Video Content Analysis Using EEG Monitoring

By
Richard Brueggman
President & CEO
Data Science Automation

Category: R&D

Products Used:

- NI DAQ
- NI IMAQ
- LabVIEW
- LabVIEW IMAQ
- LabVIEW SQL

The Challenge:

Creation of a PC based system that will quantify a person's level of engagement with audio or video based media clips through analysis of electroencephalogram (EEG) signals (i.e., the electrical activity on the skin surface that is related to brain activity).

The Solution:

A customized LabVIEW-based application was created to automate and synchronize the playback of either digital or analog video clips; the acquisition, analysis, and presentation of EEG signals; and the archival of raw data and converted results to files for future retrieval and post processing – all in real time.

375 Valley Brook Road • Suite 106 • McMurray, PA 15317 • T 724-942-6330 • F 724-942-8390 • DSAutomation.com

Abstract:

Capita Research Group, Inc. designs and markets systems and services that measure psychophysiological engagement, receptiveness, and communication effectiveness. Technology licensed to Capita from NASA's Langley Field Research & Development Center has been significantly enhanced to allow an Engagement Index (EI) to be formed from EEG data to quantify how involved a subject is with his or her current task. Capita uses this EI as a real-time, objective measure of how well a media clip holds a person's attention. Data Science Automation developed a PC-based, customized LabVIEW application to automate the collection, analysis, and presentation of the results of this media analysis for Capita. This system allows the operator to specify the number of subjects for a given trial, to configure the data acquisition and processing algorithms, and to select either digitized video clips (AVI files) or analog video input (from an S-VHS capable VCR). The data acquisition, video playback, data processing, graphical display, and file output operations are synchronized to result in a complete real-time system. In addition to the real-time function, the capability to merge independently collected data files for simultaneous analysis, results display, and video playback at some later date has been implemented as well.

System Configuration:

In addition to the third proprietary hardware for obtaining and pre-amplification of EEG signals, an E series DAQ board connected to a BNC-2090 accessory enabled signal acquisition. A third party image acquisition board was chosen to allow signal synchronization with an S-VHS capable VCR for analog video input while LabVIEW's ActiveX capabilities were used with Microsoft's ActiveMovie (version 2.0) for digital video input. A multi-processor based PC platform running Windows NT was chosen for stability and performance.

Flexible configuration screens (e.g., Figures 1,2,3,4), which are accessed through customized pull-down menus, allow the operator to modify many system parameters including the media source, data acquisition parameters, and the data processing algorithm prior to any run. Media source testing and scene configuration within specific media pieces can be accomplished from these screens as well.

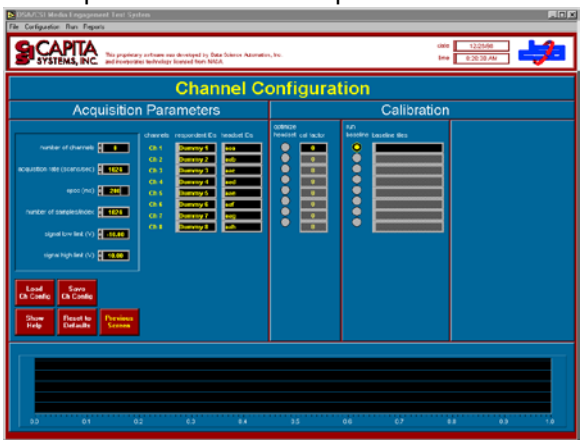

Figure 1:

Channel Configuration Screen

375 Valley Brook Road • Suite 106 • McMurray, PA 15317 • T 724-942-6330 • F 724-942-8390 • DSAutomation.com

Figure 2:

Engagement Algorithm Configuration Screen

Figure 5:

Figure 3:

VCR Video Source Configuration Screen

Figure 4:

AVI Video Source Configuration Screen

The operator can choose whether to collect new data using the current configuration or to compare existing data sets using information from one or more archived files. Either way, raw data is passed through the currently configured processing algorithm to result in a graphical display of the Engagement Index synchronized with playback of the corresponding video clip (Figure 5). In this way, events occurring within the video may be compared to correlated changes in the data giving the operator the power to determine the effect of any scene or event on the viewer's level of involvement with the media.

Planned future enhancements to this application include analysis capabilities for html based media clips, print media, and audio media; changes to the EEG pre-processing hardware to allow more subjects to be monitored at one time; and more detailed and configurable (i.e., scene based rather than clip based) analysis routines.

375 Valley Brook Road • Suite 106 • McMurray, PA 15317 • T 724-942-6330 • F 724-942-8390 • DSAutomation.com

Conclusions:

The difficulties of using LabVIEW with ActiveMovie were reduced with the release of LabVIEW 5.0.1 and through the use of Windows NT. Specifically, Active Movie release 2.0 made the possibility of including video clips in a stable LabVIEW application a reality. Combining data acquisition, ActiveX control, file i/o, analog video acquisition, and real-time advanced analysis functions all into a real-time process using LabVIEW proved to be a challenging task but one well-worth the time and effort. As a result of Data Science Automation's solution, Capita Research now has a powerful, expandable, and user friendly system from which to lead the commercial media analysis field.

375 Valley Brook Road • Suite 106 • McMurray, PA 15317 • T 724-942-6330 • F 724-942-8390 • DSAutomation.com