WEB-BASE EXPERIMENTAL VARIOGRAM MODEL FOR ESTIMATE COASTAL TOPOGRAPHY USING GOOGLE WEB TOOLKIT

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ABSTRACT: By now, the Kriging method is widely accepted to estimate the nearshore topography. And the underlying hypotheses of Kriging method are second order stationary and weaker intrinsic hypothesis to define the variogram and spatial covariance. The experimental variogram is a basic tool to find a fitness common variogram models to calculate the variance of a linear combination of regionalized variables. Because of the coastal topography were affect by naturally force in long-terms. So it should contents a spatial covariance between the terrain elevations. But how to get a fitness common variogram model for Kriging estimating is an abstruse work for surveyor and need a lot of history data for study of the local area.

In this study we built a web online Kriging processing service with Google Web Toolkit (GWT) and Java 2 Platform Enterprise Edition (J2EE) using Java language. After upload the terrain elevations to the server and implement the experimental variogram analysis with try-error to find a fitness common variogram modal then utilize the Kriging estimating process to get the DEM (Digital Elevation Model). When get enough history data sets we will create a variogram model database depend on the location for suggest the fitness variogram model.

1. INTRODUCTION

The coast protected policies have thus been adopted in establishing this long-term observation of near-shore geographic. But in this sea area, the efficiency of survey work were limited by movement and safety of surveyor to walk on surf zone. This situation case the lack of dense of survey data. In the past, we estimate the elevation of this area with linear interpolation method. But this method were ignore the covariance of the whole data set. Kriging method are second order stationary and weaker intrinsic hypothesis to define the variogram and spatial covariance. The experimental variogram is a basic tool to find a fitness common variogram models to calculate the variance of a linear combination of regionalized variables. Because of the coastal topography were affect by naturally force in long-terms. So it should contents a spatial covariance between the terrain elevations. But how to get a fitness common variogram model for Kriging estimating is an abstruse work for surveyor and need a lot of history data for study of the local area.

In this study we built a web online Kriging processing service with Google Web Toolkit (GWT) and Java 2 Platform Enterprise Edition (J2EE) using Java language. With this service, we support the query service to get a default variogram model with location and time form experimental variogram model database. And after process, the user also could upload the variogram model to an update model database to improve the estimate quality of this service.

2. SYSTEM ANALYSIS

After collection the data, the most important thing is to find a fitness common variogram model. We support a service to get a default experimental variogram model from database which was build from history data of the local area. The operator could use this default experiment variogram model to generate the Digital Elevation Model.

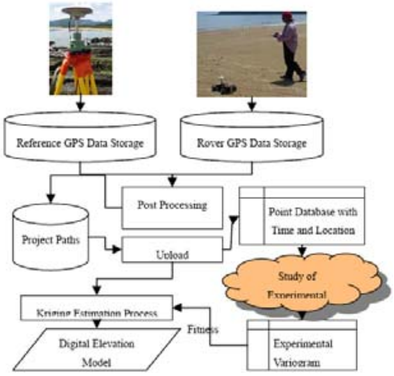

Figure 1 Flowchart of Building Experimental Variogram Database

3. FRAMEWORK

The system was programmed using Java language with J2EE framework on a GlassFish 3.1 application server (Figure 3). The user interface (UI) is using GWT for display and communication with the server side.

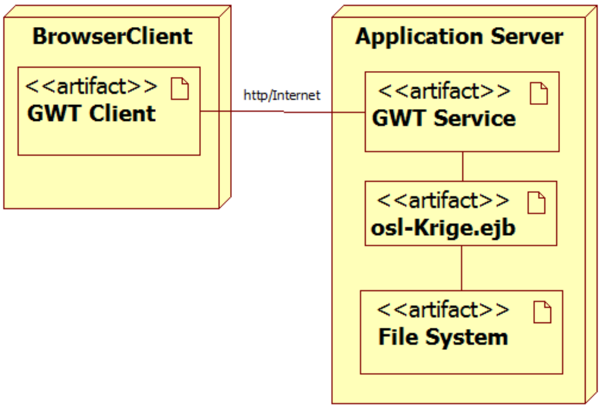

Figure 2 Deployment Diagram of the Online Kriging Service
Survey Area and Test Plan

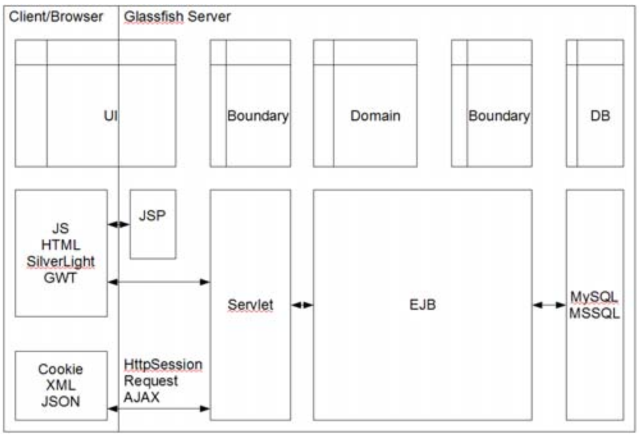

Figure 3 J2EE Framework

3.1 Use-Case of system process

The first thing is upload the coordinate file is uploaded to the server. The user plots the experimental variogram (Figure 7) on the WEB. After get a initial variogram model from database to employing cross validation (Figure 8). Using the try-error method to get the fitness variogram model which standardized kriging average error (SKAE) is closest to 0 and standardized kriging variance (SKV) is closest to 1. The model is then used to generate DEM (Figure 9).

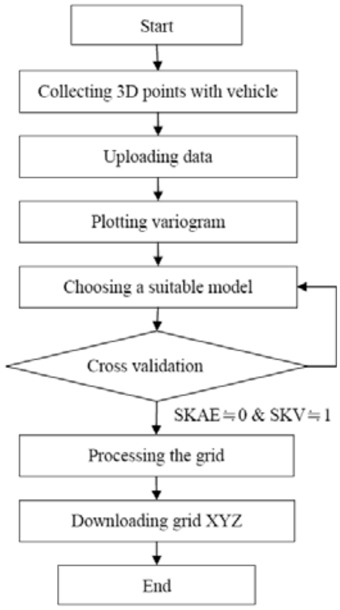

Figure 4: Flowchart of Kriging Web Service

3.2 Data structure of the Variogram

The fields definition of the variogram table in variogram model database is list blow. The records of this table are created by history data of local area.

Table 1 Fields of the variogram table

Field Name	Data Type	Description
LAT	DOUBLE	Latitue of the area
LONG	DOUBLE	longitude of the area
SURVEYTIME	DATE	survey time of the area
S	DOUBLE	Square of Standard Deviation of the area
MODEL	SMALLINT	Common Variogram Model
C0	DOUBLE	C0 parameter
C1	DOUBLE	C1 Parameter
A	DOUBLE	A Parameter
URL	VARCHAR(200)	URL of the data set
NOTE	VARCHAR(200)	NOTE
APPROVED	BOOL	Approved parameters

3.3Flowchart of cross validation

The cross validation is a try-error method to find a suitable model for this local area. First we get a initial model from variogram database and plot their Sill and Range value from variogram (Figure 7). Second, we popup the first point(X0) from dataset and estimating the elevation Z*(X0) at same position with this model and calculate the difference of the estimating and original elevation Z(X0)-Z*(X0) and pushback the original data. Then do the same thing of second point to calculate the difference of Z(X1)-Z*(X1). After all points were computed the difference of their estimating and original elevation Z(Xi)-Z*(Xi). We get the SKAE,SKV and histogram (Figure 8) of this model. After all admissible model were doing the same process, we find the suitable model when SKAE is closest to 0 and SKV is closest to 1. And save this suitable model to the database with geotag for building the Experimental Variogram Database.

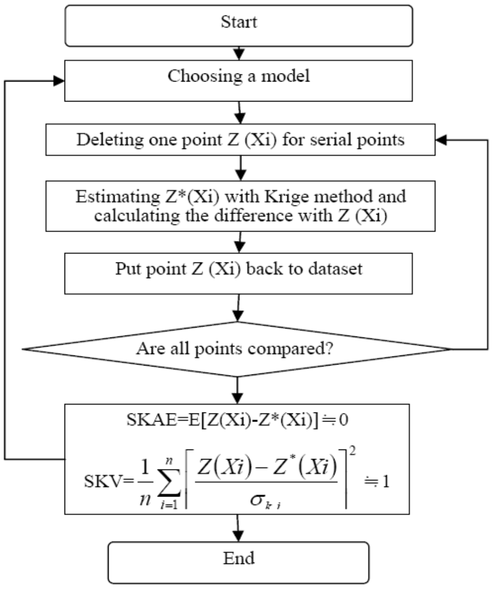

Figure 5 Cross Validation Flowchart

4. CONCLUSION

We utilizing GWT to create the online service for Krige estimation to deploy on Glassfish application server. Through the online Kriging service we hope to systematically collect data in near-shore areas, and find more suitable models to improve estimation quality.

Kriging is a popular method for the estimation of near-shore topography. But improper variogram models will cause estimation errors. So, it is important to study the respective variogram model. Since most users are not familiar with the Krige algorithm and the selection of experimental variogram models, we introduce the GIS concept for the online Kriging service, using history data to create a variogram model database to serve as initial model when selecting variogram model parameters for the topography estimate.

Because lack of the history data at the near shore area. We should collect more data from online service to approve the local area variogram model to get a better initial model to improve the estimate quality.

Figure 6 Plot of the Raw Data

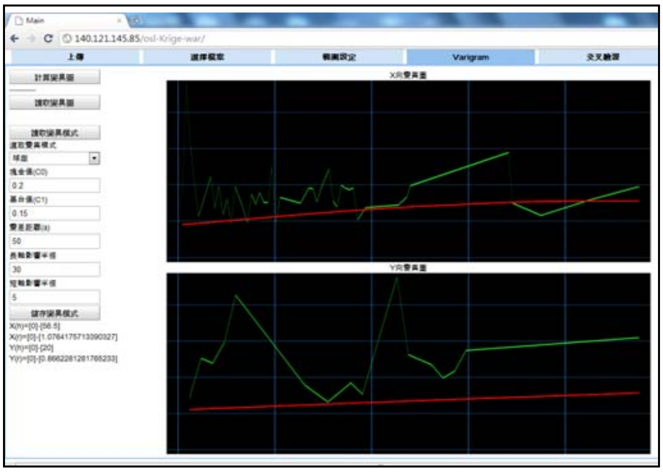

Figure 7 X & Y experimental variogram

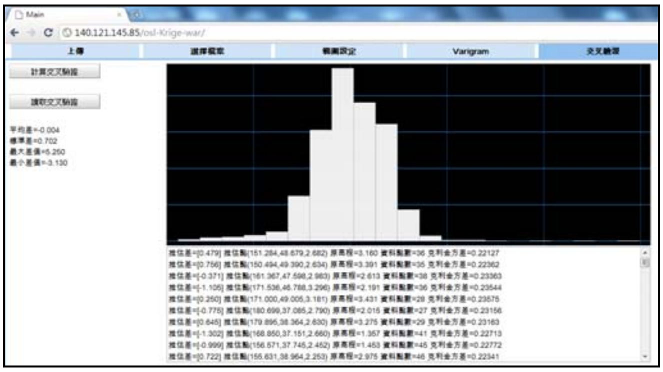

Figure 8 Histogram of Cross Validation

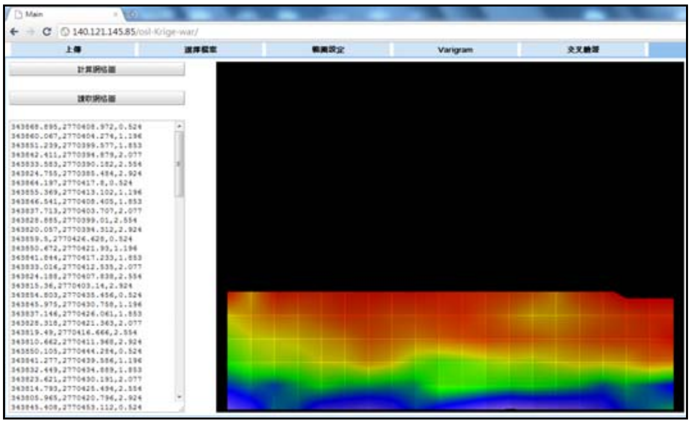

Figure 9 Render of DEM

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