Front page

- Hi, all.
- I am Benny Chin, a PhD student from Department of Geography at National Taiwan University.
- I am here to present a web-based framework for monitoring spatial temporal clustering of epidemics in Taiwan.
- This monitoring framework is a prototype of an earlywarning system, with the database of foodborne disease.
- This project is supported by the grant of the CDC Taiwan.

about Taiwan

- Taiwan is an island at East Asia. The population density is about 650 person per km. It is one of the top ten most densely populated countries.

about foodborne disease

- foodborne disease, is about the illness that when we ate something that is not clean,
- which made us feeling stomachache (acute diarrhea)
- then we might run to toilets,
- and we might go to the hospital or nearby clinic, to get some medicine.

how can GIS help

- this is an example
- one day, someone goes out from his home
- takes his lunch (where he ate some not clean food)
- meets with some friends and watches a movie
- then he feels sick (with his stomach) and finally he goes to hospital

The whole process includes a lots of movement, which we did all the time in our daily life.

- If there is a source that is causing the foodborne disease,
- there would be a lots of people getting similar symptom in the same area or the neighboring area
- with the helps from GIS and spatial analysis methods, we could find the source of the foodborne disease.

surveillance system

- so, this is what we are trying to do here.
- the hospitals record the symptoms of patients, they have the summary of the number of patients with a particular symptom, and we know where the hospitals are located.
- therefore, we could trace back to the source of the foodborne disease.

the databases

In Taiwan, the cdc provides several surveillance system and database that could be used in the framework.

- The RODS, LARS, and reporting system
- the report time of RODS is real-time or near real time, but the records would only be the symptoms, without more details information.
- LARS would have about 5 to 10 days lag. but they will also provide the experiment result of the sample, which includes the pathogens type that is causing the disease.
- reported clusters will be announced while the clusters are confirmed, which would have quite detail test results.

reporting time

- RODS is a better option for surveillance purpose
- LARS is good for supporting the surveillance purpose
- Reporting system is good for verifying the cluster

the framework

has several components:

- a core system that "control" the workflow
- a database that stores the raw data and result of the analysis
- several analysis modules that "run" the analysis and store the data back to the database
- a web-based UI for communicating with the authorized users.

core system

- we used a web-application framework name web2py, which is an open-source python-based web application, to construct a dynamic website for the surveillance framework.
- web2py use a MVC structure
- it is a simple and powerful enough web-application for our monitoring system.

the database

- we used postgresql, with psycopg2 for connecting from python environment
- to store raw data, the number of patients in each day...
- to store spatial data, the locations of the hospitals, the administrative boundaries...
- to store analysis result, where the clusters are...

analysis modules

- clustering methods
- spatial manipulations
- visualizations

web-based UI

- html forms...
- showing maps
- showing charts

warning workflow

- first, analyzing the temporal anomaly from the RODS data, give a warning signal if temporal anomaly appear.
- second, identifying the space-time hotspots from the temporal anomalies, give a warning alert if hotspot is starting or growing.
- then, integrate with the LARS data, which provide information about which types of pathogens, this helps on identifying the food source.

temporal anomaly

- is those time-point with higher values of patients than regular
- in this figure
- each dot represent the number of patients in a day at the hospital
- dots in purple means less than 50.
- dots in red means greater than 50.
- three continuous three days starting from about day 7, is higher than other days of the hospital.
- this make them temporal anomalies.

space-time hotspots

- on the other hand, space-time hotspots analysis try to find space-time hotspot from the temporal anomaly data.

screenshots - indexpage

- warning messages
- data update history
- thumbnails and links of the maps and charts

data exploring pages

- RODS spatial
- RODS temporal
- LARS spatial
- LARS temporal

identified hotspots temporal

- the lines represent the reported clusters
- dots represents the identified hotspots that classified with the LARS pathogens info - red means rota virus, and blue means salmonella species.

identified hotspot spatial

- we can view the maps of the hotspot area

and, the hotspot matrix

we can also check the historical hotspots and reported clusters, to check if the hotspot is closed to any reported clusters.

thats all

thank you