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Building information system for alerting traffic accident in Ho Chi Minh City

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Abstract

This research reports some results in building information system for warning the traffic accident in HoChiMinh city. By using neuron network and statistical methods for analysis some spatial aspects of happened accidents, the data are mined for providing traffic-crashing risk information to traveler. The accident locations are analyzed for the relationship between the recently cases and the geographical sites such as the industrial parks as well as the repeatibility. Finally, the report describes the building of information system including application on mobile device, database and the process.

Keywords: traffic accident, neuron network, hotspot analysis,

1. Introduction

Nowadays, using information system, especially geospatial enabled to analyzing accident that is applied in many majors cities in the world. Because of the high paid cost for society at long time. The researches often focus on how the cases happened and the levels of accident of people, cars and related objects. And the factors may include wide range from road to car caused techniques as well as weather conditioning,… On the road, the lighting, curving and elevation elements must be considered. But many factors related with social behavior such as people awareness and traffic habit in driving are need to checked and examined in big city such as Ho Chi Minh city where adopting too much immigrants. On the others hand, many accidents occur in the same location, time and the combination of other attributes such as ageing, home town, gender, degree,… So building the accident alerting system is the need for many people living or passing the city who joining traffic on the risking roads.

The analysis on the point-of-interest places in Ho Chi Minh city such as industrial zones attracting non-localities people. People living other regions may have different driving speeds, road sizes, traffic experiences… These traffic conditions will form the set of traffic accident risks. For such thinking, this research is oriented building alerting system on the schools, industrial zone areas.

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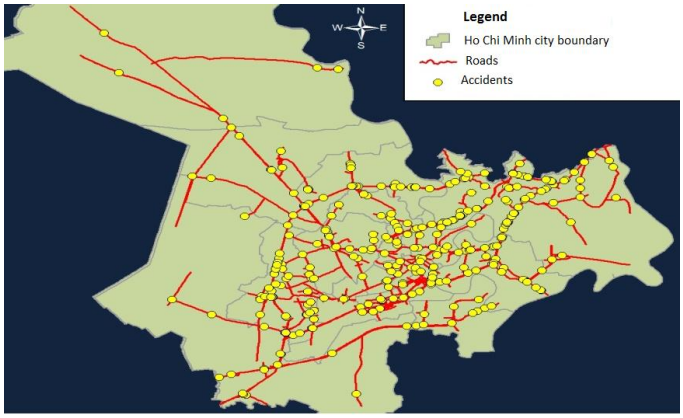

Fig. 1. A part of HCMC and traffic accidents location in this research

2. Research methodology

2.1. Acquisition and building data

Data are collected from many kinds of newspapers: local, police and traffic newspapers. These sources are not reflected all information. But the basic items is mentioned, such as: date, time, location, type of vehicles, type of injuries, genders, home town of drivers/victims, images,…

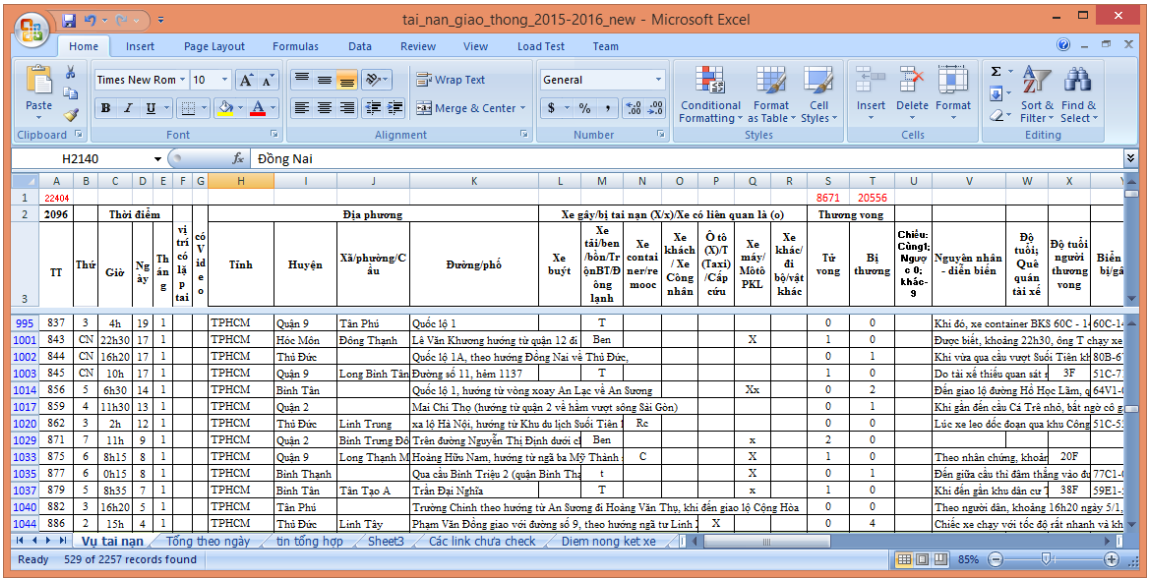

Fig. 2. Raw data collected from newspapers

In details, two data groups are:

- Based data:
  - Streets: all kind of road.
  - POIs: industrial zones, schools, universities.

- Traffic accident data:
  - Attributes: latitude, longitude, location description, day in weeks, date, time in day, injury information, kind of vehicles, home town of drivers/victims, gender.

In this paper, 339 selected traffic accidents in the period from Jan 2015 to May 2016 in HoChiMinh city is chosen to analyze.

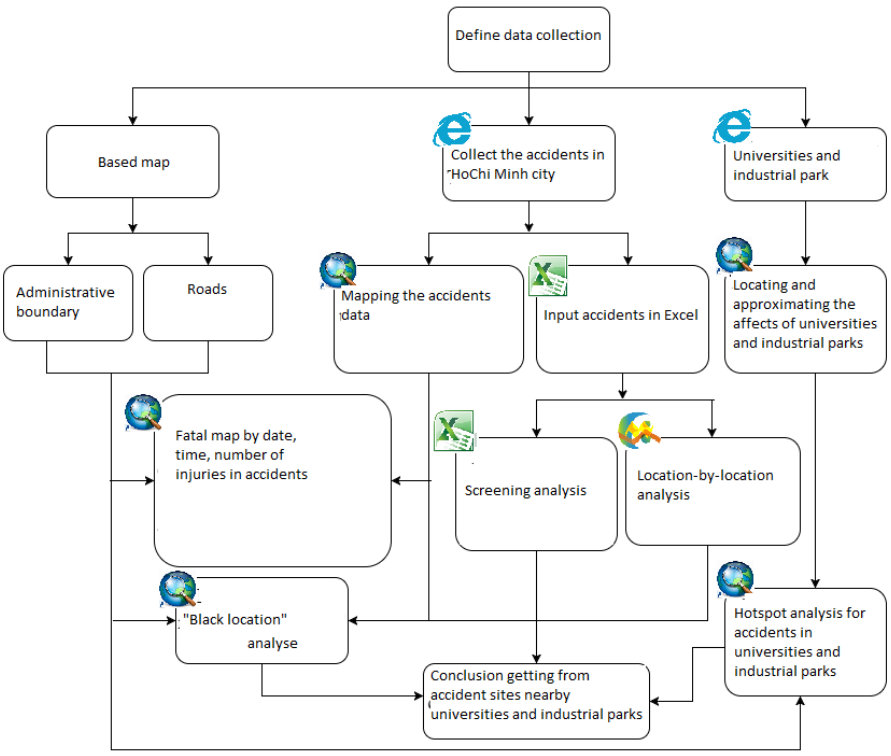

Fig. 3. Analyzing process for traffic accidents

2.2. Establish statistical analysis

After collecting, the data are mathematical screening analysis. This process will detect the features of data for future mining orientations. The techniques includes:

- Building the correlation between the injuries and other factors, such as kind of vehicles, the road width, day in week and time in day.
- Spatial relation analyzing between traffic accidents and POIs with many people lived in, such as relation to industrial zone areas in HoChiMinh and next to provinces.
- Hotspot analysis for the level of risking in areas.

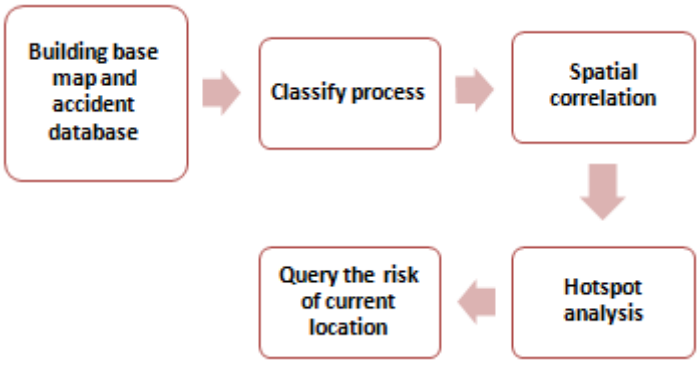

Fig. 4. The process of using statistics for making accident risk map

2.3. Building neuron network for traffic accident

The repeatability of one kind of accident on the same location is considered when the duration is short-term and social-economic condition of the area not much changing. In reseach, eight factors which are injuries, time of day, day of week, location, road intersection, repeats, kinds of vehicles and level of accident are tracked.

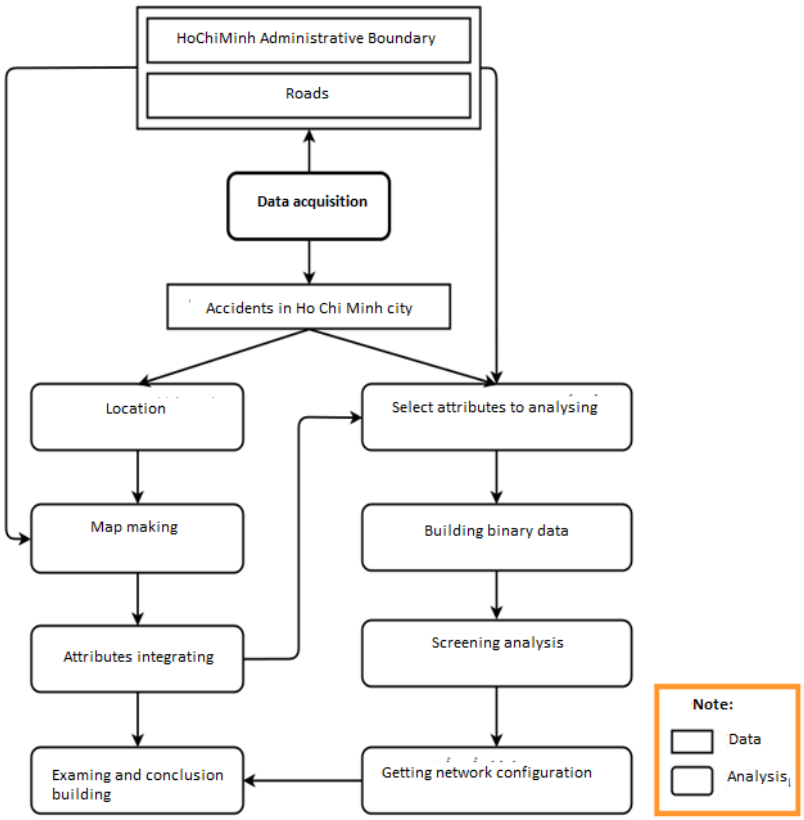

Fig. 5. Analysis schema for neuron network with traffic accident data

Collective information are coded into 0/1 values to make input vector for network training. The back propagation network is built with many hidden layers strategies to archive suitable configuration. Belows is the coding table:

Table 1. Coding for neuron network training

Fields (of accident database)	0 value	1 value
Injuries	≥ 2 people	< 2 people
Levels	Non-dead case	Dead case
Number kinds of vehicle	Many kinds of vehicle	One kind of vehicle
Time	Low-risk hour	High-risk hour
Days of the week	Low-risk day	High-risk day
Location	Low-risk area	High-risk day
Intersection with	None-intersection	Have intersection
Repeativitive	Non-repeat	Repeat

3. Results

The analyzing results outputs many maps (in ESRI ArcGIS software) and results in building neuron network (in Matlab software).

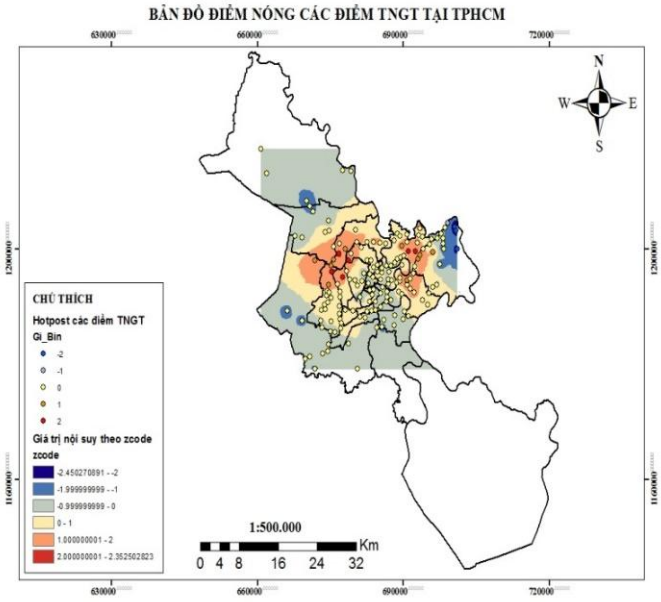

Fig. 6. Hotspot traffic accident map of HoChiMinh city

By using neuron networks, the two-networks comparison had been made. The first network has the vector which inputs are time of day, day of week, location and outputs are repetitative and level of accident. The latter network is build on the vector which inputs are number of injuries, kind of vehicles and has-intersection and the outputs are same as the first nework. Networks are built and tested with parameter of hidden layers range from two to fifteen nodes. The best configuration is the second network which has twelve nodes in hidden layers and has the error about 3%.

The research is proposed some features of accident alerting system providing information for the users include:

- The front-end of the system should be the app on mobile device and the users should provide some information for the system such as: year of birth, home town,… as well as the GPS provide information about location and traveller speed.
- Proposed the color effect for the application to alert the driver instead of text on the mobile device. Mobile device may be put in front of the drivers.
- Police/accident agencies and local governments may provide information for the system. The data are about the people density, people intellectual, working jobs, bars and the traffic density by the time in day,…
- The ability of record in the system for new accidents.
- The system of neuron network is often validated to choice the appropriate model.

4. Conclusion

The analysis may have limitation due to data collection method. Data extraction from newspaper will be not enough all the accident cases in HoChiMinh city. And therefore, many factors may be lighten or omitted. However, the analysis results show some relation between nearby industrial zones which people coming from many regions with accident location. From these analytics, the accident alert system may be built to enhancing the traffic safety. This system may help local government, traffic projects and safety traffic education archive more success.

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