INGRID: A web service tool for hierarchical open learner model visualization.

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Abstract. This paper presents a tool to visualize open learner models. The tool is domain independent and is freely available as a web service. It can be easily integrated with any existing web-based learning environment.

Keywords: Open learner model, visualization, web services

1 Introduction

The learner model is the core of any adaptable educational system. The internal representation of the learner knowledge is used to adapt the behavior of the system. In the last decade, it has been claimed that the information about the learner model should be accessible not only to the system, but also to the users. It has been proposed that the users should even participate in the refinement of the model by modifying the learner representation. Such a model is called an open learner model [2].

Many intelligent and adaptable systems have provided ways of visualizing and interacting with the learner model. [1][2][5][6][7][8]. However, the development of such components has been almost always deeply linked to the system, which means that heir reusability has been very limited as developing a new system requires a considerable amount of work and money.

This demo presents a tool called INGRID that has been designed for the visualization of open learner models. It was initially developed as a component of MEDEA architecture [3], but it has evolved as an independent application, based on web services. It has been implemented using the JavaScript InfoVis Toolkit. (See http://blog.thejit.org/). As an example, the integration between INGRID and SIETTE [4] is shown in fig. 1.

2 Open learner model visualization

The new 2.4 version of INGRID includes three types of representations of the learner model: A dynamic tree, see Fig.1 (top), that displays the knowledge level based on a color scale. This is a partial view, where users can collapse or expand nodes to explore the whole contents. The sunburst, see Fig.1 (bottom), that presents the whole

learner model in concentric sectors. The third view presents a table with the details of the knowledge level distribution for all concepts and its evolution in time, if available.

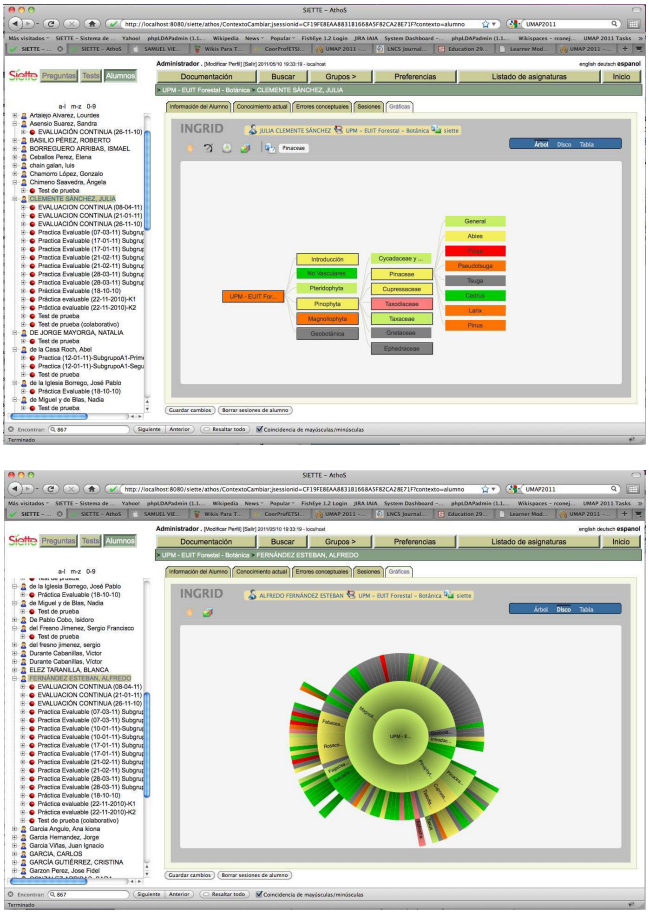

Fig. 1. The tree and sunburst views of the hierarchical learner model integrated with SIETTE.

All of these views are interactive, which means that the user can click on any concept representation to obtain a detailed description of the sources that support its current value. Alternatively, the user can select any of the possible actions associated with a particular node, which allow him to manually edit the current value, and/or access other sections of the learning environment related to the desired concept. To call the visualization web service, the learning environment should construct three XML objects: the ontology of concepts with at least the "part-of" relationship, the *(concept, knowledge level distribution)* set; and the *(concept-actions)* set. The learner's name and context are also passed, but there is no need of authentication, since the visualization tool does not store information about the user. It only

represents what its client sends. Actions are web links that, when clicked, redirect the user usually to the same learning environment that has called the visualization tool. For instance, in the integration with SIETTE, action links are knowledge assessments that are available and/or recommended to the user. Other systems can add links to specific sections of their content. Before calling the visualization tool, the learning environment composes those links so the visualization tool only has to display them.

The main advantage of this approach is the fact that the visualization of the student model is a completely independent and reusable module that can be integrated anywhere in a web intelligent learning environment, based on the classical overlay hierarchical learner model. The main integration effort is to create the XML format of the domain model and the learner model. Actions are optional. Moreover, future improvement on the visualization tools would be automatically available for clients.

Current limitations of the visualization tools include the visual representation of the uncertainty of the system about the knowledge level of a particular concept (the information can be passed but it is only displayed as a distribution in the table view); and the representation of misconceptions. The current version of INGRID is available at http://urano.lcc.uma.es/ingrid, and SIETTE at http://www.siette.org

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