Abstract

This paper describes the ideas and problems of the Edukalibre e-learning project, in which the author takes part. The basic objective of the project shares the development and exploitation of software components for web-based information systems applied to education as well as organizing of teaching material for them. The paper concerns a problem of the mathematical-oriented courseware and describes the experience in developing LaTeX-supporting online converting tool.

Keywords: Software tools, Education, Decision Making

Introduction

Nowadays most of educational institutions and universities try to complement traditional teaching techniques with the help of web-based courseware. Web-educational courses give the students a possibility to get the teaching material, assign the papers and have a communication with teachers and other students. Surely such a kind of information systems enables fulfilling the main tasks of e-learning, but they are far from perfection because of the functional and economical reasons. For example, the courseware directed at mathematical fields of science, which require the use of math-oriented tools, is not enough supported. Courseware with standard support of MS Office-type documents hardly suits to mathematicians, who get accustomed to use a software from TeX family.

The Edukalibre project (http://edukalibre.org) made a step to this problem solving by developing a courseware that would enable the collaborative editing and the converting to different formats of the math-contained documents. Primarily, the courseware is aimed at the support of LaTeX [1], i.e. its editing and converting to .pdf, .ps, .html and OpenOffice formats.

Within the bounds of the project the teaching material on Bayesian decision making is being prepared, which obviously requires the use of LaTeX.

Moreover, the strategy of the project is the use of *libre* (free, open source) software that does not contradict the applying, for example, PDFLaTeX by a mathematician. According to the principles of open source software all the developed tools will be located in CVS repository available for further improving and re-using.

The aim of the paper is to share the experience of the project team in developing the courseware supporting LaTeX and to describe the way of organizing the web-educational material on Bayesian decision making.

1 Edukalibre project

1.1 Objectives and state of the project

The main objectives of the project are the exploration, use and re-use existing open source educational software tools and development of the new ones. The courseware to be developed during the project is expected not only to make the teaching material available to the students, but also to offer a number of possibilities for course creators. At the moment the project concentrates on the work on the new version of the Edukalibre conversion tool “Collab 0.8.2”, which has been developed as a Moodle [2] module. The Moodle learning environment has been chosen for a further re-using and as a tool for online course creating after analysis of software and its comparison with Claroline [3]. According to the partner demands the functional features of the software include:

- Version control of a document;
- Authentication of the users with different privileges;
- Providing the different formats of the document;
- Availability of the document at the Web site;
- Access to the document with the aim of its obtaining in different formats, modifying, uploading as well as downloading and printing according to the privilege of the user.

1.2 Project courseware content

In order to explain for what kind of educational material the developed courseware is expected to be used it is useful to have a look at the structure of teaching content.

The content of courses has math-like structure with top-down way of explanation of underlying notions. Surely the material should satisfy requirements from the point of view of user friendliness. The general theoretical part of Bayesian Decision making is reachable in the form close to the book [4], but obviously such approach does not suit the principles of e-learning. The chapters of the book are supplied with a great amount of examples applied to specific case studies - models with normal and binomial distribution. On these simple models the individual tasks of simulation, parameter estimation, prediction and control will be demonstrated. These examples are believed to be the basic tools for the students to use. The links to the examples are available both from the general theoretical part, i.e. from the corresponding chapters, and from the table of contents, which is the list of existing case studies. Each case study must have the same structure, which is supposed to contain:

- *Aim* explains the task of the example, meaning what kind of the new knowledge a student is believed to obtain with the example.
- *Description* gives the very short description of the problem posed and points out what a branch of Bayesian Decision Making the case study is applied to. The links to the detail theory refer to the corresponding chapters and sections in the book. Description also says briefly about the principles of the algorithm functioning and mentions the results to be obtained.
- *Specification* consists of several items, namely: System, Decision, Experience, Ignorance, Admissible strategies, Loss function. They give the data necessary for specifying the case study. The items are the links themselves to the definitions of the terms applied to Bayesian Decision Making Theory.
- *Recommended experiments* give practically step-by-step instruction what manipulations are recommended trying to a student in the given example. The system behavior is briefly commented.
- *Comments and References*. It is assumed that each case study is an individual task, which needs some comments. The item explains the characteristic properties of the task and gives some advices.

In the bottom of the example main page a number of hyperlinks is given. The hyperlinks have the defined color for each target, while each variable is a hyperlink itself to its description. The link "Run example" starts the associated application and runs the program. According to the strategy of the project, only open source software can be used. Thus Octave [5], which is a free clone of MATLAB, has been chosen.

After starting Octave offers to a student a dialog, with help of which he/she is able to see the input variables, size of data sample and decide whether he/she wants to change variables or not. After getting results with default values the student is able to run further experiments on and see the next dialog that Octave offers. The dialog gives three possibilities. The user can continue experimenting with current setting as well as try with initial values and stop experiments.

The content creators group still works on optimizing the navigation of material. The link "read theory" can be also available to a student, it leads to more general part of theory. Actually "read theory" is applied to the case study, but rather at the level of chapters than of sections or subsections of chapters what is more specialized. Also the possibility to go the the guide to program tools, the examples are build on, might be among the hyperlinks. It is worth mentioning about the "view code" link, which is believed to help a student to understand better the mechanism of the experiment from the programming code. Surely it is possible to go to table of contents from each example's page.

"Collab" enables both online and offline editing of the LaTeX documents and converts them to the required formats. It compiles the single-file LaTeX documents, containing math and references. The tool becomes more and more perfect with appearing the newer versions.

But the today version of "Collab" does still not support sufficiently some important possibilities, while it satisfies to all functional requirements. It is obviously that to create such a kind of educational material, it is necessary to work with multi-file LaTeX documents in order to be able to apply such important commands as \input, \include etc. Certainly the log must be available in the case of making the syntax errors. Another obligatory requirement is BibTeX and possibility to use different .bib files.

Conclusion

Obviously, the basic disadvantages on exploiting LaTeX will be more or less fixed during the project and hopefully disappear in the next versions of "Collab". Nevertheless, the idea to make online editing the mathematical web-educational materials available through libre e-learning software tools opens a way to operate with LaTeX documents for wide variety of mathematicians, who use LaTeX for teaching. Since it is open source project, it also gives the "green light" to developers that could continue to make experiments in this field.

Acknowledgement

This work is supported by the project 110330-CP-1-2003-1-ES-MINERVA-M.

References

[1] L. Lamport, *LaTeX: A Document Preparation System, 2nd Edition*, Addison Wesley Professional, 1994, ISBN: 0201529831.

[2] M. Dougiamas, *Moodle - a web application for building quality online courses*, http://moodle.com, 1999.

[3] D. Chaparro and L. Cañas, "Moodle vs Claroline", Tech. Rep., URJC, Madrid, January 15 2004, http://edukalibre.org/documentation/.

[4] M. Kárný, J. Böhm, T.V. Guy, L. Jirsa, I. Nagy, P. Nedoma, and L. Tesař, *Optimized Bayesian Dynamic Advising: Theory and Algorithms*, Springer, London, 2005, in print.

[5] J. W. Eaton, *GNU Octave Manual. A high-level interactive language for numerical computations*, 3 edition, ISBN: 0-9541617-2-6.