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A recommendation system to support design patterns selection

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Abstract— Pattern languages might be useful tools for design as far as designers can identify the right patterns. For this users need to understand the relationships between patterns and how to combine them. In this process, knowing how patterns have been used by other designers might help in identifying the best combination of solutions. In this paper we propose a module that recommends patterns based on the selection already made by them, with a view to supporting designers in making the correct design decisions.

Keywords-component; recommendation algorithms;, design patterns

I. Introduction

Design patterns make it possible to reuse design knowledge and, hence, reduce design efforts [9]. However their application is not straightforward, as designers have to identify all the patterns they need to solve their problems. Among the different tools that might help designers in such task, VEISIG supports navigation through design goals in a visual way [8]. Designers can browse the problem space and look at the patterns that deal with a specific problem as well as the relationships and trade-offs among patterns. However, and as suggested in [5], it might be also useful to have some framework that proposes those patterns that are usually applied together by more experienced designers. In this poster we introduce a module implemented in VEISIG (Visually Enhanced and Interactive SIG) that recommends additional patterns for a given solution. This module is intended to help designers to identify other patterns that might be combined with those they have already chosen as well as to assist them in exploring the language in a deeper way.

II. Techniques for collaborative filtering

Recommendation systems use techniques of collaborative filtering to rate a collection of the items according to some input information. In the literature they are classified in four kinds of systems [3]:

- Content-based systems recommend items similar to the ones the user preferred in the past [1]. The main problem with this kind of recommendation is overspecialization.
- Collaborative systems assume that users with similar profiles like similar items. There are two types of collaborative recommendation systems:
  - Memory-based systems rely on a heuristic function to make the recommendations using items previously introduced in a database [7].
  - Model-based systems use a model built upon the items in the database [4].
- Hybrid systems are a mixture between the previous recommendation systems.
- Preference-based filtering does not focus on rating and classifying each item, instead they use a relative approach for sorting the items [6].

III. The recommendation system

Our work consists in the creation of a recommendation pattern module for VEISIG [8]. The recommendation module has a basic goal: help novice web designers to expand their solutions by suggesting other patterns to explore. Since it is expected to be used by novice designers a collaborative systems seems to be more appropriate than a content-based one. Due to the lack of initial solutions for building a Bayesian network (model-based recommendation system), we should use a memory-based collaborative recommendation system.

A. The recommendation algorithm

Our recommendation system is based on a heuristic function that obtains the utility (rating) of each pattern for a concrete solution.

$$g(f(set\{p_0, \ldots, p_N\})) = set\{p'_0, \ldots, p'_M\} \qquad (1)$$

An initial solution P (composed by N patterns) is the input, in the previous equation (1), for the following functions:

- The utility function f receives one pattern that is not in the solution and all the patterns that compose the solution specified by the designer and returns how

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useful might be add that pattern. The utility function is based on a weighted sum function[1], [2]:

$$r_{pj} = \frac{1}{3N}\sum_{i\ 1=}^{N} l(C_{p_i p_j}, k, S)w_1 + R_{p_i p_j} w_2 + A_{p_i p_j} w$$

(2)

This function (2) combines three sources of information corresponding to the three terms in the formula: previous solutions stored in the system; the relations among the patterns according to the experts, and the affinity in the type of pattern. In the language, patterns are classified in six different design views (structure, navigation, presentation, security, personalization and interaction), so that patterns in the same design view are considered closer than patterns in different views.

- Recommendation function: The utility function rates each pattern not included in the initial solution.

$$g(se\{p_0,\ldots p_N\}) = u(se\{p_0,\ldots p_N\}, p) \cup h(set\{p_0,\ldots, p_N\}, p)) - r(set\{p_0,\ldots, p_N\},$$

(3)

However we cannot return all the patterns with highest utility. There are patterns that should not be in a solution at the same time because they conflict [8] as well as patterns that should be always together. For these reasons the recommendation function add to the set of best patterns, *u*, the patterns that should be in the solution, *h*, and remove the patterns that should not be in the solution, *r*. This can be seen in the recommendation function (3).

The recommendation module returns a list of recommended patterns, at least one. The pattern list is big enough to improve the solution, but its size is smaller than the solution itself so that the number of suggestions can be managed by the designer.

B. Explanation of the prototype

VEISIG gives us a visual representation of the pattern language. With the recommendation module we can upload the solutions selected in VEISIG and to obtain the most interesting patterns for a selected solution. We have tested the prototype with solutions extracted from some sources [10]. "Fig. 1" shows an example of recommendation.

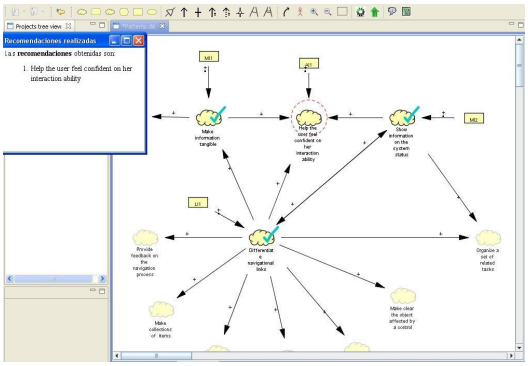

Fig 1. Example of recommendation

IV. CONCLUSIONS

In this poster we introduce a module to recommend design patterns based on the use of collaborative filtering techniques. The goal is to propose additional patterns given a collection of patterns already selected by the designer. With this module we will be able to reduce the time of searching the correct pattern and it will help users in the exploration of the pattern language. However it should be needed to have design experts and novices to evaluate the tool.

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