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VISIBLE WATERMARKING ALGORITHM FOR DIGITAL GRID MAP BASED ON WAVELET TRANSFORMATION

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INTRODUCTION

In this decade, the advent of the Internet has resulted in many new opportunities for the creation and delivery of content in digital form such as the geospatial map, which can be easily got, store, copy and distribute with the growth of Internet. An important issue that arises in these applications is the protection of the rights of geospatial maps. The digital watermarking is a new technique to solve the problem.

A digital watermark can be visible or invisible. A visible watermark typically consists of a conspicuously visible message or a logo indicating the user's ownership. Visible watermark can protect the data copyright in a more proactive way. It can not only provide a direct copyright symbol by such a visible watermark, and also can effectively stop illegal free to use.

In this paper, the visible watermarking algorithm for digital grid map based on wavelet transformation is presented.

A VISIBLE WATERMARK ALGORITHM BASED ON WAVELET TRANSFORMATION

In general, the visible watermark is smaller than the original map, it is necessary to pretreat the watermark before embedding to ensure that it can cover most areas of the original map, and the watermark embedding location in the original map should be carefully selected, to ensure that does not reduce the quality of the original map and the visibility of the watermark details. The background of raster digital map is sharper than the usual map, has higher background color value than the usual map, and the value of adjacent pixels changed greatly than the usual map. So considering the data features of raster digital map and the human visual system characteristics, we can analyze and determine the embedding position.

First, assume that the size of the original map is M*N, the visible watermark size is m*n. Extend the visible watermark to ensure it can cover most areas of the original map. Then, set the m*n regions in the upper left corner of the original map as D, W being treated as a slider, from top to bottom, left to right, slip the region D for the entire original map by each distance h. The detail steps are as follows: To slip the D from left to right firstly, each time moving the slider in distance h. When slipping in horizontal is completed, the slider moves down the distance h. Then start a new slipping in horizontal from left to right again; Do the whole process again and again until slip the entire map. Let the beginning region the slider covered be Reg(1, 1), next regions the slider covered be Reg(i, j).

The visible watermark and the original maps must be expansion at the same time when embedding because the embedded watermark can not only affect the overall brightness of the original map, but also affect their detail features. Considering the characteristics of visible watermark, the paper used linear addition algorithm.

The process of embedding the visible watermark can be described in Figure 1 as:

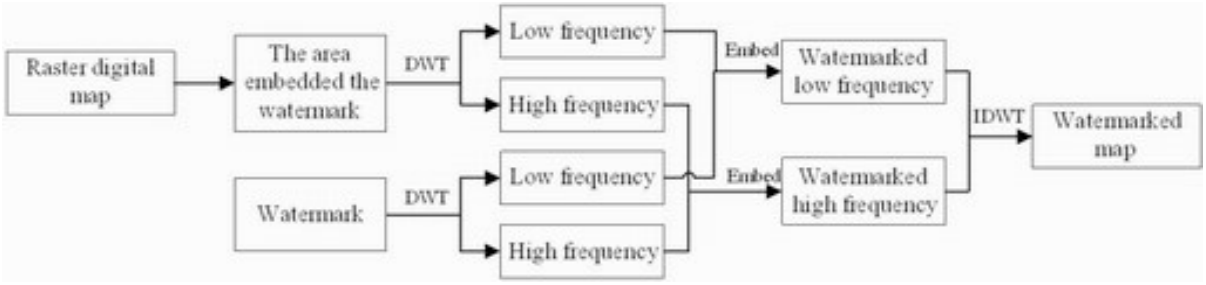

Fig. 1 The process of embedding the visible watermark

EXPERIMENTS

Here, the map (894 × 804 pixels, 256 bits/pixel) is used as the test image (Fig. 2), and the visible watermark (200 × 150 pixels, 256 bits/pixel) is shown in Fig.3.

Fig. 2 The experiment map *Fig. 3 The visible watermark*

The watermarked maps are shown in Figure 4, in which showed the visible watermark in the map with different visibility levels. In fact, the watermark can be presented in any visibility level.

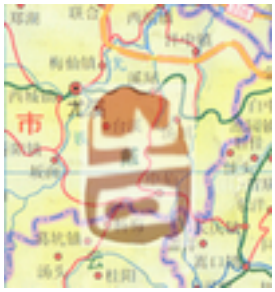

Fig. 4 The visible watermark in the maps with different visibility levels

CONCLUSIONS

In this paper, a wavelet-based visible watermarking algorithm that adapts in color or grayscale raster digital map was proposed. The raster digital map had the characteristics of high brightness and low saturation, so that the watermark information was embedded into the grid digital map in an adaptive way to meet the visible watermark robustness. At the same time, the watermark was expanded before the watermark embedding, and was embedded in the visually important region of the grid map. Moreover, proposed visible watermarking method met the requirement of without damaging the quality of the original data, and will be very difficult to remove the visible watermark.