

RESEARCH BRIEF

TIMESARCHER 2: DISCOVERY IN TIME SERIES

The potential

Time-series data sets are central to exploration in finance, meteorology, marketing, genetics, and beyond. The growing interest from data mining oriented researchers has generated a widespread need for tools that support interactive exploration to time series. TimeSearcher 2 serves those needs by enabling users to identify patterns in multivariate and lengthy time series data sets.

The challenge

While there has been substantial work in algorithmic strategies for querying and indexing data, much less work has been done in the development of interactive tools for identifying patterns in these data sets. A graphical mechanism is needed for specifying queries on time series data to provide the basis for an exploration of the algorithmic and semantic issues surrounding interactive querying.

The research

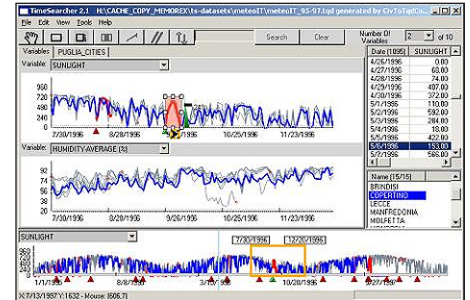
TimeSearcher 2 enables users to visualize long time series (>10,000 time points) and provides an overview that allows users to zoom into areas of interest. Users can view multivariate time series data, by showing up to ten simultaneous plots on the same screen.

TimeSearcher 2 queries are built using “timeboxes,” powerful graphical metaphor widgets that can be used in direct manipulation Graphical User Interfaces (GUIs) to specify query constraints on time series data sets.

Timeboxes are rectangular query regions drawn directly on a two-dimensional graph. The extent of the timebox on the time axis (x) specifies the time period of interest, while the extent on the value axis (y) specifies a constraint on the range of values of interest in a given time period.

The second potent tool is a SearchBox that enables users to find desired patterns throughout the data.

Users select a region of an existing time series and then they adjust the tolerance and four controls over the acceptable similarities. This enables users to find spikes, steady periods, or cyclic patterns.



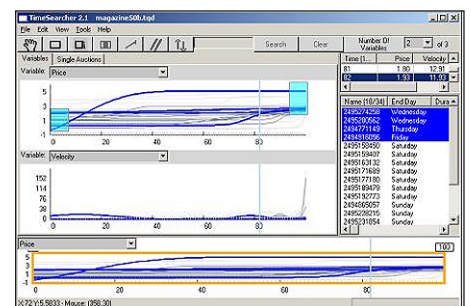
A full-screen picture of TimeSearcher 2.

Users can also view and filter by time series attributes. For example in auction data, users can chose to view only auctions by a given person, for a given set of products, or ending on a given date.

Timeboxes and SearchBoxes support interactive formulation and modification of queries, speeding the process of exploring time-series data sets and guiding data mining.

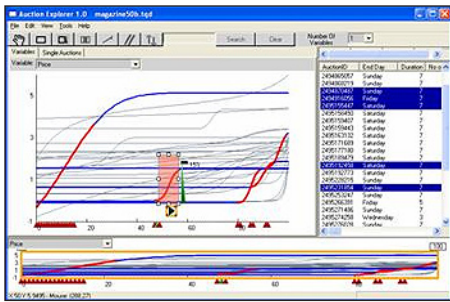
The first version, TimeSearcher 1 remains available. It was written in Java, using the Human-Computer Interaction Laboratory’s Pico toolkit for all graphic displays and manipulation of timeboxes.

TimeSearcher 2 has been completely re-written in C# using the .NET framework. TimeSearcher’s object-oriented architecture can easily be extended to support variants of the timebox model and provide additional expressive power. The prototype includes windows for timebox queries, individual time-series, and details-on-demand.



TimeSearcher 2’s graphical envelope displays the extent of the entire data set and the result set from a given query. It provides additional insight into the density, distributions and patterns of change found among items in the data set.

Application examples



A search box helps users find similar patterns in a database of eBay auctions.

TimeSearcher 2 was developed to examine oil-gas well log data and has been applied for analyzing eBay auction data, financial patterns, and disease rates over time.

Availability

TimeSearcher 2 can be downloaded for academic and noncommercial use. A user manual is also available.

If you would like to use TimeSearcher in a corporate setting, please contact Ben Shneiderman and Catherine Plaisant (see below). We are also willing to make source code available to other academic researchers.

Support

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Links

TimeSearcher web site
www.cs.umd.edu/hcil/timesearcher/

Download TimeSearcher 2 and its user manual for academic and noncommercial use at www.cs.umd.edu/hcil/timesearcher/ts_registration.shtml

Piccolo Toolkit for zoomable user interfaces
www.cs.umd.edu/hcil/piccolo/

Human-Computer Interaction Laboratory
www.cs.umd.edu/hcil/

University of Maryland Office of Technology Commercialization
www.otc.umd.edu

TimeSearcher in the press

“Software for the 4th Dimension: visual interface lets users easily query time-ordered data,” *ComputerWorld*, June 4, 2001 www.computerworld.com/industrytopics/financial/story/0,10801,60995,00.html