Benefit: LAHVA technology provides public health officials with a suite of visual analytic tools for spatio-temporal exploration of multivariate health care data sets in linked statistical and geospatial-temporal views. These tools provide advanced detection capabilities for adverse chemical and biological occurrences in the general populace.

Mission Need
The role of public health surveillance is to collect, analyze and interpret data about biological agents, diseases, risk factors and other health events in order to provide timely dissemination of collected information to decision makers. Unfortunately, data sources vary widely in accuracy and reliability, and it is often the case that unusual health trends, such as outbreaks or poisonings, have an incidence profile (signal) that is obscured by the statistical noise. In order to help investigators overcome these issues, we have developed a suite of statistical and visual analytical tools that couple novel data sources with human health data. Our primary data sources include emergency room data from the Indiana State Department of Health, general visits of pets to Banfield the Pet Hospitals, Indiana Board of Animal Health data, and data from public health news feeds, such as ProMed. These analytical tools and datasets are brought together in a visual analytics environment called LAHVA. The LAHVA application provides investigators with the ability to visually search the data for clusters in both a statistical model view and a spatio-temporal view. By providing linked graphical and statistical analysis views for public health officials, we will improve event detection and response, while reducing false positives.

Collaborators:
- Indiana State Department of Health (ISDH)
- Indiana Board of Animal Health
- The Regenstrief Institute
- Indiana University School of Medicine
- Banfield the Pet Hospital
- Georgia Department of Health
- Ceratops UAC (Utah, Pittsburgh)
- Lawrence Livermore National Laboratory

Funded by:
- US Department of Homeland Security

Linked geo-spatial temporal and statistical analysis viewing window showing influenza (red), BSE (green) and Newcastle disease (blue) collected from ProMed. Background Blue Marble map imagery courtesy of NASA.

Early Development Lab Prototype Commercial Product
January/2008
Technology Delivery

Through LAHVA, PURVAC provides a visual analytic system that allows users to analyze correlations between diverse data sources. An initial deployment has been used to retroactively analyze disease outbreaks and chemical spills. Analytic techniques that automatically identify patterns and relationships in time-varying multivariate data are being developed to help enhance the visual analytics and decision making process.

Our system consists of three components: data management, statistical analysis, and visual analytics. An initial direct access query to the database is done, and human hospitals, veterinary hospitals, and patient and pet locations are displayed on an interactive map. Currently, both structured and unstructured data from web logs to emergency room reports are being imported into our environment. Statistical plots are pre-computed and linked to the factor specification and filtering components in the system. Users can select the time period aggregation to look for trends occurring over days, weeks, etc. Case selection and factors are determined by check boxes of syndrome classifications or by keyword searches.

Health Impact Case Study: Mercaptan Release

Several potential outbreaks have already been analyzed with the use of our system. In June of 2006, the hazardous chemical mercaptan was released into the air from a toxic waste processing plant in Fairburn, GA, producing an onion like odor and clinical illness in humans consisting of headache, nausea, and skin/eye irritation. The effects on the human population were self-reported and speculative at best. In order to better analyze the effects of this release, companion animals from the Banfield Pet Hospitals were used for surveillance. The cat and dog populations of Fairburn were retrospectively analyzed based on any visit to Banfield Pet Hospitals presenting syndromes consistent with exposure to mercaptan. Plots were created detailing the history of these syndromes for 2006. Furthermore, the pet population showing these syndromes was analyzed via SatScan for clusters. Three spatio-temporal clusters representing eye-inflammation and two clusters representing respiratory syndrome clusters were found ($p<0.05$) in the months following the mercaptan release. The key cluster here is one of the eye-inflammation clusters, which originates on the day of the mercaptan release and lasts until approximately two weeks after the cleanup. Further analysis is needed to confirm these results.

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