ABSTRACT

The MyMuseum project aims to provide personalised museum tours. An essential starting point for this is to construct a model of the user and to do this efficiently, making modest demands on the user while achieving adequate fidelity in the model. This paper describes an approach to eliciting user models with a tabletop interface for concept mapping.

Keywords

Tabletop; concept map; user model; knowledge elicitation; interests elicitation

1. INTRODUCTION

Museum curators and exhibition designers try to arrange exhibits strategically so as to facilitate coherent tours. They cannot do this to match everyone’s preferences. In practice, visitors often avoid the standard route. Reasons for this include time limits which mean the visitor wants to devote their time primarily to exhibits that most interest them. Proctor and Tellis [6] indicate that adaptive descriptions of museum exhibits can enhance enjoyment for a visitor. This brings up the question of what determines the depth of contents and descriptions to deliver to a particular visitor. This may potentially be influenced by many factors. Of these, interests and knowledge are the two which we can most directly relate contents and descriptions to: for example, delivering a basic description of an exhibit to those who are not knowledgeable about it, and delivering a more advanced one to those who are.

This means that we need the means to determine a user’s interests and knowledge so that this can represented in a user model [4] which can drive the personalisation of a museum tour. We are exploring a novel approach to eliciting these aspects of a user model. It is an adaptation of concept mapping, a technique that was developed by Novak [5] to externalise learner’s understanding which has also been used to elicit expert’s knowledge of a domain [3]. It is widely used in education where it can play an important role in enabling a teacher to see how a student understands a domain, including their misconceptions. We have used a form of it [2] to build models of user’s knowledge. For our current work, on the My Museum project, we adapt it in two important ways: firstly, to elicit user interests as well as knowledge; and secondly, to move it to a tabletop interface.

2. ELICITING USER INFORMATION

Our objective is to accurately elicit the user’s interests and knowledge with a minimal user input and use this to build a robust user model.

Eliciting user interests - The usual first stage of concept mapping calls upon the user to lay out concept with more general ones higher on the map, more specific ones lower and concepts that are similar, grouped near each other. We propose to alter this stage, asking the user to consider a list of concepts, such as those shown in the left panel of Figure 1, and to select those they are interested in for the current museum tour. We ask them to place the most interesting ones higher in the map: so the vertical layout will indicate the user’s rank of the concepts. For example, for our archaeological museum, a user may choose the concepts “Trojan war”, “deity”, and “Athena”. From this, the concept mapping system can build a user model with the user’s preferences for the current tour.

Eliciting user knowledge - In classical concept mapping, the user draws labelled links between concepts that they perceive to be related. This creates propositions, such as “Trojan war involves deity”. Our second stage calls upon the user to do this creation of propositions, indicating their beliefs, where this includes their knowledge, indications of its depth as well as misconceptions. One distinctive feature of our concept mapping tool is that it aims to verify its conclusions about the user: it lists its inferences about the user’s knowledge and also asks them to check aspects that may have been slips. From this stage, the system can construct parts of the user model that represent the user’s knowledge.

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of a tabletop interface for the initial mapping activity, the map can also be made available on a handheld device that is available during the tour.

The map may then play a role during the tour, with the user amending it and adding to it as they learn more. For example, if a visitor has the misconception “mummies are from Greece” at the beginning of a tour, the system could guide them to a mummy and then highlight information about its Egyptian origins, challenging that misconception. This will give them the opportunity to realise that they were mistaken. At that point, they could amend their concept map.

3. INFERENGE ON THE USER MODEL

One of the challenges of our approach is to minimise the burden on the user. We would like the user to construct a small map, based on just the concepts that have have chosen as being of most interest, with links between these. This is unlikely to provide the richness we would like in the user model.

Accordingly, we need ways to infer additional aspects. We propose to do this by two mechanisms. The simplest is to exploit previous users’ maps. Essentially, as users create maps, we predict that people with several similar propositions in their maps are also likely to share the beliefs captured in the other propositions in their maps. To prime this approach, we need volunteers to create larger concept maps. These users need to include people with varying levels of knowledge, from expert to rank novice.

This stage may also enable the system to automatically identify misconceptions by comparing the maps of novices against those of experts. This is summarised in Table 1, where a tick (✓) represents presence in the map and an X represents absence.

<table>
<thead>
<tr>
<th>Expert map</th>
<th>User map</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>Correct knowledge</td>
</tr>
<tr>
<td>✓</td>
<td>X</td>
<td>Lack of knowledge</td>
</tr>
<tr>
<td>X</td>
<td>✓</td>
<td>Misconception</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>No conclusion</td>
</tr>
</tbody>
</table>

Table 1: Matching a novice map with an expert map

This approach suffers the cold start problem: it is ineffective until there are enough user models to make predictions that extend the directly elicited user knowledge. Moreover, it relies on having enough previous users of a matching group: if we want to supports users of different ages, experience of the museum and knowledge, we would like to have several non-expert classes.

To overcome this, we propose to also make use of a lightweight ontology to make inferences about the user’s interests. We reason that if the user indicates interest in one of the concepts available on the list, they are likely to also be interested in other, closely related concepts. This means that we can provide lists that are compact.

4. IMPLEMENTATION & EVALUATION

A part of Verified Concept Mapper (VCM) will be used in conjunction with a tabletop for constructing a concept map. VCM is a system that is originally designed to support teachers in creating concept mapping tasks intended to capture the student’s understanding of the ontology of a small domain [2]. Figure 1 shows a screen-shot of this system.

We propose to provide the VCM interface on a tabletop interface. Cruiser [1] provides a suitable platform.

We need to conduct experiments to evaluate the accuracy of the inferred user model. We will ask a group of users to compose a small concept map and then to enlarge it. This will then be used in simulations which assess the accuracy of prediction from the small map to the larger one. As we gain more users, we should be able to improve this accuracy.

5. REFERENCES


