

Poster II-25

PhysioTools: A Physiologic Data Management and Analysis System

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The Combat Casualty Care Directorate of the U.S. Army Medical Research and Materiel Command, Ft. Detrick, Maryland, supports various intramural and extramural research studies involving the collection and analysis of human and animal physiological data. These studies generate voluminous amounts of time-series data, e.g., electrocardiogram waveforms, respiratory traces, that are currently stored by each investigator in their own workstation and manually manipulated for subsequent visualization and analysis. To afford a flexible solution to warehouse and manage physiologic data and provide analytical tools to research scientists for data analysis in a central location, we are developing a novel computational system called PhysioTools.

Built on a combination of proven computational platforms and easily accessible through the Web, PhysioTools provides a flexible, modular and interactive environment for rapid prototyping and incorporation of tools for storage of new studies and to query, visualize, cleanse, extract features, and analyze physiologic data with emphasis on tools to analyze time-series data. The innovative concept of PhysioTools is an architecture where both the data and the analysis tools reside at the server while offering—through a Web browser—a feature-rich, workstation-like environment that researchers require to perform sophisticated data mining. This architecture eliminates the need to download tools and data from the server to the desktop and avoids the often-painstaking process of installing the downloaded tools into the desktop. It allows rapid incorporation of user-provided analytical tools into the system's library of functions written in computer languages callable from Matlab and supports sequential data analysis through a novel interactive concept termed *function chains*. Function chains permit the user to customize a sequence of data operations by selecting functions from the library of functions and arranging them in any desired order so that one function is applied to the result of the preceding function. Built-in mechanisms automatically construct function input-output interfaces and check for function-to-function inconsistency. Another advantage of function chains is that it only instantiates the functions in the sequence and generate derivative data when requested by the user, reducing the amount of data the system has to manage.

For proof-of-demonstration purposes, PhysioTools is currently being used to warehouse and analyze continuous pre-hospital physiologic data collected from trauma patients during transit to a trauma center. The main objective of this trauma study is to identify which physiologic parameters can be used as early predictors of clinical outcomes, such as the need for a life saving intervention.

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