Vector Map Data Watermarking Method using Binary Notation

Jung-yeop, Kim* · Soo-hong Park**

ABSTRACT

As the growth of performance of the computer and the development of the Internet are exponential, sharing and using the information illegally have also increased to the same proportion. In this paper, we proposed a novel method on the vector map data among digital contents. Vector map data are used for GIS, navigation and web-based services etc. We embedded watermark into the coordinate of the vector map data using bit operation and extracted the watermark. This method helps to protect the copyright of the vector map data. This watermarking method is a spatial domain method and it embeds the watermark within an allowable error. Our experiment shows that the watermark produced by this method is resistant to simplification and translation.

Keywords : Watermarking, copyright protection, vector data, binary notation, GIS

요 약

컴퓨터의 사용과 인터넷이 발달로 인해 데이터의 사용과 공유가 매우 증가하고 있으며, 그에 따라 불법적인 데이터의 보급도 발생하고 있다. 본 연구에서는 이러한 불법적인 데이터의 복제 문제를 해결하기 위해 디지털 워터마킹 기법을 제안한다. 특히, GIS에서 많이 사용하고 있는 데이터인 벡터데이터에 워터마크를 삽입하고, 소유권을 주장할 수 있는 워터마킹 방법을 제안한다. 연구에서 제안한 방법은 벡터데이터의 좌표에 이전 연산을 이용하여 워터마크를 직접 삽입을 하고, 워터마크를 삽입하는 역과정을 통해 워터마크를 추출하는 것이다. 실험 결과를 통해 제안한 방법이 벡터데이터에 대한 다양한 공격에 대해 강한성을 얻은 것으로 나타났다.

주요어 : 워터마킹, 저작권 보호, 벡터 데이터, 이전 연산, GIS

* Ph. D. Candidate, Department of Geoinformatic Engineering, Inha University (jyflool@empal.com)
** Associate Professor, Department of Geoinformatic Engineering, Inha University (shpark@inha.ac.kr)
1. Introduction

Today in the computer era, the usage of computer networks is a significant amount. Internet has become the world library of information and it has allowed people to share different kinds of information such as images and sounds. In particular, the digitized data can be transferred more reliably without any loss. Since the digital information can be transmitted without any loss of data, the need for the security of the data becomes undeniable.

Even though there have been more research and results in the security of the data, watermarking is regarded as a reliable security technique. This technique has been standardized, however, there were other techniques which provide the same protection. There were various watermark algorithms developed, which were meant to change the tone in the images, videos and audios. Those algorithms are mostly frequency domain watermarking technique such as DFT (Discrete Fourier Transform), DCT (Discrete Cosine Transform), and DWT (Discrete Wavelet Transform). While previous studies were mainly on the multimedia data, relatively there were few studies on vector map data used in GIS (Geographic Information System). Also, previous watermarking methods cannot be directly applied to the vector map data because the vector map data consists of many points, polylines, and polygons and also the data structure is different from the other data [3].

Vector map data have become quite popular in the last few years. These data are used not only in GIS, but also in various fields. For example, they are used in car navigation systems (Telematics) and web-based map services. GIS-data represent a high material value due to its high efforts and costs in the acquisition and maintenance of point coordinates [1].

A GIS is a system for capturing, storing, analyzing and managing the data and the associated attributes which are spatially in reference with the earth using computer techniques. In Korea, many databases for GIS communication were constructed by several local bodies and enterprises, and the Korean government too have begun NGIS (National GIS) project. Even though there are more advantages in the construction of the data and the protection of the data using this algorithm, there is little awareness regarding the copyright protection of the data in GIS field. In order to enhance the copyright protection in GIS, applying watermarking for vector map data is important.

The vector and the raster structure are used to represent the spatial objects relative to the geographic information in a GIS. Raster structure is a geographic data set in which values are assigned to a rectangular array of object in two dimensions the plane is covered with a rectangular array. Vector is a data structure, used to store the spatial data. Vector map data is comprised of lines or arcs, defined by a beginning and an end point, which meet at nodes. The locations of these nodes and the topological structure are usually stored explicitly. Each structure has its own advan-