Reversible fragile watermarking for locating tampered blocks in 2D vector maps

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Abstract For 2D vector maps, obtaining good tamper localization performance and original content recovery with existing reversible fragile watermarking schemes is a technically challenging problem. Using an improved reversible watermarking method and a fragile watermarking algorithm based on vertex insertion, we propose a reversible fragile watermarking scheme that detects and locates tampered blocks with high accuracy while ensuring recovery of the original content. In particular, we propose dividing the features of the vector map into different blocks, calculating the block authentication watermarks and embedding the watermarks with different watermarking schemes. While the block division ensures superior accuracy of tamper localization, the reversible watermarking method and the fragile watermarking algorithm based on vertex insertion provide recovery of the original content. Experimental results show that the proposed scheme could detect and locate malicious attacks such as vertex/feature modification, vertex/feature addition, and vertex/feature deletion.

Keywords Fragile watermarking · Reversible data hiding · Authentication · Tamper localization · 2D vector map

1 Introduction

These days, 2D vector maps, the fundamental data of geographical information systems (GIS) are gradually replacing their classical analog counterparts. This is quite understandable because vector geo-spatial data are of high accuracy [22], and easy to replicate, manipulate and distribute. On the other hand, thanks to powerful available tools and equipment, it is very easy even for an amateur to illegally modify these valuable data and create "perfect" forgeries. This

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