

A RESEARCH ON FOR DISASTER DAMAGE PREDICTION MODEL BY DATA MINING TECHNIQUE

Duke H. Jeong¹, Hyoung S. Shim²

Department of Management Information, Dongguk University, Korea

Keyword: Disaster Damage Prediction, Natural Disaster, Data Mining

Abstract

This research is to implement a model for disaster damage Prediction using Data Mining analysis. The case research data were used to analyze the disaster types and damages. The disaster types and damages were used to find factors of typhoon damage type by property of typhoon. The factor analysis and correlation were conducted to analyze relationship between time, location, and size of disaster based on damages .The Data Mining analysis technique were used to find pattern and relationships for typhoon example.

Introduction

Many properties and casualties are damaged by typhoons on summer in Korea. The government and private sectors have been working on mitigating and minimizing damages by typhoons through broadcasting alarm enforcement and forecasting damages in disaster mitigation and preparedness.

This research is to research and implement a model for disaster damage prediction using data mining analysis. The model is to analyze factors of typhoon damage types by properties damages during past 10 years. It has been executed correlation analysis on those data with factor analysis. Finally, it was to implement a model based on the factors of data mining analysis with typhoon sample data. The results are presented a prediction model to mitigate and minimize the disaster damages.

Research Procedure and Scope

In this research, the research is to be limited to the typhoon damages on analysis unit of disaster prediction. The case analysis areas are limited to the regional area in Seoul. The achieve data are presented according to research procedure with [Figure 1].

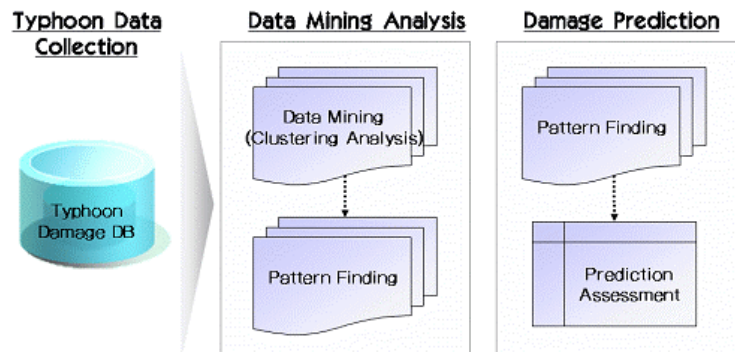
Firstly, the analysis of typhoon attribute are conducted the typhoon's data during past 10 years (1994 ~ 2003 year). The data are executed correlation analysis to find factors for prediction collecting damage data which happened by occurrence special property of typhoon. Secondly, the application of data mining technique with finding factor and damage prediction model to develop and implement a model are conducted a damage prediction model using Clustering

¹ duke@dongguk.edu

² hsshim@dongguk.edu



Analysis of data mining. At last, the model was chosen for typhoon on assessment of a prediction model applied Data mining. Then it compares and evaluates with actuality damages from analysis result applying prediction model.



[Figure 1] Research Procedure

Research Subject

Typhoon Characters

The characters of typhoon factors are divides into different properties of typhoons to analyze special properties and interrelations for damages. Numbers of typhoon origination that happen during past 10 years in Korea with [Table 1] course is about 164, and number of typhoon occurrence that inflict direct damage examined by 32. Typhoon is influencing in Korea yearly mean about 3, and damage about 1 out of 3, like 'Rusa'(2002), 'Maemi'(2003), 'Maegi'(2004)

[Table 1] Typhoon numbers

Year	June	July	August	September	Total
1994	2	7(2)	9(2)	8	16(4)
1995	1	2(1)	6(1)	5(1)	14(3)
1996		5(1)	6(1)	6	17(2)
1997	3(1)	4(1)	6(2)	4(1)	17(5)
1998		1	3	5(1)	9(1)
1999	1	4(1)	6(2)	6(2)	17(5)
2000		5(2)	6(2)	5(1)	16(5)
2001	2	5	6(1)	5	18(1)
2002	3	5(3)	6(1)	4	18(4)
2003	2(1)	2	5(1)	3(1)	12(3)
Total	14(2)	40(11)	59(13)	51(7)	164(32)
Average	1.4(0.2)	4(1.1)	5.9(1.3)	5.1(0.7)	16.4(3.2)

*() is Typhoon number of effect Korea

Heo (2003) are presented shapes and transfer paths of course associating according to the type of typhoon since selected 76 types among typhoons that happen between 1960 and 1989 classifies course 8 pattern. Also, Lee(2003) presented that influenced factor of precipitation, Highest Velocity, shortest path etc. In this research, the interrelation of weather element and typhoon damage are presented in [Table 2]

[Table 2] Correlation atmospheric factor & typhoon damage

	Amount of Damage	Inundation Area
Average Temperature	-0.089	-0.074
Highest Temperature	-0.101	-0.179
Precipitation	0.397**	0.520**
Wind Velocity	0.157	0.344**
Highest Velocity	0.260**	0.471**
Relative Humidity	0.130	0.234
Sea-level Pressure	-0.097	0.013
Shortest Path	-0.233**	-0.137

In this research, the special properties of occurrence cause of typhoon with [Table 3], finding property of typhoon with pre-data and post-data of typhoon occurrences.

[Table 3] Typhoon Properties

Property	
Pre-data	- Occurrence Time - Occurrence Area - Typhoon Size
Post-data	- Central Pressure - Typhoon Level - Typhoon Path - Precipitation - Highest Velocity

Typhoon Damages

Damage types with relationships damage division are dividing by casualty and facility damages. Facilities damage divided Public facilities and private facilities and assessment damage sizes. Since the research is limited extent to regionally Seoul City with [Table 4] together, with Seo (2004) research that do Pusan city damage division factor establishing damage factor of typhoon.

[Table 4] Damage Division

Division	Sufferer		Number				Flooding(ha)		
	Households	Number	Death	Disappearance	Injury	Total	Farmland	City	Total
Total									
Division	Facility					Farmland	Crops		
	Washout	Destruction	Flooding	Total					
Total									
Division	Facility Damage ()								
	Road		River	Waterworks	School	Water supply			



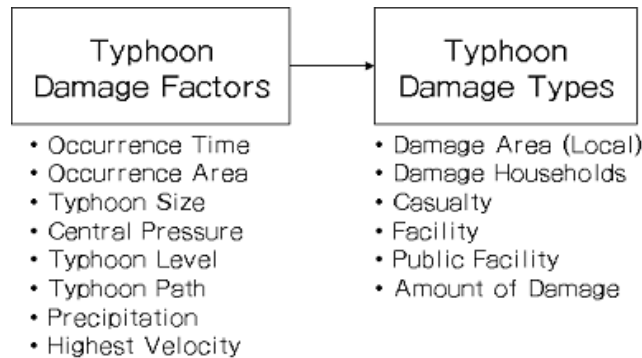
Total					
-------	--	--	--	--	--

This research applied factor deduction to value about damage example such as damage number of household according to occurrence area, person's number etc.. for factor for damage by [Table 5].

[Table 5] Factor of Typhoon Properties

Analysis Content	
Occurrence Area	- Damage (Local)
Damage Types	- Damage Households - Facility - Public Facility - Amount of Damage

With [Figure 2], correlation analysis between Properties factor for typhoon and factor for damage by typhoon, finding effecting for damage of typhoon.



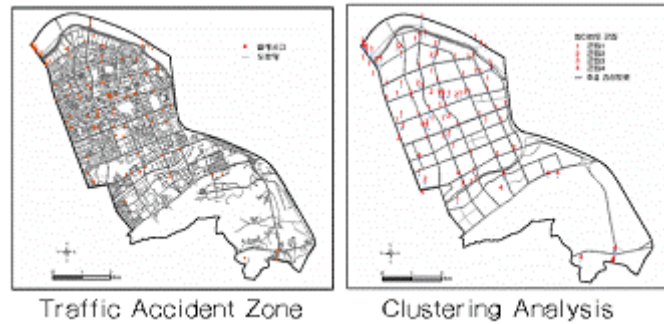
[Figure 2] Typhoon Damage Factor

Data Mining Analysis Technique

Disaster damage prediction Technology is to construct and to research TAPS (Typhoon Analysis & Prediction System) that utilize super-computer for prediction about typhoon, and damage prediction that applied LiDAR technology and a GIS Mapping technology. The damage prediction is needed fast and expensive equipment for correct analysis sequence. However, data mining would support decision-making through analysis - sales forecast, customer inclination etc.- and so on. It is used for deducing pattern by analytical method that achieve to find relevant information or knowledge because analyze data more effectively.

Lee(2003) is done to research a prediction model that applied GIS and data mining for investigated pattern about occurrence in traffic accident. Applied clustering analysis is done to classify a district accident pattern to Seoul city(Gangnam-gu) areas on [Figure 3].



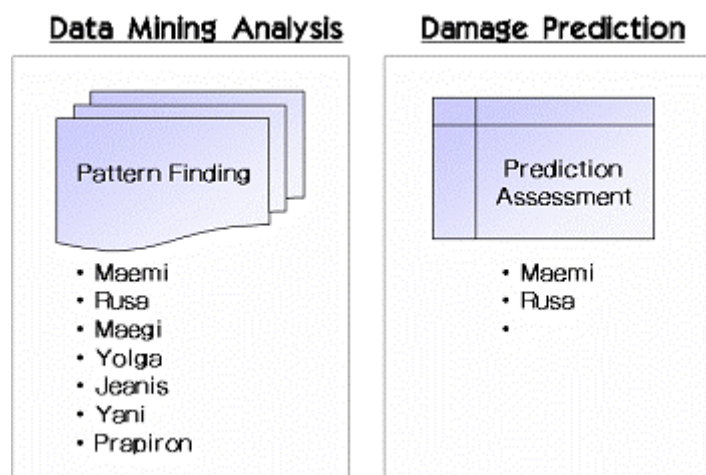


[Figure 3] Data Mining Analysis Result

In this research, one of the advantages of Clustering Analysis technique of data mining and produces typhoon, achieving research technique was to use forecasting information, damage type and scale for damaged district of Seoul area.

Result Testing

In order to test validity assessment of data mining technique, it is applied damage predictions about execution of damages, and it is done a comparative analysis that applies a typhoon example. The results are presented properties in result finding on [Figure 4].



[Figure 4] Data Mining Result Testing

Conclusion

The disaster prediction model is used to achieve disaster damage prevention and mitigate disaster impacts. The disaster management is to minimize damages at disaster occurrence and minimize a loss of lives with disaster prediction. Effectively achieve make certain human and material resources disaster response activity

Quick and correct disaster prediction technologies contribute prediction analysis through analysis on multidimensional analysis takes advantage of new information technology. The damage prediction model was conducted based on data for topographical characteristic and building.

References

Heo, Chang hee(2003), “A Research on Climatologic Type Classification by Typhoon path”



Lee, Eun Gul(2002), “ Occurrence Factor of Typhoon Disaster in Korea”

Choi, Jang Soon(2004), “Factors and Response of Typhoon “Rusa”

Meteorological Research Institute (<http://www.metri.re.kr/>)

Lee, Gun Hak(2003), “Traffic Ancient Applied GIS and Data mining Technique”

