

A NEW STEGANOGRAPHY METHOD VIA VARIOUS ANIMATION TIMING EFFECTS IN POWERPOINT FILES

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Abstract:

In this paper, a new steganography method that hides message via various animation timing effects in a PowerPoint file is proposed. The animation effects are designed for the presenter to emphasize the key points, control the flow or enrich the interesting in presentation. Then the animation timing effect is the speed, time and repeat control part of animation effect. It is worth mentioning that adding animation effects does not change any content of the slides in the PowerPoint file. In contrast to other steganography methods, using various animation effects to hide message not only livens up on-screen presentations, but also keeps the real content of the PowerPoint file intact.

Keywords:

Steganography, Data hiding, PowerPoint file, animation timing effects

1. Introduction

Due to fast growth of Internet applications, digitized data becomes more and more popular. Because of the property of digitized data, easy to duplicate and modify, the researches of information security become prosperous. The techniques of cryptography and steganography are usually used in privacy communication. The term of steganography comes from the Greek words, stegano and graphia, and means "covered writing" which is usually interpreted to mean hiding information in other information [1]. In contrast to cryptography which is about protecting the content of privacy messages, the steganography is about concealing their very existence. Many steganography methods [2-7] use various digital materials to cover privacy message, for example using inter-word space to hide message in electronic document [2], hiding data imperceptibly in a digital audio recording [3], hiding message in the least-bit plane of a digital image [4], and etc. Most of steganography methods acquire good performance of secret communication but cause little distortion of cover materials.

In our previous research [8], we use various animation

effects to stand for characters. We discover the embedded PowerPoint file made by the previous method may be unnatural in few cases. In this paper, we extend the preceding research and propose a new steganography method that hides message via various animation timing effects in a PowerPoint file. The animation timing effects can be added in any animation effects even if in the same effect appearing on any slide of a PowerPoint file, such as a text box, a line, an image, etc. Since different animation timing effects is used to represent (hide) different message, the real content of the PowerPoint file can be kept intact.

In the remaining of the paper, Microsoft PowerPoint and its animation effects will be described briefly in Section 2. In Section 3, we will present the proposed method. An example will be given to illustrate the embedding procedure in Section 4. Some conclusions will be made in the last section.

2. Microsoft PowerPoint and Animations

Microsoft PowerPoint is a ubiquitous presentation program and widely used by businesspeople, researchers, and educators. It is a powerful tool to create professional looking presentations and slide shows. In Microsoft PowerPoint, text, images, graphs, and other objects are positioned on individual pages or slides.

Microsoft PowerPoint lets user create "animations" to liven up on-screen presentations. Animations are applied on text, images, or other elements and appear on a slide at timed intervals or with a mouse click. Animations are often accompanied by a sound effect. They can be used to control how and when text, images, graphs, and other objects appear on your PowerPoint slides. For example, you can make images or text items appear one at a time and add visual or sound effects. Animation can aid in focusing attention during a presentation and make your Slide Show more interesting.

Figure 1 shows three different types of objects appearing on a slide of a PowerPoint file. Each of them is a

text box, a directed line, and a sunset image. Here, we will give an example to illustrate the animation effects. Figure 2 shows a slide without animation effect. If we add the “Bold Reveal” animation effect in the text box “Steganography & Watermarking”, the animation effect as shown in Figure 3 will appear when we click mouse. This will attract the attention of audience on the emphasized object.

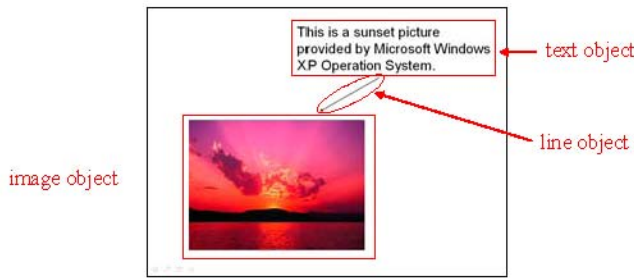


Figure 1. Three different types of objects appearing on a slide.



Figure 2. The presentation without animation effect.

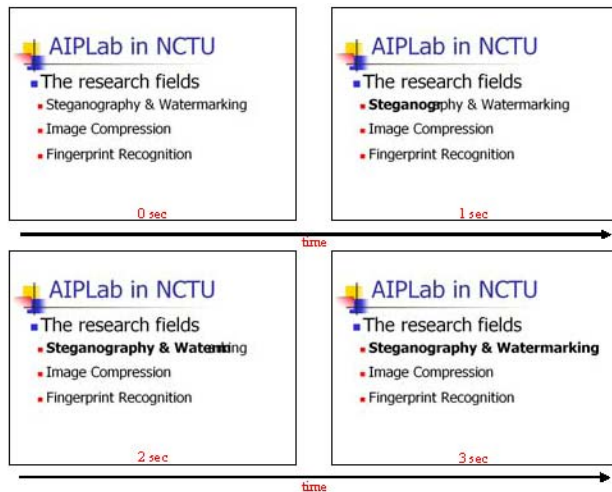


Figure 3. The presentation with “Bold Reveal” animation effect on the text object “Steganography & Watermarking”.

The Microsoft PowerPoint animation effects can be

grouped into four categories: Entrance, Emphasis, Exit and Motion Paths. Entrance effects can be set to objects so that they enter with animations during Slide Show. Emphasis effects animate the objects on the spot. Exit effects allow objects to leave the Slide Show with animations. Motion Paths allow objects to move around the Slide Show.

Furthermore, the PowerPoint 2003 software provides the timing operation to enrich the animation effect and make the slide show livelier. The timing operation includes four parts, start rule, delay time, speed and repeat times. We describe the four terms briefly. The start rule includes On Click, With Previous and After Previous. The delay value is that the differences between the three animations really becomes obvious. The speed decides the show time of animations and provides five default types. The repeat times denote times of the animation effect show. Each animation effect contains its own timing parameter. This makes animation effects more flexible and interactive.

As shown in the above figures, we can see that using animation effects in presentation can help the presenter more easily to catch the attention of viewers on the highlighted object and keep the slide content intact. Based on this property, we will propose a method to hide messages via various animation timing effects in a Microsoft PowerPoint file. Different animation timing effect will be used to represent (hide) different secret message, and the real content of the PowerPoint file can still be kept intact.

3. The proposed Method

As mentioned previously, to make presentation more attractive, some animation effects are usually applied in a PowerPoint file. We present a new method to embed secret message via animation timing effects in a PowerPoint file. The proposed method combines speed and delay to generate different animation timing effects that stand for different characters and no matter what the embedded animation effect is.

Furthermore, to speedup and simply our method, a codebook is designed to record the corresponding between the animation timing effects and characters and is used to convert the characters in a secret message to the animation timing effects or reverse the animation timing effects to the message. The proposed method contains two parts, one is the embedding process and the other is the extracting process. Both processes use the same animation timing codebook as a look-up table. The detail will be described in the following subsections.

3.1. Animation Timing Codebook

As mentioned previously, there are four parts, start rule, delay time, speed and repeat times in timing operation in the Microsoft PowerPoint. The number of variations of each part is shown in Table 1. From Table 1, we can see that the total volume of animation timing effect variations of the PowerPoint is very large. It is very helpful for us to design an animation timing codebook.

Table 1: The number of animation timing effect variations.

Animation Timing Effect Operations	Numbers of Variations
Start	3
Delay	Unlimited
Speed	5(default);Unlimited
Repeat	8

Although the delay time and speed are unlimited, we only use the delay time interval from 0.1 second to 1 second and five types of speed (the default values) for security and natural slide-show purposes.

3.2. Embedding Process

Before introducing the embedding process, we will make two general assumptions. These will be followed by the proposed embedding process.

Assumption 1: The sender and receiver have the same animation timing codebook.

Assumption 2: The embedding animation timing effects applied on objects must obey the human perception.

In the embedding process, we need three materials to create the embedded PowerPoint file. The first is the secret message M being transmitted. The second is the Animation Timing Codebook (ATC), which will record the corresponding between characters used in secret message and the animation timing effects. The last is the cover media, the adaptive PowerPoint file, which can be downloaded from Internet and will be used to embed secret message. In the following, we will describe the embedding steps in detail.

1. Find out the set of animation effects, E , which could be text boxes, directed lines, and images, in all slides.
2. Generate a random binary sequence, R , with the number of 1 being the same as the length of secret message.
3. Process each animation effect in E based on the binary sequence R .
4. For each animation effect processed and the corresponding bit on R , R_i :

- (1) If $R_i = 0$, either an animation timing effect not in ATC or no any animation timing effect is added.
- (2) If $R_i = 1$, the animation timing effect in ATC corresponding to the secret character is added.
5. Repeat step 4 until all characters in secret message are embedded.

3.3. Extracting Process

Similar to the embedding process, we need two materials to extract our secret message in the extracting process. One is the embedded PowerPoint file and the other is the same Animation Timing Codebook, ATC , used in the embedding process. The steps of the extracting process are described as follows.

1. Extract all animation timing effects, added in objects from the embedded PowerPoint file sequentially.
2. For each extracted animation timing effect, check if it is in ATC . If yes, convert it to the corresponding character based on ATC . Otherwise, skip.
3. Merge all extracted characters to form the secret message.

4. Experiments

Note that one of the most important works in the proposed method is to design an adaptive animation timing codebook, which will be used to embed and extract secret message. Here, we will give an example of codebook design by combining delay and speed. A simple codebook with 37 different characters/symbols is created and shown in Table 2. For security and natural slide-show purposes, every animation timing effect is limited to the delay time. The delay time interval is from 0.1 second to 1 second and 5 speed types (the default values); this makes information hiding securer and more natural.

Table2: An example of animation timing codebook.

Delay time	Speed	Corresponding symbol/ character
0.1 seconds	0.5 seconds (Very Fast)	0
0.2 seconds	0.5 seconds (Very Fast)	1
0.3 seconds	0.5 seconds (Very Fast)	2
0.4 seconds	0.5 seconds (Very Fast)	3
0.5 seconds	0.5 seconds (Very Fast)	4
0.6 seconds	0.5 seconds (Very Fast)	5
0.7 seconds	0.5 seconds (Very Fast)	6
0.8 seconds	0.5 seconds (Very Fast)	7
0.9 seconds	0.5 seconds (Very Fast)	8
1 seconds	0.5 seconds (Very Fast)	9
0.1 seconds	1 seconds (Fast)	A
0.2 seconds	1 seconds (Fast)	B
0.3 seconds	1 seconds (Fast)	C
0.4 seconds	1 seconds (Fast)	D
0.5 seconds	1 seconds (Fast)	E
0.6 seconds	1 seconds (Fast)	F
0.7 seconds	1 seconds (Fast)	G
0.8 seconds	1 seconds (Fast)	H
0.9 seconds	1 seconds (Fast)	I
1 seconds	1 seconds (Fast)	J
0.1 seconds	2 seconds (Medium)	K
0.2 seconds	2 seconds (Medium)	L
0.3 seconds	2 seconds (Medium)	M

0.4 seconds	2 seconds (Medium)	N
0.5 seconds	2 seconds (Medium)	O
0.6 seconds	2 seconds (Medium)	P
0.7 seconds	2 seconds (Medium)	Q
0.8 seconds	2 seconds (Medium)	R
0.9 seconds	2 seconds (Medium)	S
1 seconds	2 seconds (Medium)	T
0.1 seconds	3 seconds (Slow)	U
0.2 seconds	3 seconds (Slow)	V
0.3 seconds	3 seconds (Slow)	W
0.4 seconds	3 seconds (Slow)	X
0.5 seconds	3 seconds (Slow)	Y
0.6 seconds	3 seconds (Slow)	Z
0.7 seconds	3 seconds (Slow)	Space/blank

Based on the codebook, we will give an example to embed message in a PowerPoint file. Assume that Alice wants to make a date with Bob on July 30 at NCTU; she wants to transmit the message “NCTU0730” to Bob in secret. First, Alice creates a PowerPoint file which describes the ten research fields of the automatic information processing laboratory in National Chiao-Tung University (AIPLab in NCTU). The PowerPoint file contains two slides, the first one shown in Figure 4(a) lists the first five research fields, the second one shown in Figure 4(b) lists the last five research fields. Each research field is considered as a text object. The PowerPoint file includes thirteen animation effects and describe briefly as follows:

1. The first five research fields enter the first slide through Entrance-Box effect.
2. The first research field is emphasized with Emphasis-Bold Reveal effect.
3. The second research field is emphasized with Emphasis-Bold Reveal effect.
4. The third research field is emphasized with Emphasis-Bold Reveal effect.

5. The forth research field is emphasized with Emphasis-Bold Reveal effect.

6. The fifth research field is emphasized with Emphasis-Bold Reveal effect.

7. The second slide enters through Entrance-Box effect.

8. The last five research fields enter the first slide through Entrance-Box effect.

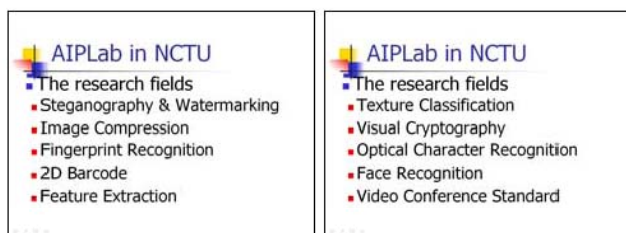
9. The sixth research field is emphasized with Emphasis-Bold Reveal effect.

10. The seventh research field is emphasized with Emphasis-Bold Reveal effect.

11. The eighth research field is emphasized with Emphasis-Bold Reveal effect.

12. The ninth research field is emphasized with Emphasis-Bold Reveal effect.

13. The last research field is emphasized with Emphasis-Bold Reveal effect.



(a) The first slide. (b) The second slide.
Figure 4. A PowerPoint file with two slides.

Then Alice generates the random binary sequence "1111001101001". After getting the random binary sequence, the secret message "NCTU0730" can be embedded in selected animation effects of the PowerPoint file. "N" can be embedded in the first animation effect through Delay "0.4 seconds" and Speed "Medium" animation timing effect, "C" in the second animation effect through Delay "0.3 seconds" and Speed "Fast" animation timing effect, "T" in the third animation effect through Delay "1 seconds" and Speed "Medium" animation timing effect, "U" in the forth animation effect through Delay "0.1 seconds" and Speed "Slow" animation timing effect, "0" in the seventh animation effect through Delay "0.1 seconds" and Speed "Very Fast" animation timing effect, "7" in the eighth animation effect through Delay "0.8 seconds" and Speed "Very Fast" animation timing effect, "3" in the tenth animation effect through Delay "0.4 seconds" and Speed "Very Fast" animation timing effect, and the final character "0" in the last animation effect through Delay "0.1 seconds" and Speed "Very Fast" animation timing effect. To see the animation effects, the embedded PowerPoint file can be

downloaded from <http://debut.cis.nctu.edu.tw/Reports/ppt/test.pps>. In the example, many different kinds of animation timing effects can be embedded to the same animation effect and a object can be embedded at most three symbols via using Entrance (the effect how the object comes in the side), Emphasis/Motion Paths (the effect where the key point is in presentation) and Exit (the effect how the object leaves the side) animation effects sequentially.

According to the example, we can see that the proposed method not only keeps the fidelity of the content of PowerPoint file but enriches the PowerPoint file in presentation.

4. Conclusion and Discussion

In this paper, we propose a new steganography method via the animation timing effects in PowerPoint files and make a experiment to show the performance of the proposed method. In contrast to other steganography methods, our method does not distort the PowerPoint file and can naturally hide information in files.

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References

- [1] S. Katzenbeisser and F. A.P. Petitcolas. Information Hiding Techniques for Steganography and Digital Watermark. Massachusetts: Artech House, Inc., 2000.
- [2] D. Zou and Y. Q. Shi. "Formatted text document data hiding robust to printing, copying and scanning." in Proc. of IEEE Int. Symposium on Circuits and Systems, vol. 5, pp. 4971-4974, Kobe, Japan, May 2005.
- [3] J. Chou and K. Ramchandrad. "Next generation techniques for robust and imperceptible audio data hiding." in Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing, vol. 3, pp. 1349-1352, Salt Lake City, UT, USA, May 2001.
- [4] S.-H. Liu, T.-H. Chen, H.-X. Yao, and W. Gao. "A variable depth LSB data hiding technique in images." in Proc. of Int. Conf. on Machine Learning and Cybernetics, vol.7, pp. 3990-3994, Shanghai, China, Aug 2004.
- [5] Y.-K. Lee and L.-H. Chen. "High capacity image steganographic model." in IEE Proc. on Vision, Image,

and Signal Processing, vol. 147, issue. 3, pp. 288-294, June 2000.

- [6] Y.-K. Lee and L.-H. Chen. "Object-based Image Steganography Using Affine Transformation," Int. J. of Pattern Recognition and Artificial Intelligence, vol. 16, no. 6, pp. 681-696, September 2002.
- [7] Y.-K. Lee and L.-H. Chen. "Secure Error-Free Steganography for JPEG images," Int. J. of Pattern Recognition and Artificial Intelligence, vol. 17, no. 6, pp. 967-981, September 2003.
- [8] W.-C. Yang and L.-H. Chen. "A Novel Steganography Method via Various Animation Effects in PowerPoint Files," in Proc. of Int. Conf. on Machine Learning and Cybernetics, vol. 6, pp. 3102-3107, 12-15 July 2008.