

Using Entropy for Biosurveillance

Research Mission

The early detection of disease outbreaks is crucial to effective mediation; yet, disease reporting data is notoriously noisy. This project, initiated as part of the DHS Summer Research Team Program for Minority Serving Institutions (MSIs), examines the potential for using information theoretic measures of entropy in biosurveillance. Together with our MSI teams, we developed an algorithm for transforming surveillance data into an entropy signal for analysis. The work on this project demonstrated, for the first time, that entropy measures can detect disease outbreak signals earlier and more accurately than other methods currently in use. We observed that abrupt and early changes in the entropy signal can be used to signal the onset of epidemics, and work is ongoing to analyze the conditions under which entropy-based methods provide increased sensitivity.

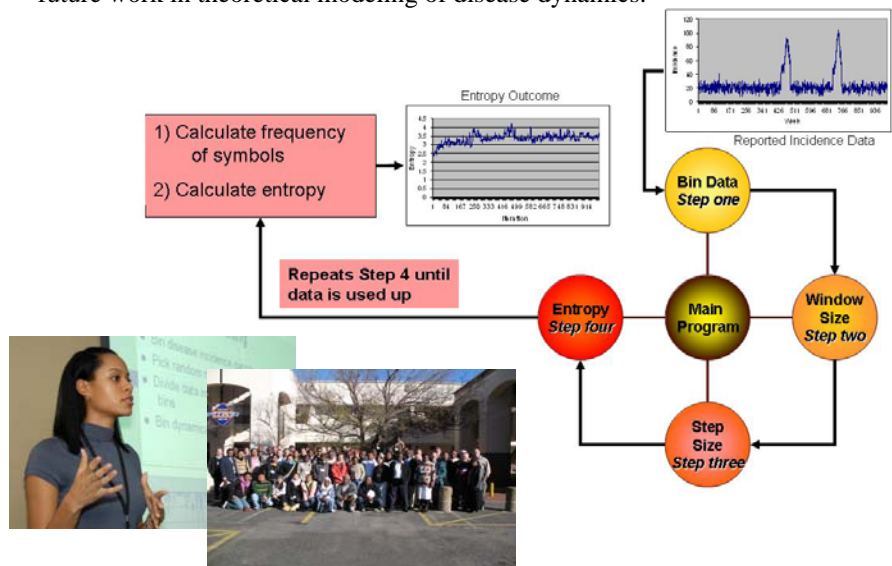
Outreach Mission

The DHS Summer Research Team Program for Minority Serving Institutions seeks to engage faculty and students from MSIs in research that will offer opportunities to understand the mission and research needs of DHS, while strengthening the talent pool of scientists and engineers. The students from our teams had the unique opportunity to attend a two-week advanced study program at the African Institute for Mathematical Sciences near Cape Town on mathematical modeling of infectious diseases that occur in Africa. Afterwards, they joined faculty members for a scientific conference on the topic with world experts. This participation was critically important to their summer research and builds their understanding of the most advanced techniques available for future work in theoretical modeling of disease dynamics.

Benefit: *The need for improved biosurveillance is articulated by Dr. Rajeev Venkayya, Special Assistant to the President for Biodefense, in a July 2007 press briefing on the National Strategy for Pandemic Influenza: "We continue to have a great deal of difficulty in determining when outbreaks of infection occur in animals and in humans overseas. Just to be brutally honest, we have a lot of trouble determining when we have an outbreak of infectious disease in a community here in the United States."*

Collaborator(s):

- Howard University
- Morgan State University



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Clockwise from top: Diagram of the new algorithm for calculating entropy of disease surveillance data; attending the workshop in South Africa in June 2007; presenting final results at DHS in August 2007

