T-Cube Web Interface for Real-time Biosurveillance in Sri Lanka

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Objective

We present results of the initial evaluation of utility of the T-Cube Web Interface as a framework for interactive surveillance of public health data collected through the pilot project in Sri Lanka.

Background

The second half of 2007 and early 2008 witnessed an alarming number of deaths due to Leptospriosis in Sri Lanka [1]. This disease presents flu-like symptoms, which are common during monsoon seasons. The scattered number of patient complaints went unnoticed until a few deaths were reported by the individual hospitals. An unusual spatio-temporal increase of the reporting rate of flu-like symptoms might have alerted the epidemiologists about an emergence of the event. However, the current paper-based disease surveillance and notification system in Sri Lanka [2] takes more than 10 days just to pass data to the central Epidemiology Unit. This latency limits the utility with respect to monitoring for disease outbreaks.

Methods

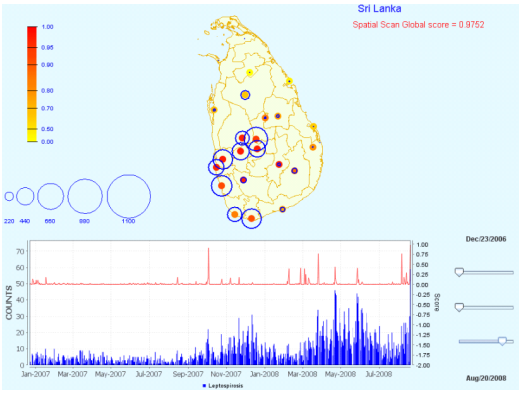
Real-Time Biosurveillance Program (RTBP) is a pilot aiming to introduce modern surveillance technology to health departments in Sri Lanka and Tamil Nadu, India. It consists of an information gathering component based on mobile handheld devices and wireless networking, and of the data analysis and visualization component based on T-Cube Web Interface (TCWI). The processes involve digitizing all clinical health records and analyzing them in near real-time to detect unusual events to forewarn health workers before the diseases reach epidemic stages. Patient records from health facilities, including case disease, syndromes, and demographic information, are collected through a mobile phone application and fed into the central database.

The data is available to analysts through the TCWI. It is a browser-based software tool based on T-Cube data structure [3] designed for fast retrieval of large scale multivariate time series and spatial information. The interface enables interactive geo-temporal visualization of syndromic data, navigation through different levels of data aggregation, and execution of selected types of statistical analyses including spatial scan and temporal scan for rapid and reliable detection of emerging public health events.

We present the results of initial evaluation of TCWI in the retrospective replication setup. We use data from Weekly Epidemiological Reports published between December 2007 and July 2009, and synthetically distributed across RTBP dimensions to reflect the current schema of the system database.

Results

Within seconds of loading the data, the analysts found an emerging event involving flu-like symptoms in the South-Western and Central provinces of Sri Lanka. Bayesian spatial scan algorithm, tracking probabilities of Leptospirosis outbreak anywhere in the nation for all days in the past data (red line, and red dots in the map), shown a value greater than 97% on 8/20/2008.



TCWI temporal scan algorithm used in the massive screening mode has also identified early indications of the 2008/09 Dengue fever outbreak in Sri Lanka.

Conclusion

TCWI supports disease surveillance by enabling: (1) Automated comprehensive searches for events of interest through large collections of data, (2) Interactive data navigation and visualization, (3) Automated explanation of detected patterns. It is well suited to support rapid detection and mitigation of bio-medical threats in developing countries.

References

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