A Steganalysis Method for 2D Engineering Graphics Based on the Statistic of Geometric Features

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ABSTRACT

Aiming at hiding information in 2D engineering graphics based on geometric features, a steganalysis method is proposed in this paper. First, the authors obtained the number of 2D engineering graphics’ strictly vertical and horizontal lines and identify the number of horizontal and vertical lines which are deviated from the straight line within a certain range. Subsequently, the authors selected the ratio between the deviated lines and the normal lines as the statistical characteristics. Finally, a detection model was constructed based on the hypothesis. Experimental results show that the algorithm can detect hidden information in the 2D engineering graphics effectively.

Keywords: 2D Engineering Graphics, Detection Model, Geometric Features, Information Hiding, Steganalysis

1. INTRODUCTION

With the development of the multimedia and information technology, information security is becoming an increasingly prominent issue. Currently, Information hiding is a research hotspot in the digital media security. Information can be embedded into the host without degrading its visual quality. Contrary to information hiding, steganalysis is a technology for detecting hidden information. Research on steganalysis is mainly concentrated on mediums such as image, audio, video and text, while little attention has been paid to 2D engineering graphics. Many scholars have put forward information hiding algorithms for 2D engineering graphics and achieved some good results. The existing information hiding algorithms for 2D engineering graphics can be classified into two categories: (1) information hiding algorithms based on the change of the property characteristics of 2D engineering graphics; (2) information hiding algorithms based on the change of the geometric features of 2D engineering graphics. For the first category, a steganalysis method is proposed for 2D engineering graphics based on...

DOI: 10.4018/jdcf.2011040103
the statistic of characters (Peng & Sun, 2008), and it can effectively detect hidden information based on the change of the color and line width. However, it cannot detect hidden information based on the change of the geometric features.

For this situation, we propose a steganalysis method for 2D engineering graphics based on the statistics of geometric features. A detection model is constructed based on the hypothesis that the normal graphics should have a normal ratio between the deviated lines and the strictly vertical and horizontal lines.

The rest of the paper is organized as follows: the information hiding method based on the geometric features is briefly introduced in the second Section and the detection algorithm is described in the third Section. The results are demonstrated in the fourth Section. The summary of the paper is given in the last Section.

2. INFORMATION HIDING FOR 2D ENGINEERING GRAPHICS BASED ON GEOMETRIC FEATURES

Information hiding algorithms by changing geometric features can be divided into algorithms in spatial domain and algorithms in frequency domain. In the spatial domain, a scale digital watermarking algorithm for 2D engineering graphics is proposed in Wang and Xu (2003). It uses vertices of all entities as watermark carriers and can resist attacks such as translation, rotation and scaling. However, it is vulnerable to entity addition and deletion. A spread spectrum digital watermarking algorithm for 2D engineering graphics is proposed in Wang, Liu, and Xu (2005). Firstly, the narrow band signal for embedding is spread into wide band pseudo-random sequence, then the watermark is embedded by modulating and modifying the length of the lines. It is robust against the translation, rotation, scaling, entity addition and deletion, but the capacity is small and spread spectrum synchronization is complex.

In the frequency domain, a non-blind detection watermarking algorithm for 2D engineering graphics is proposed in Huang and Gu (2006a), the vertices of all entities are acted as watermark carriers. Firstly, the coordinates of 2D engineering graphics are used to construct complex signals, and then Fourier transform is applied to them. After that, the watermark is embedded into the magnitude of the Fourier coefficients. Due to the advantages of Fourier transform, it can resist attacks such as translation and rotation. Since the embedded watermark information is redundant, it is also robust against attacks such as entity addition and deletion, but cannot resist against scaling. A watermarking algorithm based on chaotic and wavelet transform for 2D engineering graphics is proposed in Huang and Gu (2006b). The coordinates of vertices are used to construct complex signals, and wavelet transform is applied to the complex signals. After that, the watermark encrypted by chaos sequence is embedded by modulating the amplitudes of detail wavelet coefficients. Because of the characteristics of wavelet transform, it is robust against translation, rotation and scaling. It can also resist attacks such as entity addition and deletion, but the embedding capacity is relatively low.

After an analysis of the information hiding algorithms for 2D engineering graphics based on geometric features, we find that the essence of them is that the watermark embedded is based on the modification of the vertex coordinates. Here, a steganalysis method is proposed based on this principle.

3. A STEGANALYSIS METHOD FOR 2D ENGINEERING GRAPHICS BASED ON THE STATISTICS OF GEOMETRIC FEATURES

Generally, the process of designing a 2D engineering graphic is regulated by some rules: the normal vertical or horizontal lines should be
The General Theory of Crime and Computer Hacking: Low Self-Control Hackers?
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