

Dietary Ontology for Nutrition Counseling Expert System

POSTER DESCRIPTION

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Dietary menu planning is an important part of personalized lifestyle counseling. The poster presents the dietary ontology developed for the automated menu generator MenuGene. The menu generator uses Genetic Algorithms to prepare weekly menus for web users.

In GAs a population of abstract representations of candidate solutions evolves toward better solutions. The evolution starts with a population containing random individuals and happens in generations, in which stochastically selected individuals are modified to form the population of the next iteration. In each iteration, the GA evaluates the candidate solutions, assessing their goodness in solving a particular optimization problem.

The evaluation of dietary plans has at least two aspects. Firstly, we must consider the quantity of nutrients in the dietary plan. As for quantity, the task of planning a meal can be formulated as a constraint satisfaction and optimization problem.

Secondly, the harmony of the dietary plan's components should be considered. Plans satisfying nutrition constraints should also be appetizing. The dishes of a meal should go together. By common sense some dishes or nutrients do not appeal in the way others do. This common sense of taste and cuisine can be described by simple rules recording the components that should fit together. The dietitian knowledge about the harmony of the various components of a dietary plan should be formalized. The ontology, jointly developed by the University of Pannonia and the Semmelweis University addresses this problem.

Protégé OWL is used by our domain experts to classify nutrients [1], foods, dishes and meals. In contrast to other ontologies [2], [3], our implementation classifies instances by level in the food hierarchy and role in the dietary plan. We developed a rule base for the GA to assess dietary plans according to harmony. The rule editor application uses the Protégé OWL API. The rule based assessment proved capable to drive the evolutionary search such that non-harmonizing solutions were omitted, while more and more harmonizing ones were found during the iterations [4].

The ontology is currently a work in progress. We intend to build a comprehensive Protégé based dietary knowledge base which can be employed in the following tasks:

- Assessing dietary plans
 - according to nutritional content
 - according to harmony
- Create and modify recipes
 - Create recipe from high level recipe template
 - Modify a recipe for diabetes or another specific diet
 - Concretize recipes (e.g. containing foods from the nearest shop)
 - Modify a recipe according to taste (make it more hot)
- Automated translation and comparison of recipes
 - Change metrics
 - Modify recipes according to national cuisines and availability
 - Compare recipes (internet recipe portals – is it a new one, or just another name for the same recipe)

- Automated processing of recipe sources
 - Extracting recipes from textual descriptions
 - Extracting recipes from structured descriptions (eg.: RecipeML XML)
- Dietary log
 - Approximating dietary intake from textual logs
 - Retrieve recipe name and definition from ingredients defined in dietary log
- Short dietary advice
 - Short textual advice according to dietary log and goal

[1] Ireland, J.; Møller, A.: Review of food classification and description systems for use in food composition databases, EUROFIR IA 1.6

[2] Cantais, J.; Dominguez, D.; Gigante, V.; Laera, L.; Tamma, V.: An example of food ontology for diabetes control in C. Welty and A. Gangemi, "Working notes of the ISWC 2005 workshop on Ontology Patterns for the Semantic Web", Galway, Ireland, 2005.11.07.

[3] Batista, F.; Paulo, J.; Mamede, N.; Vaz, P.; Ribeiro, R.: Ontology construction: cooking domain; 2006.

[4] Gaál, B., Vassányi, I., Kozmann, Gy., A Novel Artificial Intelligence Method for Weekly Dietary Menu Planning, Methods of Information in Medicine, 44: 655-664, 2005.