Rapid Dialogue and Branching Tutors

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Abstract. The technology used as part of the Tools for Rapid Automated Development of Expert Models (TRADEM) project has been featured at a number of conferences and publications throughout its creation and development. As a part of these efforts, it has been integrated with the Generalized Intelligent Framework for Tutoring (GIFT) in two fashions: branching, using the Engine for Management of Adaptive Pedagogy (EMAP), and dialogue-based, using open-source chat technology. This technology is nearly ready to be deployed to the public, enabling this workshop to demonstrate its capability, highlight its use, and allow users to make their own tutors centered about their own content.

Keywords: intelligent tutoring system, ADDIE process, dialogue based tutoring, branching tutoring

1 Introduction

The Tools for Rapid Automated Development of Expert Models (TRADEM) project was first published in 2013 in a simulation venue [1]. The technology was demonstrated last year at the Intelligent Tutoring Systems 2014 conference, as part of a workshop on authoring tools [2], at the Educational Data Mining 2014 conference, as part of an industry session [3], and at the annual GIFT Symposium, as part of general GIFT development [4]. The project has recently come to completion, with the outputs intended to be made publicly available soon, and physically distributed as part of this workshop.

As described by many, including the GIFT foundation paper [5], Intelligent Tutoring Systems (ITSs) contain four components: a domain model, an expert model, a learner (or student) model and a pedagogical model. TRADEM uses a domain model built as a summarization of provided content mixed into a set of topics, as a part of the GIFT Domain Module. The expert model consists of a domain model together with expert-derived information concerning the order of topic learning, information about the content, and a basic manner of assessing learner response. These pieces of information are represented in the GIFT Domain Knowledge File (DKF), and are linked with a series of questions in the Survey Authoring System (SAS). The pedagogical model used as part of TRADEM-produced tutors is simply the GIFT default engine, called the Engine for Management of Adaptive Pedagogy (EMAP), which has been documented in greater detail in other literature [6].

The purpose of the TRADEM project has been to rapidly and mostly-automatically create expert models and sequence domain material from initially provided texts. The traditional teaching model relies upon teachers to select the material for consumption by the learners, where the teacher provides the material. The TRADEM model of development is to condense the material selected for students, where the system provides the learning material created from previously provided learning materials. Naturally, there is some disagreement in the literature as to the nature of an "expert model."; is it the selected materials by the teacher, or the core concepts identified by the system? In the TRADEM formulation, a domain model consists of a set of topics in a domain, while an expert model consists of a domain model together with expert-derived information concerning the order in which topics should be learned and expert-derived data that enables an ITS to present each topic and assess learner knowledge. Expert derived information may take a few different forms. The first of these are the topic names and conventions used as a map of the topics, as shown later in Fig. 3 and Fig. 6. The second part of the expert-derived information is in metadata about the type of information content contains (e.g. Gagne's 9 Events [7] or Merrill's Component Display Theory [8]). The last of the expert-derived information is questions and answers, which are automatically suggested based on the content, and curated by the human expert.

This paper is intended to briefly describe the how the system operates and the technologies which it relies upon, as a short description is helpful to the reader, although not required for practical use. In practice, the purpose of the workshop of this technology is to demonstrate the technology. In short, TRADEM uses automated text analysis techniques to create core groups of "topics" based upon the topics that appear to have been discussed the most. It uses automated summarization techniques to create summary text paragraphs and link it to an exact topic, and uses this text to propose a name for the topic, as content for the topic, and as a basis for creating questions. The technical tasks to perform each of these items are described in other works throughout the literature [1-4].

2 Use

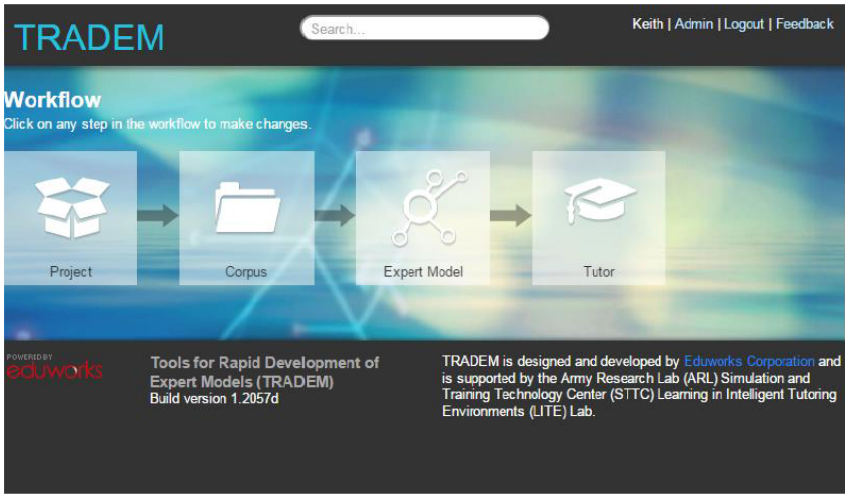

Fig. 1. TRADEM User Interface

The basic process of creating a tutor with TRADEM is simple, and relies upon a few basic steps, all of which are shown from the screen following login, as seen in Figure 1. In this section, we will highlight the specific steps required to produce a tutor within the TRADEM authoring workflow.

Step One: Create a new project and give it a name.
Step Two: Create a corpus, upload documents to it, and save, as seen in Figure 2.

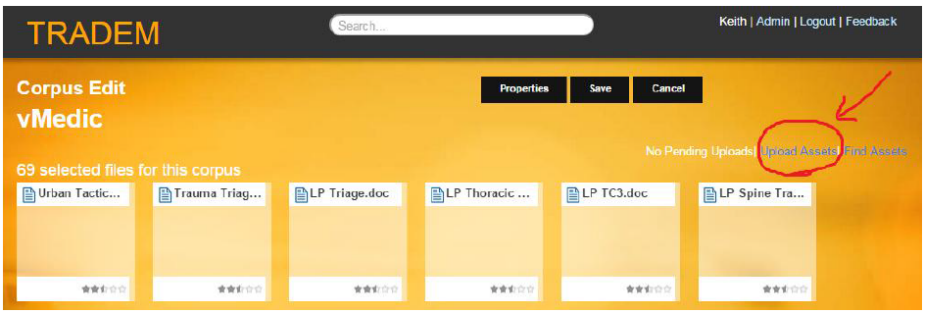

Fig. 2. Corpus creation and editing

Step Three: Add a new expert model through a selection of features. TRADEM provides an estimation of the number of topics present within your model when using the default settings. If your corpus has a fewer number of documents, or some

of the documents in your corpus are short but contain critical information, you may consider adjusting the expert model parameters to be higher than the default values, shown in Figure 3.

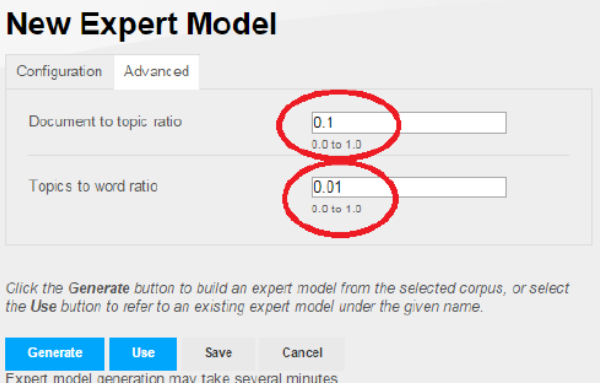

Fig. 3. TRADEM Expert Model Parameters

Step Four: Edit the expert model and mini-corpus. Be sure to have enough questions on each topic to support the GIFT default exports (3 questions per topic). If TRADEM has not suggested enough questions related to the topic, the user may have to create them manually or generate a new expert model. See the highlighted area in Figure 4 to edit the topic in this manner.

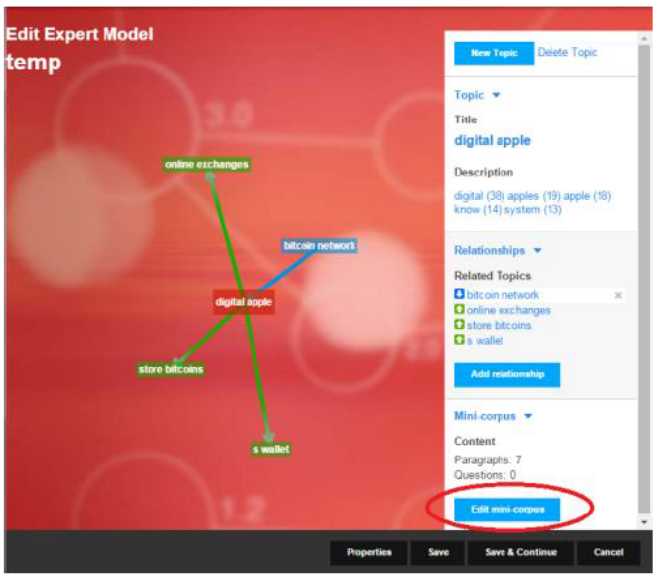

Fig. 4. Expert Model Editing

Step Five: Export the tutor. At this point you will receive three options to either 1) export as a standard package, 2) export as a GIFT TRADEM-Tutor ("T-Tutor") pack-age, or 3) export as a GIFT PowerPoint (PPT) package. The first of these options exports unadorned slides and questions/answers for presumed import into other Learning Management Systems (LMSs) and traditional training content. The second option exports a dialogue-based "talking head" which can understand basic student inputs and course directions, and can be imported into GIFT. The third of these options exports a series of PowerPoint shows and pre-/post-tests which can be imported into GIFT and managed as a branching course. These options are shown in Figure 5 which shows the "export tutor" option and the "generate export" option after selecting one of the above three choices.

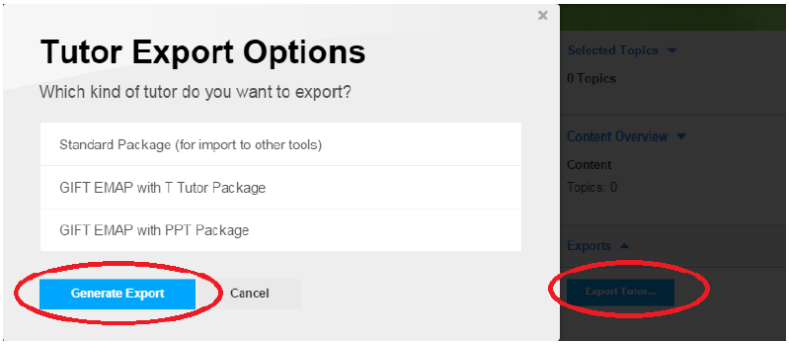

Fig. 5. TRADEM Export Tutor Dialogues

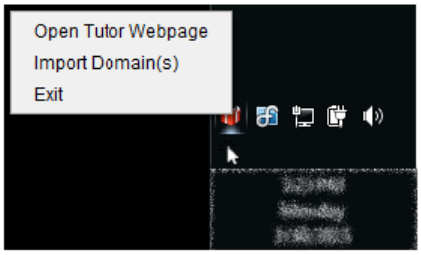

Fig. 6. GIFT Import

Step Six: Import the package into an existing GIFT installation using the GIFT Import Tool. The GIFT import tool can be found by right-clicking on the GIFT icon as shown in Figure 6, or in the GIFT\scripts\tools\launchControlPanel.bat interface. After import, the EMAP course will be selectable and display as traditional PowerPoint slides, while the "TTutor" export will display with a "talking" head and simplistic dialogue responses, as shown in Figure 7.

Fig. 7. TRADEM-Tutor Interface [4]

3 Benefits for Use

There are a few benefits to using the TRADEM tool, including aiding in front end analysis of content, automatically summarizing existing documents, or providing the foundation of a GIFT course. This section briefly discusses these three use cases.

One of the manners of TRADEM use is to perform a front end analysis of the content being worked with. The import of content into TRADEM and looking at the structure of the domain can prove valuable to deciding other methods of instruction. As an example, differing domains may represent different manners of instruction, as shown in Figure 8 with a few different domains. This analysis may affect human decisions of how to instruct the material, and can be garnered fairly quickly (minutes).

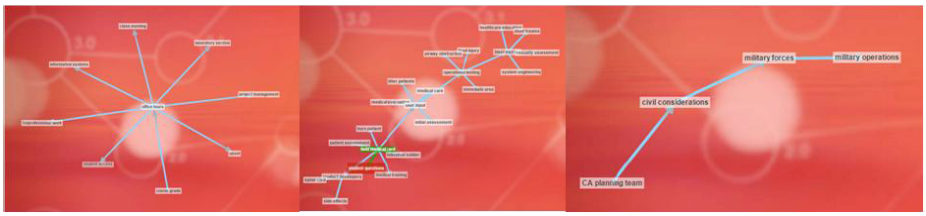

Fig. 8. Discovered organizational structures [3], which may be instructed differently

A second manner of technology use is in the automated summary of learning materials. The automated summarization techniques can be used with conference track papers as input, and presented a summary of the things discussed in the individual tracks [1]. Such use may be able to guide conference learners to the sessions of their greatest interest, based on the papers accepted to the tracks.

Further, a GIFT tutor which uses the EMAP can be created with very little effort through the use of TRADEM. Instead of uploading various learning materials, tagging them with metadata, and building a course, the TRADEM tool can be used to integrate checkboxes for metadata, and automatically sequence the content. Given the speed and simplicity of use, such practice may prove standard to the creation of GIFT-EMAP courses. This allows tutor creators to benefit from an extensively researched instructional domain model without significant investment of time, and us-

ing content which can be fine-tuned at a later time with the GIFT authoring tools. Other benefits are more extensively discussed in other works [3].

3.1 Licensing

The open-source nature of GIFT means that reproducible code is freely released and updated with each subsequent version. Tutors, the output of GIFT, are free to produce and may be sold or freely provided for community benefit. Developed modules and plug-ins may additionally be sold or donated, while GIFT components may never be sold. While TRADEM is free for both use and modification in Government applications, it is not open source. The close-source encumbrances of TRADEM, however, are not burdensome. The closed-source encumbrances are 1) that the user must agree to a licensing agreement on branding prior to the generation of tutoring materials, and 2) not to remove the branding of the tutoring materials created as part of the TRADEM process. Aside from these issues, the tutors produced using the TRADEM process are free to be used and commercialized as GIFT outputs.

4 Future Work

The primary use of TRADEM is for use as an advanced and automated authoring capability [9], but there is a follow-on effort to automate the process of evaluating the weaknesses of the produced courses. The intention is that an instructor, after creating a GIFT or TRADEM course, would be able to analyze the course for the items that produce (or omit) learning gains on the relevant post-test measures. Additional measures are being taken to change the login/logout credentials to match GIFT, to make the Gateway Module plug-in an interoperable and separable service, and to enable web-based learning and software testing. The current architecture and integration is shown in Figure 9, and represents a way for other dialogue tutoring services to integrate into GIFT, as they can either follow this example integration, or the one provided by the AutoTutor webservices.

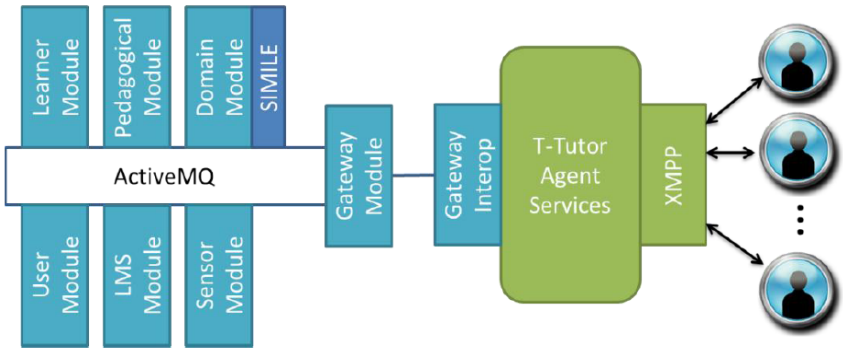

Fig. 9. GIFT and TRADEM Combined Architecture

In the above diagram, the agent services for the TRADEM-Tutor are shown as a plugin to the Gateway interoperability section. These interact with Extensible Messaging and Presence Protocol (XMPP) software, for the purpose of interacting with Google Hangouts or other delivery engine. The use of such architecture allows for the combination of traditional GIFT course elements with the newly added TTutor elements. An example of such an integration may be the use of the Student Information Modules for Intelligent Learning Environments (SIMILE) rule assessment engine for digital games [10], as a practice environment for medical training taught by TTutor.

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