Steganography in Color Animated Image Sequence for Secret Data Sharing Using Secure Hash Algorithm

Ratan Kumar Basak (✉ ratan.iww@gmail.com)
University of Engineering and Management, Kolkata

Ritam Chatterjee
University of Engineering and Management Kolkata

Paramartha Dutta
Visva-Bharati University

Kousik Dasgupta
Kalyani Government Engineering College

Manuscript

Keywords: Steganography, SHA1, LSD substitution, ASCII

Posted Date: February 5th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-193132/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License
Abstract

This paper presents a high capacity steganographic approach with secret message validation scheme at the receiver end. The proposed idea develops specifically for animated GIF, the cover media, to conceal secret text messages where Least Significant Digit (LSD) method is employed to embed secret information in the form of ASCII value. To validate the secret information at the receiver end, the secret text is encoded with Secure Hash Algorithm-1 (SHA1) which is subsequently embedded in certain pre-defined portion of the cover media. The proposed algorithm is experimented on a large set of colored animated image sequences by varying text messages which produces satisfactory results. The proposed method also maintains good visual perceptibility while securing high embedding capacity.

Full Text

This preprint is available for download as a PDF.

Figures

Figure 1

Step 2 example

Figure 2
Right Rotate

![Right Rotate Diagram]

Figure 3

Left Rotate

![Left Rotate Diagram]

Figure 4

Pixel Block
### Figure 5

Pixel Block with value

|   |   |   |
|---|---|---|
|160|162|160|
|158|162|160|
|161|159|168|
Figure 6

Old Block

|   |   |   |
|---|---|---|
| 160 | 162 | 160 |
| 158 | 162 | 160 |
| 161 | 159 | 168 |
|    | 161 | 162 | 163 |
|----|-----|-----|-----|
| 154| 162 | 165 |
| 166| 157 | 168 |

**Figure 7**

New Block
Figure 8

Flow chart

Start

Take secret message

Take image sequence as Cover

Start creating 3x3 pixel blocks

Embed the ASCII string in the pixel blocks

If Secret message ends

Create 3x3 pixel blocks and embed the ASCII SHA1 in the pixel blocks as well.

If the SHA1 ends

End
|    | 240 | 230 | 227 | 231 | 240 | 251 | 230 | 240 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|
| 235| 210 | 200 | 205 | 200 | 240 | 230 | 227 | 231 |
| 231| 240 | 251 | 230 | 247 | 235 | 210 | 200 | 205 |
| 240 | 240 | 230 | 227 | 231 | 240 | 230 | 227 | 231 |
| 231 | 240 | 230 | 227 | 231 | 231 | 240 | 240 | 230 |
| 235 | 210 | 200 | 205 | 200 | 205 | 200 | 210 | 200 |
| 240 | 240 | 230 | 227 | 231 | 240 | 230 | 227 | 231 |
| 239 | 230 | 251 | 230 | 247 | 240 | 230 | 227 | 231 |
| 231 | 240 | 240 | 230 | 227 | 210 | 200 | 205 | 200 |
| 205 | 200 | 210 | 200 | 205 | 251 | 230 | 247 | 239 |
| 231 | 240 | 251 | 230 | 247 | 198 | 240 | 240 | 230 |
| 251 | 230 | 247 | 239 | 230 | 239 | 230 | 247 | 251 |
| 240 | 230 | 227 | 231 | 240 | 231 | 240 | 240 | 230 |
| 210 | 200 | 205 | 198 | 205 | 200 | 210 | 200 | 205 |
| 251 | 230 | 247 | 239 | 230 | 231 | 240 | 251 | 230 |
| 240 | 240 | 230 | 227 | 231 | 200 | 198 | 251 | 230 |
| 231 | 240 | 251 | 230 | 247 | 239 | 230 | 251 | 230 |

Figure 9

Cover Frame

| 240 | 230 | 227 |
|-----|-----|-----|
| 231 | 240 | 251 |
| 230 | 247 | 239 |

Figure 10
3x3 pixel block from cover frame

| 246 | 235 | 228 |
|-----|-----|-----|
| 233 | 239 | 246 |
| 237 | 247 | 233 |

**Figure 11**

New embedded Values

| 246 | 235 | 228 |
|-----|-----|-----|
| 233 | 239 | 246 |
| 237 | 247 | 233 |

**Figure 12**

New embedded Values
|   | 246 | 235 | 228 | 233 | 239 | 246 | 237 | 247 | 233 | 230 | 251 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 235 | 210 | 200 | 205 | 200 | 240 | 230 | 227 | 231 | 240 | 240 |
| 231 | 240 | 251 | 230 | 247 | 235 | 210 | 200 | 205 | 200 | 210 |
| 240 | 240 | 230 | 227 | 231 | 240 | 230 | 227 | 231 | 240 | 251 |
| 239 | 240 | 251 | 230 | 247 | 239 | 230 | 251 | 230 | 247 | 239 |
| 240 | 240 | 230 | 227 | 231 | 231 | 240 | 240 | 230 | 227 | 231 |
| 239 | 230 | 200 | 205 | 200 | 205 | 200 | 210 | 200 | 205 | 205 |
| 240 | 230 | 227 | 231 | 240 | 231 | 240 | 251 | 230 | 247 | 231 |
| 239 | 230 | 251 | 230 | 247 | 240 | 230 | 227 | 231 | 240 | 251 |
| 240 | 240 | 240 | 230 | 227 | 210 | 200 | 205 | 200 | 198 | 251 |
| 205 | 200 | 210 | 200 | 205 | 251 | 230 | 247 | 239 | 230 | 240 |
| 231 | 240 | 251 | 230 | 247 | 198 | 240 | 240 | 230 | 227 | 231 |
| 251 | 230 | 247 | 239 | 230 | 239 | 230 | 251 | 230 | 247 | 251 |
| 240 | 230 | 227 | 231 | 240 | 231 | 240 | 240 | 230 | 227 | 240 |
| 210 | 200 | 205 | 200 | 198 | 205 | 200 | 210 | 200 | 205 | 251 |
| 251 | 230 | 247 | 239 | 230 | 231 | 240 | 251 | 230 | 247 | 210 |
| 240 | 240 | 230 | 227 | 231 | 200 | 198 | 251 | 230 | 247 | 240 |
| 231 | 240 | 251 | 230 | 247 | 239 | 230 | 251 | 230 | 247 | 239 |

**Figure 13**

Stego-frame
|   160   |   165   |   161   |
|-------|--------|--------|
|   151   |   162   |   161   |
|   160   |   154   |   166   |

Figure 14

Old Block
| 160 | 165 | 161 |
|-----|-----|-----|
| 151 | 160 | 161 |
| 160 | 154 | 166 |

**Figure 15**

New Block
|   |   |   |
|---|---|---|
| 245 | 233 | 224 |
|   |   |   |
| 239 | 239 | 249 |
|   |   |   |
| 237 | 240 | 231 |

**Figure 16**

Example Block
| 245 | 233 | 224 |
|-----|-----|-----|
| 239 | 239 | 249 |
| 237 | 240 | 231 |

**Figure 18**

Example Block
| GIF | Input | Output |
|------|-------|--------|
| ![Pikachu](Pikachu.gif) | ![Frame 1](Pikachu.gif) | ![Frame 1](Pikachu.gif) |
| ![Pikachu](Pikachu.gif) | ![Frame 2](Pikachu.gif) | ![Frame 2](Pikachu.gif) |
| ![Pikachu](Pikachu.gif) | ![Frame 3](Pikachu.gif) | ![Frame 3](Pikachu.gif) |

**Figure 19**

PSNR 35.21
**Figure 20**

PSNR 35.38
Figure 22

PSNR 35.34
Figure 23

PSNR 35.92
Figure 24

PSNR 35.29
Figure 25

PSNR 35.24
| GIF   | **Input** | **Output** |
|-------|-----------|------------|
| Kakashi.gif | ![Frame 1](image1) | ![Frame 1](image2) |
|       | ![Frame 2](image3) | ![Frame 2](image4) |
|       | ![Frame 3](image5) | ![Frame 3](image6) |

**Figure 26**

PSNR 36.01
| GIF | Input | Output |
|-----|-------|--------|
| Naruto.gif | | |
| | | |
| | | |
| | | |

**Figure 27**

PSNR 36.09
Figure 28

PSNR 35.51
Figure 29

Performance comparison of proposed method with test GIFs scheme
| Method    | GIF | PSNR | Capacity |
|-----------|-----|------|----------|
| SGSAHPD   | ![GIF](image) | 36.83 | 74 Kb    |
| Proposed  | ![GIF](image) | 36.03 | 1.8 Mb   |

**Figure 30**

Comparison between Steganography in gray scale GIF Using HASH based pixel value differencing
Figure 31

Comparison of performance using Bar graph
Figure 32
PDH Analysis of Sins.gif

Figure 33
PDH Analysis of floppy.gif

Figure 34
PDH Analysis of kakashi.gif
Figure 35

PDH Analysis of naruto.gif

Figure 36

PDH Analysis of pikachu.gif