Ramesh Jain
Georgia Institute of Technology

Multimedia Electronic Chronicles

Recently, there has been a lot of talk about LifeLog, a new project that the Defense Advanced Research Projects Agency (DARPA) is going to start. LifeLog is about recording everything that a person does using video, audio, and other sensors (see http://www.darpa.mil/baa/baa03-30.htm). The goal is to

- record all this data,
- organize it so that it becomes easy to analyze the activities of this person,
- review the person's activities as needed,
- detect patterns, and,
- organize the information so that the LifeLogs of different people can interact with each other.

This will facilitate routine tasks like coordinating meetings by considering not only calendars but also individual preferences inferred by these systems and thus provide "cognitive assistants" to people for organizing their activities. Many people are against such a project because of privacy issues. I am reminded of an interesting book written by David Brin, *The Transparent Society* (Perseus Publishing, 1999), that raises this issue in a thought-provoking manner in the context of surveillance cameras and other sensors that are becoming common in our society. He shows that the major issue isn't whether activities should be recorded using numerous surveillance cameras in cities, but who should have access to the data.

Because of advances in technology in the last few decades, there's an increasing trend to record events for later analysis. In many situations—like some important public meetings—such recordings are now legally required. Historical accounts of important events in human society, meeting minutes, conference proceedings, wedding videos, surveillance videos, visitor logs, and sales activities warehouses for Wal-Mart are different forms of chronicles.

Until electronic recording became possible, you could only keep a record of historical events by writing about it or taking pictures of it. Historical accounts written by people were subjective. Hence, it was common that the history was rewritten whenever kings changed. What we really need is a more objective recording mechanism. Photographs provide that, but only to a limited extent. Now, many corporations and legal systems require a video record of a meeting to be kept. We assume that the video is more objective than the record written by a person. And, an unedited video definitely provides an objective recording of the proceedings in a meeting or events at a place.

From logs to e-chronicles

Many organizations keep detailed logs of events. Rumor has it that many corporations keep a log of every keystroke made by their employees. And, it's widely believed that government agencies in many countries log all events, including telephone conversations, of suspected criminals—in most cases without the subject's knowledge. These activities are hardly surprising because for decades detectives have reported the activities of enemies as well as loved ones.

So what does all this have to do with multimedia research and practice? I believe that multimedia is at the center of a newly emerging field: multimedia electronic chronicles, or e-chronicles. An e-chronicle records events using multiple sensors and provides access to this data at multiple levels of granularity and abstractions, using appropriate access mechanisms in representations and terminology familiar to application users.

Until a few decades ago, it was natural to keep a record or log using alphanumeric techniques both in paper as well as in electronic form. Elec-

continued on p. 111

1070-986X/03/$17.00 © 2003 IEEE

Published by the IEEE Computer Society

continued from p. 112

tronic recording has made it easier and cheaper to keep video records than human-reported alphanumeric records. With advances in processing, storage, and sensor technologies, it's extremely easy now to record disparate activities in different situations using different types of sensors. Thus, logging information has become easier and cheaper than ever.

As you might expect, this trend in technology is going to result in interesting applications. In the "Next 1000 Years" special issue of *Communications of the ACM* (March 2001), I wrote about the digital experience and some of its exciting applications. The same issue had an interesting essay by Gordon Bell and Jim Gray about digital immortality and its implications. As envisioned by them, digital immortality is a personal log that uses video and other recording mechanisms. Both articles suggested that e-chronicles are going to come soon and will be an interesting research topic in this century.

Opportunity for multimedia researchers

If an e-chronicle contained just data streams using multiple sources of continuous high-fidelity multifarious data streams for the life of a person, I don't think that it would be useful. A volume of raw logs, even high-fidelity multimedia logs, will become mostly write-only logs; they will be written but never accessed. To make them useful, e-chronicles will need to continuously process raw data into meaningful data events in each stream. Such events must be aggregated into episodes using domain models including ontologies and other useful concepts to make all this data easily accessible to people as well as to other programs as required. Anybody working in multimedia databases, semantics, knowledge representation, and related areas knows that these are all challenging problems.

A well-designed e-chronicle will maintain all detailed records, while providing summaries of important events as well as access to events at the required level of granularity. In addition to serving as an accessible automatically created multimedia log, it could serve as a powerful mechanism to identify abnormalities, inefficiencies, and unusual behaviors as well as conditions for appropriate actions and feedback. These systems could be as proactive as the application dictates to help users in their activities. Finally, with increasing progress in privacy and security issues, it will be possible to provide different levels of access privileges to different users, thus allaying privacy concerns of users.

A well-designed e-chronicle will maintain all detailed records, while providing summaries of important events as well as access to events at the required level of granularity.

Many variants of e-chronicles have already appeared and are being used. Data warehouses, video surveillance systems, meeting recording systems, sensor networks, and even blogs are early forms of e-chronicles. To facilitate development of these systems, we must identify the basic research and implementation issues in these systems and then develop appropriate approaches and systems for e-chronicles as a class of systems. Multimedia has a key role to play in these systems. Compression and storage issues and semantics of multimedia streams and presentation systems for different data streams are the central issues in these systems. So without getting into the privacy issues of the LifeLog project, I challenge the multimedia research community to contribute their ideas and solutions to e-chronicles. **MM**

Readers may contact Ramesh Jain at jain@ece.gatech.edu.