A MathML content markup editor on the xfy

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Abstract

In this paper, we propose yet another MathML content markup editor. Since our editor is a plug-in component on the xfy, we can provide a seamless authoring environment for MathML content markup vocabulary embedded in compound XML documents. Further, our editor is going to support a shortcut input by the use of computer algebra systems.

1 Introduction

Our goal is to develop a WYSIWYG editor for mathematical documents on the xfy [9]. The xfy is a software for authoring compound XML documents. As for reuse and calculation of mathematical expressions for some reason, it is necessary to hold semantic information of the expressions in a XML format. For example, OpenMath and MathML content markup are two candidates to present the semantic information. Some computer algebra systems have input/output interface for them. When we prepare a scientific document, we often put the results obtained by the use of such scientific computation software into the document. If we could have seamless interaction, e.g. cut and paste, with the scientific computation software, it would be useful to reduce human error

when editing somewhat complex results. There is no such semantic based XML documents processing platform at this moment.

In this paper, we propose yet another MathML content markup editor plug-in on the xfy. Since our editor is a plug-in component on the xfy, we can provide a seamless authoring environment for MathML content markup vocabulary embedded in compound XML documents. Further, we consider a shortcut input of expressions by the use of computer algebra systems .

2   xfy

The xfy is a software to handle compound XML documents. Furthermore, in order to manage any type of XML vocabulary, it has extensible architectures, plug-in and XVCD.

The xfy plug-ins are adaptive, modular, and vocabulary specific authoring engines for representative standard or private XML vocabularies. Each plugin corresponds to a different namespace that specifies which one will be applied to the XML vocabulary. The xfy plug-ins are developed in Java and perform the DOM tree manipulation (display and edit) through the xfy API.

Unlike other useful software for compound XML documents, such as Amaya [1], a significant feature of the xfy is that it has the Vocabulary Connection (VC) technology. The VC defines a bidirectional link between a source XML vocabulary (e.g. a private XML) and a destination XML vocabulary (e.g. XHTML). The destination XML is viewed by the appropriate plug-in. If a part of the destination XML is edited through the plug-in, the corresponding part of the source XML is changed immediately. Thus, the VC provides an editing feature for any documents.

In order to apply the VC to a XML document, the xfy has a script language, XVCD, available. The XVCD itself is written in a XML format to define the bidirectional link between the source XML vocabulary and the destination XML vocabulary.

Using the xfy's extensible architecture, we hope to develop an authoring environment for any mathematical XML documents on the xfy. We have already shown some advantages of the xfy on applications for mathematical education [5] and computations using mathematical Web-services [4].

In such applications, it is necessary to handle the syntax of mathematical expressions by MathML content markup [6] or OpenMath [7] on the xfy. In this paper, we deal with the former. The MathML content markup editor is an underlying basis for calculating mathematical expressions on the xfy.

3   MathML content markup editor on the xfy

Here, we propose a MathML content markup editor on the xfy. Our editor is designed as a template editor to edit the syntax of mathematical expressions correctly, like other useful MathML content markup editors, such as Formula-

tor MathML Weaver [2] and Integre MathML Equation Editor [3]. These are designed as software only for authoring MathML. Since our editor is a plug-in component of the xfy, we can provide a seamless authoring environment for compound XML documents including MathML content markup. This is an advantage of our editor.

Fig. 1 shows a typical screenshot taken while authoring an expression in a compound XML document (XHTML and MathML content markup).

Figure 1: authoring an expression by our MathML content markup editor

We referred to a helpful paper [8] when we designed the MathML content markup editor with uniform behavior and usability. In order to realize good usability, we conducted a usability test of our editor versus the other ones, Formulator MathML Weaver, Integre MathML Equation Editor and the MathML presentation markup editor on the xfy. We examined click and typing counts for randomly chosen ten expressions from manuscripts, and obtained the average number of the sum of them for 7 users (5 undergraduate students and 2 graduate students) as an input cost.

For analyzing of the input cost performance, we have a statistically-based method (Student's t-test). According to the results, except for a MathML presentation markup editor for xfy, our editor works in similar performance like the other editors.

4   Editing using computer algebra systems

Computer algebra systems (CASs) may be utilized to edit mathematical expressions by 2-D editors, implemented in any authoring software, such as word processors, e-learning management software, and so on.

For example, suppose a monomial basis representation of a polynomial. Most CASs can compute its factorization form directly on their system. If the factorization form is more complex than the monomial basis representation, we might hope to shortcut by using their function to factorize the polynomial on the 2-D editors.

For this purpose, full of functionalities of CASs may not be necessary. Some

sort of CASs that perform a limited function are enough. Supporting interactivity of 2-D editors, efficient implementation is rather important.

For example, here we focus on Maple. Though Maple is a computer algebra system with full features, it provides OpenMaple API, which is the ability to access Maple data structures and commands. Furthermore, Maple provides MathML package to import or export Maple expressions from or to MathML format. Using these features, we can easily access Maple algorithms and data structure from the xfy. Our editor has a Maple frontend to compute the part of the MathML expression and insert the result back into the original place.

Fig. 2, 3, 4 and 5 demonstrates the expansion of the subexpression on the MathML editor.
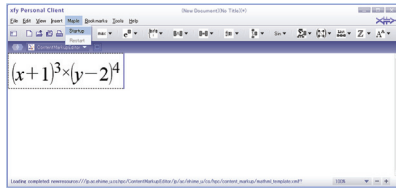
Figure 2: start a Maple session
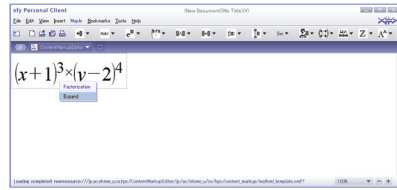
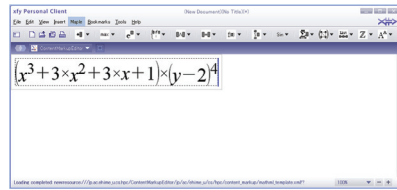Figure 4: choose the operation

Figure 3: mark the region

Figure 5: renew the expression

5   Conclusions and future work

In this paper, we proposed a MathML content markup editor. This is an ongoing project and there are many things to be done in the future.

We evaluated an input cost performance of our editor versus existing MathML content markup editors. The results show our editor works in similar performance like the other editors. However, template editors like our editor and other MathML content markup editors give worse experiences than direct manipulation editors like MathML presentation markup editors. How we can improve the user-interface to provide more freely inputs to users.

Furthermore, our editor is going to support a shortcut input and a validation of the semantic information of expressions by the use of computer algebra systems. At this moment, a few functions, e.g. factorization and expansion, can be used. We should consider an efficient and interactive method to select operations appropriate to the entire expression or the subexpression to be processed, acting like that Maple's context menus to manipulate expressions.

References

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