PROGRESSIVE COMPRESSION OF DIGITAL ELEVATION DATA USING MESHES

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ABSTRACT

Several different GIS Data Formats exist [1]. These data formats can store informations such as;

- geographic information, which provides the position and shapes of specific geographic features,
- attribute information, which provides additional non-graphic information about each feature, and
- display information, which describes how the features will appear on the screen.

Therefore geospatial data is similar to 3D mesh representation in many ways. As seen on Figure 1, a typical digital elevation representation consists of 3D point clouds and their connectivity information. These information correspond to the geometry and connectivity information of 3D mesh models respectively [2]. X, Y locations of a map point can be stored as the X, Y coordinate of a mesh vertex and, moreover, the elevation of the particular point can be stored as the Z coordinate of the vertex. Therefore, digital elevation data can be treated as mesh models. A mesh like representation of a digital elevation data have several advantages. For example calculation of the slope and the aspect, which are crucial for the applications like fire propogation calculation [3], can be easily done from a 3D mesh like representation of a map.

As the area represented by the map file gets larger, the amount of data stored in the map file also increases. Therefore ways of efficiently storing those data become a crucial issue. Since the digital elevation data, can be represented as a 3D mesh, static mesh compression techniques can be used to efficiently store these data. Especially the algorithm given in [4], which compresses 3D mesh models using image compression tools, is very suitable for the compression of the digital elevation data. In [4] it is proposed that, 3D mesh models can be converted to images using orthographic projection, that can then be compressed using image data compression algorithms. Digital elevation data is very suitable for orthographic projection in its nature. One can directly use the elevation data as the pixel values of the projected image and the X, Y value of each node as the pixel location. Therefore it is straightforward to create 2D images from maps. Actually grid-like digital elevation data is a raster format itself. The connectivity infomation of a map can also be defined directly for the pixel neigborhood therefore there is no extra need for the trasmission of the connectivity information like in 3D meshes.

In this paper a new compression algorithm will be proposed. First, geometric information of a map will be converted to an image using the method proposed in [4]. The obtained image will be a grayscale image, whose pixel values are the elevation values of the map points. Then this grayscale image will be compressed using an adaptive wavelet based image compression algorithm [5],[6],[7]. The compression method will be an adaptation of the wavelet based compression methods proposed in [4]. It is planned to take advantage of the multiresolution property of the wavelets while coding the map images. Using multiresolution techniques of wavelets, it will be possible to decode different resolutions of the map from the encoded bit stream providing a multiresolution display of a map. By this way a multiresolution technique for the map representation is planned to be developed.

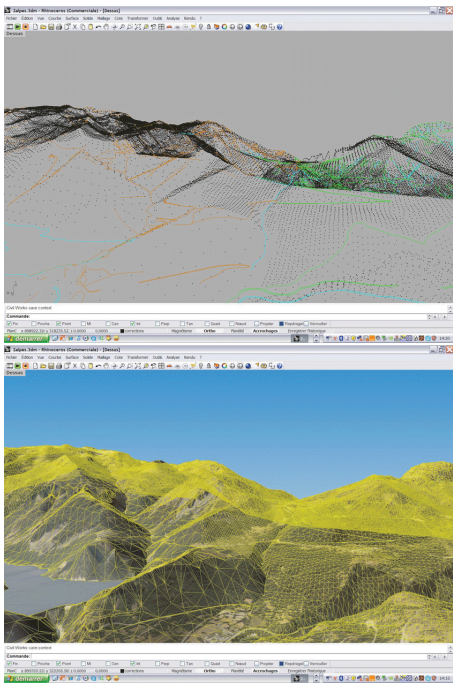

Fig. 1. Irregular mesh like representation ofdigital elevation data

1. REFERENCES

[1] http://data.geocomm.com/helpdesk/formats.html# types (accessed 12 January 2009)

[2] A. Smolic, et. al. (Eds. H. M. Ozaktas, L. Onural), Chapter 8 - A Survey on Coding of Static and Dynamic 3D Meshes, *Three Dimensional Television-Capture, Transmission, Display*, Springer, 2008.

[3] K. Kose, N. Grammalidis, E. Y?lmaz and E. Cetin, 3D Wildfire Simulation System, *ISPRS*, Commission VIII, WG VIII/11, August, 2008.

[4] K. Kose, A. E. Cetin, U. Gudukbay, L. Onural, Connectivity-Guided Adaptive Lifting Transform for Image Like Compression of Meshes, *3DTV Conference*, Kos Island, Greece, 7-9 May 2007.

[5] O. N. Gerek, A. E. Cetin, Adaptive polyphase subband decomposition structures for imagecompression, *IEEE Transactions on Image Processing*,2000

[6] O. N. Gerek, A. E. Cetin, A 2-D orientation-adaptive prediction filter in lifting structures for image, *IEEE Transactions on Image Processing*, 2006

[7] A. E. Cetin, O. N. Gerek, S. Ulukus, Block wavelet transforms for image coding, *IEEE Transactions on Circuits and Systems for Video Technology*, 1993