REVIEWS USABILITY OF A SOFTWARE FOR DIET CONTROL USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

The objective of this paper is to present a proposal for usability evaluation in terms of an Expert System for diet control using Artificial Intelligence. It also uses fuzzy logic to make reviews of a diet menu in the system. It is expected that the proposed method presents a new approach for nutrition education and a usability evaluation in accordance with the recommendations.

KEYWORDS

HCI, Usability, Interaction, Diet, Artificial Intelligence.

1. INTRODUCTION

There are nowadays many software applications being developed to solve real life problems. The health area can benefit from using Artificial Intelligence (AI) to support their professionals to solve problems and to make the right decisions. More specifically in nutrition, computer systems have been used to help the modern man to find a balanced diet, preventing obesity to become the most prominent disease of our society (Bosko et al, 2009).

Some of these applications promise to create diets for people but they usually do not fit their needs since they are often poorly formulated and not interactive. Therefore, it is necessary to evaluate the usability of these applications. According to the ISO/IEC 9126 standard, software usability is defined as: "The capability of a software product to be understood, learned, used, and be attractive to the user when used under specified conditions". Some of the important characteristics when defining software usability are: understandability, learnability, operability, and attractiveness. Cognitive modeling involves creating a computational model to estimate how long it takes for the users to perform a given task (Rubin, 2008; Yen et al, 2012). It involves one or more evaluators inspecting a user interface by going through a set of tasks by which understandability and ease of learning are evaluated. The user interface is often presented in the form of a paper mock-up or a working prototype; but, sometimes, it might also be a fully developed interface (Dasari, 2013; Harrison, 2013).

Many of these computational models are called Expert Systems and claim to deal with uncertainties that are neither represented by any general theory nor employ the most suitable method to solve the problem (Bittencourt, 2001). As the computational tools can assist in nutrition education, we propose the development of an Expert System for controlling the weekly diet of a patient, using AI tools, so that, intuitively, the person is able to digitally follow a proper diet, based on recommendations from a professional in the health area. The objective of this paper is to evaluate the usability of this expert system for diet control, using Artificial Intelligence. Thereby, the methodology applied is presented and some preliminary discussions are shown.

2. METODOLOGY AND PROPOSED SOFTWARE TOOL

There are many software applications and expert systems available on the market today that propose diets and menu planning with nutritional assessment, such as CAMP, PRISM, CAMPER, DietPal e VIE-PNN (Bosko, 2009). The main difference of what we describe in this paper lies on the fact that our proposed tool will allow the registration of multiple users, weekly monitoring each diet, highlighting the daily amount of calories taken and defining, according to its own logic (based on fuzzy logic), if the menu chosen by a user is good or not. Therefore, the user is able to find another choice that best suits his purpose, being influenced by the expert system. Usually, the other software applications available generate food menus for a single user. Our software also uses a fuzzy logic for the individual amount of calories of each food and another which gives a score, at the end of the proposed menu, called fuzzy collective. In both there is a ranking using the same scale which considers the terms bad, poor, regular, good and excellent, distinguished by the amount of calories – of each food item and the collective chosen menu.

The expert system called S-Health was recently released by Samsung S4 smartphone, as one of the applications that can daily monitor calories intake, weight and workouts, and calculate the basal metabolic rate (BMR), recommending a daily amount of calories intake for the diet. This application can also pull calories information from a database of common food items (Samsung, 2013).

In our case, the proposed expert system should be installed only in standalone platforms, requiring a migration of the code to mobile devices. Furthermore our expert system has the automatic calculation of body mass index (BMI) that is a measure of body fat based on height and weight that applies to adult men and women, helping the user to maintain a proper diet based on his BMI. These values are presented in

Table 1 (Bosko *et al*, 2009; Flegal, 2013).

Table 1. Body Mass Index (BMI) Chart for Adults

BMI	Classification
< 18.5	Underweight
18.5 – 25	Normal
25-30	Overweight
30 & Above	Obese

The fuzzy logic proposed here can be divided in two categories: (1) the classification is done according to the amount of calories of each type of food; (2) considers the sum of calories of food items that compose a meal called fuzzy collective.

Keeping in mind that a person needs 2500 calories per day, Figure 1 shows these categories and the use of fuzzy logic to represent knowledge to model the inaccurate arguments of a set of possible calories, in this case, making decisions in an uncertain setting composed by the menus (Anantha et al, 2013; Lee et al, 2009; Lee et al, 2011). The fuzzy set theory was used in this expert system to disseminate the classical notion of sets and propositions, providing models for food categories and menus.

Figure 1. Fuzzy Logic Proposals

The proposed methodology aims at monitoring users´ food intake, including the user's selection, days of the week and food items to be chosen for a particular meal, considering the average consumption of 560 kcal in each meal (Bosko, 2009). This way, the system will display the weekly amount of calories, adapt the menu and evaluate the options chosen, providing a critical profile about the amount of calories recommended by nutrition professionals. It will allow the modification of the menu, after the response of the software, by displaying colors and icons, in a very intuitive way. The choice of each food for a menu reflects the reasoning with uncertainty that is solved by this research proposal, by using a specific fuzzy logic.

The adopted approach is empirical and focused on the perception of users and nutrition professionals, through questionnaires about usability issues and Human-Computer Interaction (HCI) in Experts Systems. The system will be available in a repository for download and analysis, which will be based on the evaluation of interfaces according to heuristics specifications, requiring observation and immersion in the system. Answers should be given on questionnaires about checklists recommended by software evaluation authors, addressing usability in the usage context, form theory foundations and observation of the mediation elements – icons, images and pictures.

This conceptual model of the evaluation for usability using checklists is detailed in Aita et al (2012), focusing on social constructivist theories in which the answers range from Excellent (E), Good (B), Sufficient (S), Insufficient (I) to Not Applicable (N). Each question is chosen, sorted and applied according to the following guidelines: (1) Interface General Presentation;, (2) Interface Readability; (3) Navigability, (4) User Adaptation ; (5) Proper Guidance to the User; (6) Proximity and Clustering; (7) Alignment; (8) Standardization and Consistency; (9) Evaluation Mechanism and (10) Pedagogical principles for properly understanding and handling the system.

This Expert System is being developed using C# language, since, compared to other programming languages, it presents a good computational performance in Object-Oriented Programming . Besides, its code can be written in any text editor. C# is a C++ based language and was developed to provide portability for distributed applications over network and internet. C# is Microsoft's latest object-oriented programming language developed for .NET platform and .NET is Microsoft's latest platform technology for creating web services (Bender, 2011; Derezińska, 2009). It also provides an easy way to program based on mobile devices.

3. PRELIMINARY DISCUSSION

This paper presents a still ongoing assessment of the usability of an Expert System developed to analyze food intake by individuals, making use of computational techniques and Artificial Intelligence. The presented methodology uses AI techniques to represent knowledge in nutritional diets and a fuzzy logic to deal with uncertainties present in the evaluation process of food intake. It also enables users to make choices according to their eating habits, and then, afterwards, evaluates the chosen menu taking into account different calories levels. As the user creates his weekly menu, the software makes recommendations based on healthy choices, allowing, this way, a nutrition education approach, changing his eating habits, if necessary.

It is also expected that the proposed methodology may foster a new practice for nutrition education and a new educational process by the results of the usability evaluation. As a result, there is also the potential for modeling expert systems based on fuzzy logic to calculate the uncertainties present in the process for food evaluation. As prospects for improvement, it is possible to implement the entire system on the internet and mobile devices. As future work, we also plan to implement the system, building up menus for all four meals in the day – breakfast, lunch, dinner and snacks.

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