of nutrients is very important, particularly in infants. When the body is deprived of essential nutrients, it can lead to serious disease and organ deterioration which can cause serious health issues in adulthood. Automated monitoring of the nutritional content of food provides to in daycare facilities, are essential for their healthy development. To address this challenge, there is a system is introduced based on IoT and fully automated nutrition monitoring system called Healthy diet monitoring system. In this paper there is a review about this automated system.

Keywords: IoT, Food Monitoring,Nutrition Monitoring

I. INTRODUCTION

Daily food intake is a relevant and monitoring it is an important problem in health care. The wearables or monitoring systems in smart healthcare are designed to maintain a healthy lifestyle, focusing on calorie input and calorie output monitoring. As important as it is to monitor the calorie output, it is equally important to monitor the calorie intake. Though the focus of such monitoring systems might range from tracking weight loss to having a healthy balanced diet, the underlying motivation is to address nutrition imbalances. This condition can be caused by both undernourishment, in which not sufficient nutrients are consumed, as well as overeating, which results in excessive consumption of non nutrient rich food, particularly in fats and salt. Overeating can lead to obesity which is a serious health concern in affluent societies today. Imbalance nutrition in infants and children can manifest in numerous modalities in adulthood including weak immune systems, cognitive disorders, weakened skeletal structure, thinning hairlines and bleeding gums, to mention just a few. The primary enabler for this research is the Internet of Things (IoT). The IoT is used as the link between sensor-derived data and cloud-based analytics. The IoT is a network of physical devices where each device is recognizable within the network. Each recognizable component in the IoT is a "thing" which can connect to the Internet. With the IoT covering a wide range of the business spectrum, it has helped researchers and developers to make intelligent systems. The IoT is also the enabling technology of smart cities where diverse infrastructure components are interconnected. In the context of health care, the IoT has enabled remote assistance and has enriched peoples quality of life.The paper is divided into three main categories in which in first section we are giving a brief introduction about the system, in the second section we are making a review about the system and , in section three we concludes.

II. LITERATURE REVIEW

In[1]Spectrogram-Based Audio Classification of Nutrition Intake the acoustic monitoring of food intake in an unobtrusive, wearable form-factor can encourage healthy dietary choices by enabling individuals to monitor their eating patterns, maintain regularity in their meal times, and ensure adequate hydration levels. This paper, describe a system capable of monitoring food intake by means of a throat microphone, classifying the data based on the food being consumed among several categories through spectrogram analysis, and providing user feedback in the form of mobile application. We are able to classify sandwich swallows, sandwich chewing, water swallows, and none, with an F-Measure of 0.836.

Increasing physical activity levels is just one component necessary for weight loss, and maintaining healthy eating habits remains an important factor. For example, studies have revealed that various trends in eating frequency, the number of skipped meals, and the timing of food consumption can be associated with the prevalence of obesity. This necessitates the design of practical, lightweight, wearable, wireless sensor based systems capable of monitoring nutrition intake. Furthermore, merely identifying the number of swallow events may not be sufficient for all use cases, as many recommended dietary techniques suggest individuals to increase their liquid consumption while reducing their intake of other foods. This motivates the design of the system and algorithms described in this paper.

Here, we present an acoustic technique for detection and classification of swallow events in a mobile, wearable platform. The system is packaged in the form of a throat microphone, and an associated Android application which rapidly samples audio data associated with chewing and swallowing various foods. Through spectrogram analysis, feature extraction, and

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the application of several learning algorithms, basic classification can be performed, which provides more insight into the nutrition intake of the subject. The system architectural flow from audio acquisition to user guidance.

Spectrograms, while typically used for speech processing, speech training, the study of phonetics, as well as countless other applications, appears to be very well suited for classifying different food types by exploiting the unique features found in audio recordings of swallows of various food types. In this paper, we are able to classify between sandwich swallows, water swallows, sandwich chews, and none, using a Bayesian classifier and features extracted from an audio spectrogram. The resulting F-Measure for classification is 0.836, based on 189 collected samples.

In[2] the paper A Wearable Nutrition Monitoring System maintaining appropriate levels of food intake and developing regularity in eating habits is crucial to weight loss and the preservation of a healthy lifestyle. Moreover, maintaining awareness of one's own eating habits is an important step towards portion control and ultimately, weight loss. Though many solutions have been proposed in the area of physical activity monitoring, few works attempt to monitor an individual's food intake by means of a non-invasive, wearable platform. In this paper, we introduce a novel nutrition-intake monitoring system based around a wearable, mobile, wireless-enabled necklace featuring an embedded piezoelectric sensor. We also propose a framework capable of estimating volume of meals, identifying long-term trends in eating habits, and providing classification between solid foods and liquids with an F-Measure of 85% and 86% respectively. The data is presented to the user in the form of a mobile application.

We address the problem of accurately detecting eating patterns by building a non-invasive nutrition and activity monitoring wearable necklace that aids users in preventing weight gain and promoting a balanced healthy lifestyle. Our approach is twofold. First, we propose a system comprising a low-cost sensory necklace with a low-power Bluetooth LE Transceiver, and a smartphone application for receiving sensor data and applying signal processing algorithms. The necklace consists of a microcontroller board with an integrated RF transceiver, a piezoelectric sensor, and a lithium-polymer battery. Piezoelectric sensors are capable of producing a voltage at their terminals in response to mechanical stress. Thus, the motion of the throat during a swallow is detected using the sensor, and the associated data is transmitted to a mobile application for processing. The mobile application provides a platform through which several algorithms identify swallow events while filtering extraneous noise. Furthermore, these algorithms are able to classify food intake into broad categories of solids and liquids, providing advanced analytics for viewing historic trends, and guiding the users to improve their eating habits based on their chosen goals. The data is then uploaded to a secure cloud server with optional social network integration. Such a system has several crucial benefits including increasing user awareness of their food consumption, Empowering individuals to establish more regularity and balance in their diets, Encouraging users to maintain adequate hydration levels, and Giving users the ability to track their historic eating patterns in order to identify changes in their diet. This robust system can empower an individual to self-monitor their eating patterns, while providing feedback and user guidance from the mobile application.

Though the system attempts to identify the volume of food consumption and make users more aware of their eating habits, the next logical step is to extend the classification of food types into several broad categories. This may require supplementing the hardware with additional sensors such as a small microphone. Another potential improvement is to extend the system with fully real-time functionality. In the current system, data is transmitted from the necklace in real-time, and instant feedback is given to the user when a swallow is detected. However, the more advanced classification algorithms which distinguish between different food types are implemented offline.

Here describes a low-cost, wearable sensor system in the form of a necklace with an embedded piezoelectric sensor. The necklace is capable of estimating volume of food consumption and transmitting the data to a mobile phone for analysis. The system was able to detect 85.3% of potato chip swallows, 84.5% of sandwich swallows, and 81.4% of water swallows. Furthermore, the system is capable of identifying solid and liquid foods with an average F-measure of 86%. The system and software described in this paper were designed with the primary goal of making individuals more aware of their eating habits, which we believe is critical for weight loss.

Diet [3] and physical activity are important lifestyle and behavioural factors in self-management and prevention of many chronic diseases. Mobile sensors such as accelerometers have been used in the past to objectively measure physical activity or detect eating time. Diet monitoring, however, still relies on self-recorded data by end users where individuals use mobile devices for recording nutrition intake by either enter in texture taking images. Such approaches have shown low adherence in technology adoption and achieve only moderate accuracy. In this paper, we propose development and validation of Speech-to-Nutrient-Information (S2NI), a comprehensive nutrition monitoring system that combines speech processing, natural language processing, and text mining in a unified platform to extract nutrient information such as calorie intake from spoken data. After converting the voice data to text, we identify food name and portion size information within the text. We then develop a tiered matching algorithm to search the food name in our nutrition database and to accurately compute calorie intake. Due to its pervasive nature and ease of use, S2NI enables users to report their diet routine more frequently and at any time through their smart phone. We evaluate S2NI using real data collected with 10 participants. Our experimental results show that S2NI achieves 80.6% accuracy in computing calorie intake.

The proposed system aims to monitor food intake using speech recognition and natural language processing techniques. The user talks through a speech-to-text mobile application. The audio signal is converted to text. The text is processed in real-time and after finding the food name and portion size, it computes the amount of calories.

The major innovation of this paper is the introduction of an entirely novel approach for nutrition monitoring. This research integrates advances in speech recognition, natural language processing, text analysis, and mobile health in order to provide a more pervasive approach for recording and understanding spoken language for diet assessment. In using speech-to-text app, our goal was to provide a more convenient tool for users in different situations to record their food intake data. We also utilized natural language processing algorithms to identify nutrition specific information within the generated text. Furthermore, we devised a 2-layer approach for analyzing the identified text to compute calorie intake. The results show that the performance of the S2T app is 66.50%. For extracting the nutrition specific data from the S2T output, NLP program was implemented in Python.

In[4] artificial Speech2Health: A Mobile Framework for Monitoring Dietary Composition from Spoken Data the diet self-monitoring is one of the earliest approaches to nutrition assessment. Diet and physical activity are known as important lifestyle factors in self-management and prevention of many chronic diseases. Mobile sensors such as accelerometers have been used to measure physical activity or detect eating time. In many intervention studies, however, stringent monitoring of overall dietary composition and energy intake is needed.

Currently, such a monitoring relies on self-reported data by either entering text or taking an image that represents food intake. These approaches suffer from limitations such as low adherence in technology adoption and time sensitivity to the diet intake context. In order to address these limitations, we introduce development and validation of Speech2Health, a voice based mobile nutrition monitoring system that devises speech processing, natural language processing (NLP), and text mining techniques inaunified platform to facilitate nutrition monitoring. After converting the spoken data to text, nutrition-specific data are identified within the text using an NLP-based approach that combines standard NLP with our introduced pattern mapping technique .We then develop a tiered matching algorithm to search the food name in our nutrition database and accurately compute calorie intake values. We evaluate Speech2Health using real data collected with 30 participants. Our experimental results show that Speech2Health achieves an accuracy of 92.2% in computing calorie intake. Furthermore, our user study demonstrates that Speech2Health achieves significantly higher scores on technology adoption metrics compared to text-based and image-based nutrition monitoring. Our research demonstrates that new sensor modalities such as voice can be used either standalone or as a complementary source of information to existing modalities to improve accuracy and acceptability of mobile health technologies for dietary composition monitoring.

We introduce a new framework for voice-based nutrition monitoring and propose an array of data processing modules including a speech to text conversion, nutrient attribute extraction, and string matching to extract nutrient information from spoken language. We devise a nutrient attribute extraction by utilizing Natural Language Processing (NLP) and developing a novel pattern mapping approach for tagging nutrient data.

We develop a 2-tier string search algorithm including an exact matching and an edit distance-based approximate matching to search food items from a given nutrition database (e.g., United States Department of Agriculture Food Composition Databases) and to compute nutrient values such as calorie intake, fat, and protein. The system is evaluated with real data collected with 20 subjects in an experimental setting that mimics noise-free as well as realistic noisy environments where the spoken data are entered into the system. We assess user acceptance of our nutrition monitoring approach with 10 additional participants to compare voice based nutrition recording with two other diet recording systems including text-based and image-based methods in a week-long experiment.

The major contribution in this work is the introduction and validation of a novel approach for nutrition monitoring based on spoken data. This research provides a pervasive approach for recording and understanding spoken language for diet assessment by integrating advances in speech recognition, NLP, text analysis, and mobile health. The goal of using a speech to-text app is to provide a more convenient nutrition monitoring tool for users in different situations. We utilized NLP algorithms to identify nutrition-specific information within the generated text. A 2tier approach was devised for analyzing the text and calorie computation. The performance of the system in presence of error-free text is 97.7%. Although the performance of the speech-to-text app is 82.0% individually, the calorie calculation accuracies of the erroneous text using the system are 92.2% and 90.4% for noise-free and noisy environments respectively. The accuracy of our system cannot be compared with text and image-based approaches, due to the difference in modalities. Still, we performed a user acceptance analysis for comparing Speech2Health with two other nutrition monitoring techniques. The results show that Speech2Health achieves significantly higher scores in technology adoption metrics compared to the other approaches.

Healthy diet[5] with balanced nutrition is key to the prevention of overweight and obesity, cardiovascular disease, as well as other life threatening metabolic co morbidities such as type 2 diabetes, and cancer , which warrants personal diet monitoring. In contrast to the traditional manual food logging that is time consuming and hard to sustain, smart phones applications such as My Fitness Pal, LoseIt and Fooducate, have demonstrated high level of usability by providing effective dietary feedback .However, many of these applications require significant amount of manual input from users and poorly perform in assessing the exact ingredients and food portion of a meal, which has hindered users' experience in a long run. In order to make food journaling easier and more accurate, we proposed to develop a novel automated system that integrates diet recoding via interactive food recognition and assessment though smartphone apps, exercise detection via wearable devices, and personalized energy balance monitoring through metabolic network modelling, and just-in time dietary intervention. For instance, a user can take photos of his/ her meal using smartphone and within

seconds, receive nutritional information about the underlying food items. With more food logging activities, the system is capable of identifying individuals' eating patterns and rendering interventions, e.g., recommending healthier food or providing warnings when detecting bad eating habits. To accomplish this, we first explored new methodologies in Computer Vision and Machine Learning to address key issues in each of the following components:1) a comprehensive food image database that contains diverse and abundant images from a large number of food classes, in order to avoid the food discrepancy when training a food image classifier; 2) a food segmentation strategy that can correctly identify all items in an image from the background regardless the lighting conditions or if the foods are mixed or not; 3) a Machine Learning model to be trained for classifying each segmented item; 4) volume and weight estimation to be performed on each food item, followed by the nutrient analysis. In addition, one unique feature included in this system is a metabolic network simulation that takes into consideration individual's basal metabolism and monitors the real-time energy production in the presence of nutrients available in the meal.
The rationale behind the modeling is that, with different respective metabolic baselines, individuals may respond differently in terms of energy production to the same meal or similar combination of nutrients. This paper is organized as follows: it starts with a general review of the related work in food image processing and classification, followed by an overview of the entire work flow of this project. We then present the details of our methodologies and results, followed by the discussion on remaining challenges and future outlook to close the paper.
This paper presents a proof-of-concept study of an image based classification system using smartphone applications specifically designed for automated food recognition and dietary intervention. Particularly, the entire framework can be broken down into four major parts that involve new strategies for comprehensive food image databases, classifiers capable for food item recognition, food volume estimation, and nutrient analysis that provide information for diet intervention. In addition, an energy-related metabolic model was implemented including all the chemical reactions participating in the main ATP-producing metabolic pathways. The results of a meaningful trend for ATP concentration in presence of regular meals or a random load have demonstrated the feasibility of the given model. Worth mentioning is the increasingly growing application of Deep Learning methods in image-based food recognition, which outperformed traditional approaches using handcrafted features.

III. CONCLUSION

An autonomous food data logging system is presented in this work. The implemented design is cost efficient with high accuracy in diet monitoring. The algorithm for nutrient feature extraction based on a Bayesian network and an algorithm based on a 5 layer perceptron neural network for determining the nutritional balance after each meal, was proposed after a thorough analysis of various classifiers using WEKA. Since an open food database was used, the input dataset contained certain products logged multiple times. To overcome this, the user is presented with additional options to correct a data entry in case of redundancy with corresponding increase in the final accuracy. In addition to an analysis of the meal nutritional content, suggestions are made by the system to decrease the risk of imbalanced diet. This system can become an essential product for household or child care usage. Even though the scope of the system is demonstrated in the context of food habits of infants in the current paper, the system can be used for adults as well by expanding the food databased in its cloud storage. As future research, system will be integrated with physiological monitoring mechanisms to keep track of user activities for accurate automated prediction of diet for adults. In future we can add a feature for read the [6] ingredients of packet food and determine the chemical contents.

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REFERENCES

[1]. Haik Kalantarian, Nabil Alshurafa and Mohammand Pourhomayoun "Spectrogram-Based Audio Classification of Nutrition Intake" Conf, 2014
[2]. A H.Kalantarian, N.Alshurafa, & M.Sarrafzadeh, "A Wearable Nutrition Monitoring System," in Proc. IEEE Int. Conf. Wear. Implant. BSN, 2014, pp. 75–80.
[3]. Niloofar Hezarjaribi, Cody A. Reynolds, Drew T. Miller, Naomi Chaytor, and Hassan Ghasemzadeh "S2NI: A Mobile Platform for Nutrition Monitoring from Spoken Data."Embedded & Pervasive Systems Lab (EPSL)2016
[4]. Niloofar Hezarjaribi, Sepideh Mazrouee and Hassan Ghasemzadeh" Speech2Health: A Mobile Framework for Monitoring Dietary Composition from Spoken Data" in Proc. IEEE Journal (2017).
[5]. Bruno Vieira Resende e Silva1, Milad Ghiasi Rad1, Juan Cui1*, Megan McCabe2 and Kaiyue Pan3 "A Mobile-Based Diet Monitoring System for Obesity Management" Silva et al., J Health Med Informat 2018, 9:2.
[6]. Mr. Pratik Madhukar Manwatkar and Mr. Shashank H.Yadav "Text Recognition from Images", in IEEE Conf. on innovations in information, Embedded and Communication system, 2015