Interfaces for Geographic Applications on the World Wide Web: an Adaptive Computational Hypermedia

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Abstract. The creation of interfaces in complex projects involving geographic data, heterogeneous and distributed, also on the Web, are usually based on a centralized server collecting the geographic data to be delivered to clients: they are remote searching systems, in which users type or select keys, to obtain results from the server. Possible computations cannot be usually performed by users. Our proposal is to develop *Web-based interfaces to geographic applications* and data by combining hypertext navigation with more conventional computation. The idea is to go beyond the current concept of hypermedia by offering a desktop in which users may both explore pieces of knowledge and apply computational tools, with the possibility of interact in more than one session. The hypermedia interface development has been performed on the basis of a design methodology in order to obtain an *adaptive hypermedia* environment to be offered to various types of intended users, for their special purposes, in rapidly evolving geographic scenarios.

1. INTRODUCTION

Many complex projects involving geographic data, carried on by several partners and laboratories spread all over the world, imply to consider a lot of heterogeneous contributions, deriving from different and specialised skills and backgrounds. Web-based solutions aim to give remote access to all the information by the use of Web-browsers which constitute a kind of homogeneous interface. They are usually based on a common geographic server collecting data coming from partners, integrated on the basis of a common data model; heavy elaboration on data are performed in the centralised system or committed to partners themselves. They are usually searching systems, and users are allowed to express their needs by typing or selecting keys, or by selecting areas on a map, to obtain results from the server [Adam 97].
Moreover, the majority of developed applications and models in the field is founded on a representation of information in which the geographic layout is only a support (the context) on which basically «textual» information - resulting from previous elaboration of knowledge and no more alterable - is written to be only displayed.

2. THE PROPOSAL

Our proposal is to design Web-based interfaces to geographic data and applications following the paradigm of 'computational hypermedia applications', which combine hypertext navigation and computation. The idea is to offer a desktop in which users may explore pieces of knowledge (by both searches and associations) and apply computational tools, with the possibility of suspending, resuming, and repeating their conceptual path whenever they will [Rossi 99]. The hypermedia interface has been accurately designed on the basis of a design methodology in order to obtain an adaptive environment to be offered to various types of intended users, for their special purposes, in rapidly evolving geographic scenarios.
The aim of the Web application reported is to access and display both satellite images and the related thematic maps obtained by a classification process. This is performed by comparison of

spectral features of original images with the so called spectral signatures, that is the spectral characteristics of certain surface materials. The application has been chosen as case study since: data involved are heterogeneous and of the common formats in geographic applications (images, maps, texts, tables, etc.); pieces of information are related by various relationships (structural, associative, chronological, etc.); the Web site has to offer to some kind of users computational capabilities (classification algorithms, statistical values elaboration, etc.).
The application interface was conceived as a complex environment with both working tools and elaboration products in their different stages of development. In such a framework, offered tools could be identified in: the traditional tools for navigating in the Web; the tools fitting the users' profile and purpose; the tools suitable to the class of data to be manipulated; the generic tools for working on the windows of the desktop.
A special issue was the mapping of data/tools with the users' types: for example, displaying of sketches from spectral values and zooming of images and maps are processes which must be available to all users; but only expert users can activate classification algorithms starting from a satellite image, having as input the spectral signatures, and producing the classified image.
XML is bringing in such technological innovations to make it possible to build prototypes according to the above cited requirements. The software tools exploited in the implementations were:
1. XML to define a support for information exchange, in accordance to the data types of the case study, to the nature of elaboration, and to the users' needs;
2. DOM and a scripting language for data manipulation;
3. XHTML and SVG [Bowler 00] to build the desktop and render objects.

3. CONCLUSIONS

Right now, forthcoming proposals like SVG, seem to promise so much to the development of Web-based interfaces to spatial information systems. It is important, however, to profit by all experiences carried on till now in the field of information systems off and on-line. This contribution wishes to show an example of application in which new technological standards benefit of design that, may be regarded as the basis of reliable and robust applications.
The design of the application interface was undertaken in the convinction that a hypermedia environment should be considered adaptive and computational only if the user is not a passive one, who searches, navigates, looks at calculation results, etc., in a just arranged and consolidated network of data and, if possible, elaboration facilities. The information network and the set of available computations do represent a basis, to be completed by the final user also in more sessions, directly through the browser, to be viewed as a working desktop, no more as a simple access portal.

REFERENCES

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