WWW Khorosware on Digital Image Processing

Roberto Lotufo,[1] Ramiro Jordán[2]

[1]DCA-FEE-Unicamp
C. P. 6101
13081-970 Campinas, SP, Brazil
lotufo@dca.fee.unicamp.br

[2]University of New Mexico - EECE Dept
EECE Dept.
Albuquerque, NM 87131, USA
rjordan@eece.unm.edu

Abstract. This paper presents how the Khoros system, hypertext (html), and network browsers can be integrated to produce an interactive Digital Image Processing Khorosware to enhance our ability to learn and work together across geographical, temporal and cultural distances. This new interactive course is available via WWW. The success of the Khorosware lies on its broad technology base which encourages and facilitates collaboration.

1 Objectives of the Khoros Project

Khoros is a software integration and development environment that emphasizes information processing and data exploration. The objective of the Khoros project is to build a complete application development environment that redefines the software engineering process to include all members of the work group, from the application end-user to the infrastructure programmer, in the productive creation of software. The Khoros environment accomplishes this objective

- by providing a broad set of program services (libraries) that can be used as a source of reusable code for visual program development,
- by providing visual software development tools that can be used to quickly prototype new software and maintain developed software,
- by being portable and extensible,
- by supporting four different levels of user interaction (from unskilled end user to expert programmer),
- and by motivating a broad community to collaborate utilizing both synchronous and asynchronous exchanges of resources and knowledge.

Furthermore, Khoros is distributed via the Internet as **Free Access Software**. Source code and binaries are available throughout the world via File Transfer Protocol (ftp); it can be used by any organization, but it can not distributed for profit without a license. In addition, the user participation in the Khoros project, via different forums, is critical to the evolution of Khoros.

2 Learning

The *classic* or top-down approach used to teach image processing combines a textbook, a sequence of lectures and tests, and perhaps a project. This approach has a variety of problems:

- theory is often considered boring
- it is a domestication process, it is static not dynamic
- hardly any exploration is possible
- no link between instruction and research is made
- no opportunity for self-paced learning
- no opportunity for students from other disciplines to get involved

All in all, such an image processing course can become a passive experience for the student. There are a variety of techniques that involve the student more in the process of learning, thus making the experience more interactive. Students learn in the classroom, from tutors and fellow students in study groups, by working directly with faculty, graduate students and staff in research projects. Khoros enhances the connection of research and teaching to better education. Presently, the difference in firms and individuals is between over specialization, fixed knowledge or limited scope versus broad scope, adaptability, information retrieval and learning abilities. Students learn in the classroom, from tutors and fellow students in study groups, by working directly with faculty, graduate students and staff in research projects. Khoros enhances the connection of research and teaching to better education. One technique is for the instructor to use an "authoring system" to develop computer based course material and enhance the learning capabilities of its audience.

An authoring system is a software system that allows an instructor (author) to create and develop instructional software. A good authoring system should be usable by non-experts, have different levels of interaction, and provide for developing individualized training material. The instructional software that the author produces should provide the student with a creative playground for asking "what if". The student should be able to pose a hypothesis, and then use critical analysis to develop an experiment to confirm the hypothesis.

3 Khorosware on Digital Image Processing

This interactive course on Digital Image Processing (DIP) is based on hypertext (HTML) and Khoros 2. It uses network browsers such as Mosaic or Netscape. The purpose of the course is to give users a hands-on approach to Image Processing through an extensive number of experiments. In addition, we hope that with this new type of technology a wide range of users of different backgrounds can be introduced to "image engineering", and also encourage and facilitate multidisciplinary collaboration.

The DIP toolbox has the following objectives:

- Transfer the theory and practice required to process and visualize digital information.
- Expose students to state-of-the-art technology through a hands-on approach to Digital Image Processing.
- Present Khoros 2.0 as a software integration and development environment that emphasizes information processing and exploration.
- Apply Khoros 2.0 as a common language platform for collaboration, software development, demonstration, technology transfer and training/education.
- Provide new teaching and learning tools to motivate the user community to collaborate utilizing both synchronous and asynchronous exchanges of resources and knowledge.

This course was used in the training of 18 scientists from Ibero-America where the feedback was excellent. This effort was the result of a joint venture between the Ibero-American Science and Technology Education Consortium (ISTEC), the Organization of American States (OAS), and Khoral Research, Inc. (KRI). Since then, several hands-on courses were given by the authors in several sites such us Spain, Brazil, Argentina and USA. In addition, many "surfers" have taken the course via the Internet and others have ftp the DIP course and installed in their systems. Because of its success, we have decided to keep improving and releasing it frequently.

This course can be used as a self study guide or for any type of training format. We expect this course to grow through the active participation of the user community. In the first four months of its release, Dec. 1994 - April 1995, over 3000 users executed the course and over 400 sites grabbed the toolbox via ftp to install it at their sites. These statistics are from one distribution site, www.khoral.com, and other sites around the world have not been considered.

The DIP Khorosware can be obtained via anonymous ftp, some sites are: ftp.unicamp.br, ftp.khoral.com, and ftp.eece.unm.edu. It can be used by any organization, but it cannot be distributed or used for profit without a license.

Other Khorosware toolboxes being develop are on the topics of Mathematical Morphology, Wavelets, Fuzzy Logic, and Neural Networks.

4 Conclusion

Clearly, through this new type of "toolboxes" and other multimedia mechanisms, as well as collaboration technology, our ability to learn and work together across geographical, temporal and cultural distances will be greatly enhanced. The future belongs to inter-disciplinary collaboration and education across international borders, mediated by computers and high-speed links. The Khoros system, hypertex, and network browsers have taken the initial steps to produce the DIP Khorosware and work toward these ambitious goals.

5 References

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