# LAHVA: Linked Animal-Human Health Visual Analytics

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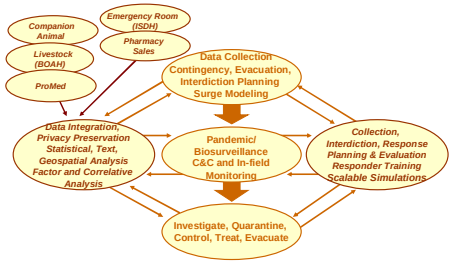
## Introduction

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. By providing linked graphical and statistical analysis views for public health officials, we will improve event detection and response, while reducing false positives.

Our **primary data sources** include:

- **Indiana State Department of Health**
- **Banfield the Pet Hospitals**
- **Indiana Board of Animal Health data**
- **ProMed news feeds**




## System

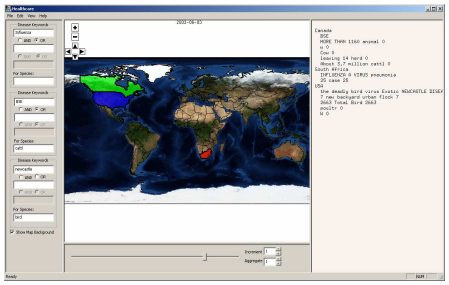
These analytical tools and datasets are brought together in a **visual analytics environment** called LAHVA. An initial direct access query to the database is done, and human hospitals, veterinary hospitals, and patient and pet locations are displayed on an interactive map. Currently, both structured and unstructured data from web logs to emergency room reports are being imported into our environment. Statistical plots are linked to the factor specification and filtering components in the system.

**Our system has three main components:**

- **Data management**
- **Statistical analysis**
- **Visual analytics**

**System features include:**

- **Linkage** between geospatial windows and traditional time series views
- **Factor specification** tools
- Advanced filtering for **demographic analysis**
- **Temporal aggregation** for
- **Correlation analysis**
- **Interactive heat maps**
- Keyword searches

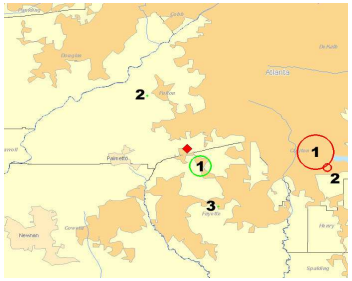


*Linked geo-spatial temporal and statistical analysis viewing window showing influenza (red), BSE (green) and Newcastle disease (blue) mined from ProMed. Background Blue Marble map imagery courtesy of NASA.*

## Results

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.

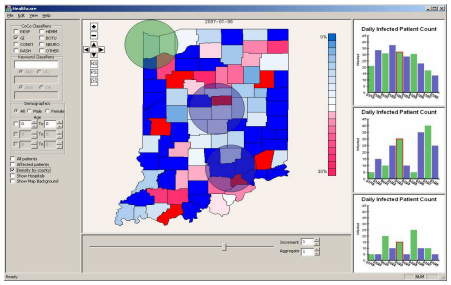
- **Three spatio-temporal clusters** ($p<.05$) in the months following the mercaptan release.
- The **eye-inflammation** cluster originates on the day of the mercaptan release (green).
- The cluster persists until approximately two weeks after the cleanup.




*SatScan clusters of dog syndromes immediately following the release*

## Conclusions

While our current work has been retrospective, we intend to modify the system and integrate our statistical models for better interactivity. By doing this, we can provide health care officials and epidemiologists with tools to monitor varying regions of the country and provide better detection for potential disease outbreaks and health incidents. Future work will focus on verification of these case study results, as well as others, and system enhancements to LAHVA.



*Plot of gastro-intestinal cases distributed by county in the state of Indiana. The circles correspond to linked statistical views allowing advanced disease outbreak analysis through the use of visual analytics.*

## Acknowledgements

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## For further information

Please contact *rmacieje@purdue.edu*.
More information on this and related projects can be obtained at http://www.purvac.org

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