Computing Is Pretty Strange

Steganography: Something Amazing To Do with Bits

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Steganography

- The process of hiding information
- Two Greek roots meaning:
  “stego” == “roof”  “stega” == “cover”
Why Hide Information?

- Most common reason to hide information is to avoid being caught with it
  - Military and spy documents
  - Repressive governments restricting news/info
  - Avoid others “snooping” – privacy

- Hiding is different than encryption ... uses the fact that the searcher doesn’t know it’s there
Illustrate A Way To Do It

- The Plan ...
  - hide “subversive” protest photo in “calendar art”
Step 1: Reduce Bits of Guest

- We don’t need all of the bits in RGB to get a decent picture

```plaintext
1011 0100 1101 0011 0001 1100
1011 0100 1101 0011 0001 1100
```

All bits

Left 2 bits of each color
Step 2: Replace Bits In Host

- Put guest bits into right 2 bits of host
Compare fog.jpg with stegFog.png

Really? Just Do It!

fog.jpg

stegFog.png
Each of the colors is shifted left 1 bit at a time

... and then we’ll see the details
Processing Code For Guest → Host

```cpp
Plimage crowd, fog;
int i = 0;
int srcw=512;
int srch=346;
int wid=450;
int hi=300;
color c, cprime;

void setup( ) {
    size(srcw, srch);
    crowd = loadImage("egypt.jpg");
    fog = loadImage("fog.jpg");
    image(fog,0,0);
    for (int i=0; i<srcw; i++)
        for(int j=0; j<srch; j++) {
            c = get(i,j);
            if (i<wid & & j<hi) {
                cprime=crowd.get(i,j);
                cprime=color(4*(int(red(c))/4) + (int(red(cprime))/64),
                          4*(int(green(c))/4) + (int(green(cprime))/64),
                          4*(int(blue(c))/4) + (int(blue(cprime))/64));
                set(i,j, cprime);
            } else {
                set(i,j,c);
            }
        }
}

void draw( ) {
    if (mousePressed) {
        saveFrame("stegFog.png");
    }
}
```

Code To Save Result on Click
Setup to Hide The Egypt Pic

```cpp
PImage crowd, fog;
int i = 0;
int srcw=512;
int srch=346;
int wid=450;
int hi=300;
color c, cprime;

void setup( ) {
    size(srcw, srch);
    crowd = loadImage("egypt.jpg");
    fog = loadImage("fog.jpg");
    image(fog,0,0);
}
```
```c
for (int i=0; i<srcw; i++) {
    for(int j=0; j<srch; j++) {
        c = get(i,j);
        if (i<wid && j<hi) {
            cprime = crowd.get(i,j);
            cprime = color(4*(int(red(c))/4) + (int(red(cprime))/64),
                           4*(int(green(c))/4) + (int(green(cprime))/64),
                           4*(int(blue(c))/4) + (int(blue(cprime))/64));
            set(i,j, cprime);
        } else {
            set(i,j,c);
        }
    }
}
```
After the pictures are loaded

```
cprime = color(4*(int(red(c))/4) + (int(red(cprime))/64),
    4*(int(green(c))/4) + (int(green(cprime))/64),
    4*(int(blue(c))/4) + (int(blue(cprime))/64));
```

Clear right 2 bits of host

```
101101xx 110100xx 000111xx
```

Extract left 2 bits of guest

```
10110100 11010011 00011100
```

New combined color
Code To Extract Image

```c
Plmage fog;
int flip = 0;
int srcw=512;
int srch=346;
int wid=450;
int hi=300;
color c, cprime;

void setup( ) {
   size(srcw, srch);
   fog = loadImage("stegFog.png");
   image(fog,0,0);
}

void draw( ) {
   if (mousePressed) {
      for (int i=0; i<srcw; i++){
         for(int j=0; j<srch; j++) {
            c = get(i,j);
            if (i<wid && j<hi) {
               cprime=color(64*(int(red(c))%4),
                         64*(int(green(c))%4),
                         64*(int(blue(c))%4));
               set(i,j, cprime);
            } else {
               set(i,j,c);
            }
         }
      }
   }
}
```
How Does It Work

- Read in the file, and then on mouse click, pull out the bits and make a picture

```c
    cprime=color(64*(int(red(c))%4),
               64*(int(green(c))%4),
               64*(int(blue(c))%4));
```

Remove right 2 bits

Make them left 2 bits for each color

New color
How Much Is Coded Like Original?

- Run A Test ... www.tineye.com

5 Results

Searched over 1,8825 billion images in 0.013 seconds.
for file: fog.jpg

These results expire in 72 hours. Why?
Share a success story!
TinEye is free to use for non-commercial purposes.

Download the official TinEye extension for Firefox
with right-click functionality!

Sort Order

<table>
<thead>
<tr>
<th>Best Match</th>
<th>Most Changed</th>
<th>Biggest Image</th>
</tr>
</thead>
</table>

www.milliyet.com.tr
2.jpg
http://www.milliyet.com.tr/content/galeri/yeni/...

forum.shiftdelete.net
2.jpg
http://forum.shiftdelete.net/sdn-magazin/gunun...]
Check The “Steganized” File

5 Results

Searched over 1,8825 billion images in 2.609 seconds.
for file: stegFog.png

These results expire in 72 hours. Why?
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Sort Order

Best Match
Most Changed
Biggest Image

www.milliyet.com.tr
2.jpg
http://www.milliyet.com.tr/content/galeri/yenil/...

forum.shiftdelete.net
2.jpg
http://forum.shiftdelete.net/sdn-magazin/gunun-...