RGB Intensity Based Variable-Bits Image Steganography

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Outline

- The problem
  - Instance
  - Goals
- Algorithm
  - Idea
  - Step
  - Examples
- Experimentations
  - Visual and statistical analysis
  - Comparisons

The Problem

- Hide (embed) a file within another file

Data File

Cover File

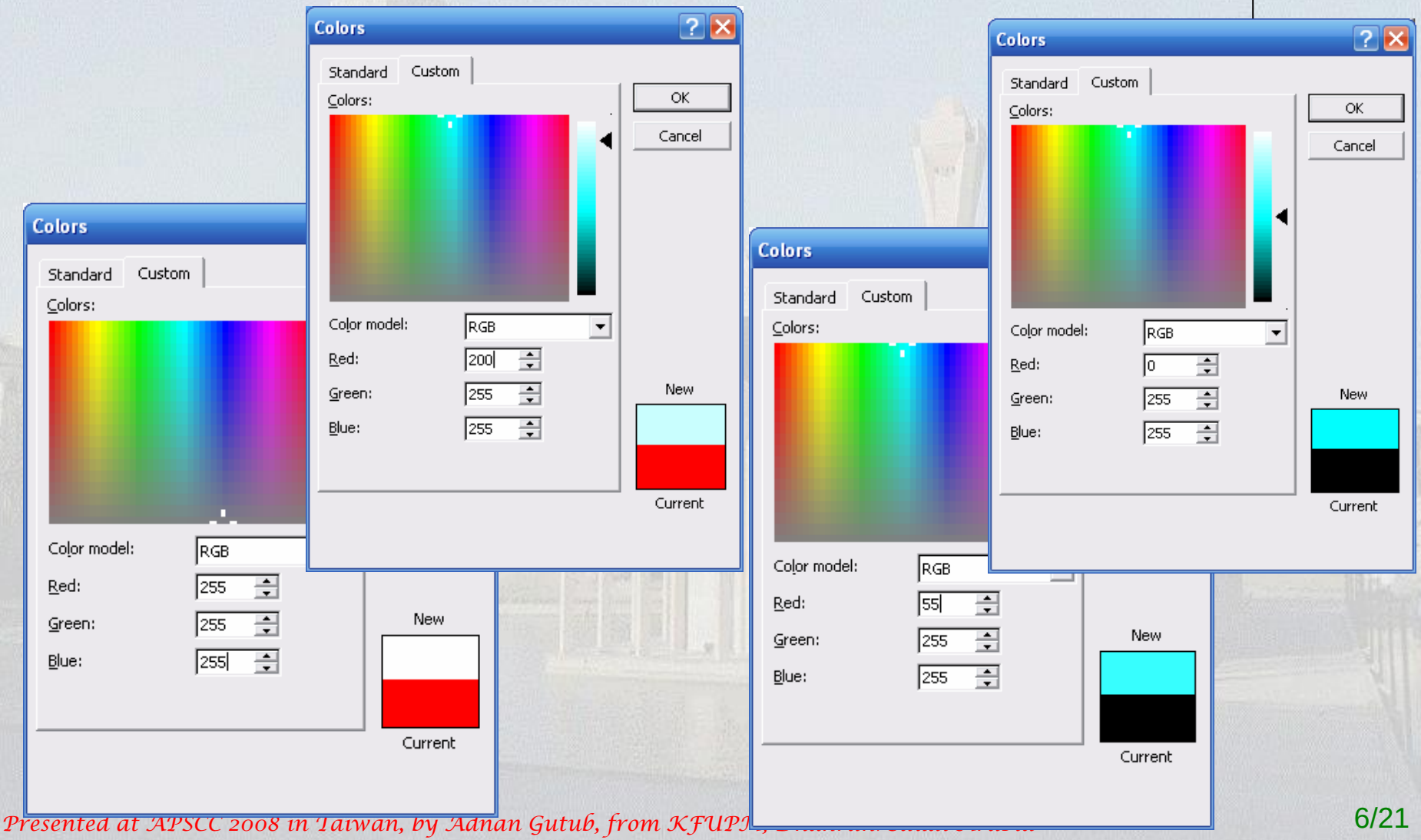
Applications

- Hiding copyright info
- Avoid snooping
- Data encapsulation
  - E.g. explanatory information within X-ray images
- Copyright protections

Algorithmic Goals

- Secure
  - Less Distortion
    - Visual
    - Statistical (like Histogram)
  - Not guessable
    - Data location
- High capacity
  - Not dependent on cover image

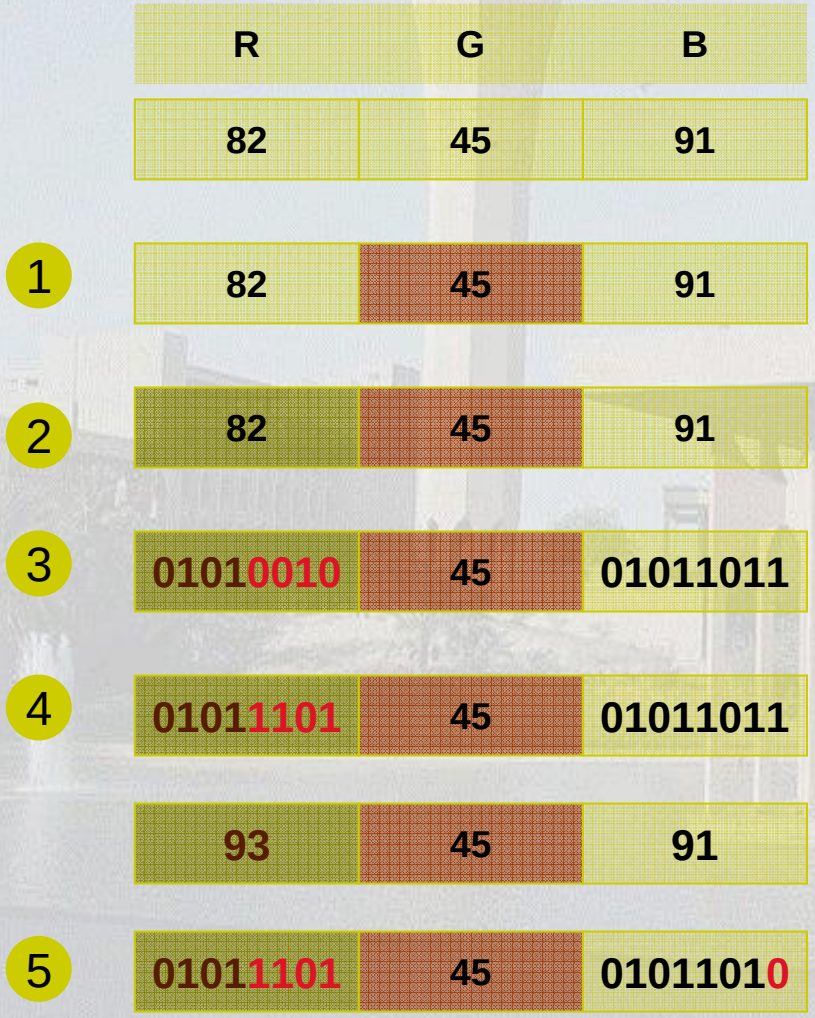
The Idea


Colors
Standard
Custom
Colors:
Color model:
RGB
Red:
255
Green:
255
Blue:
255
New
Current
Colors
Standard
Custom
Colors:
OK
Cancel
Color model:
RGB
Red:
200
Green:
255
Blue:
255
New
Current
Colors
Standard
Custom
Colors:
Color model:
RGB
Red:
55
Green:
255
Blue:
255
New
Current
Colors
Standard
Custom
Colors:
OK
Cancel
Color model:
RGB
Red:
0
Green:
255
Blue:
255
New
Current

Algorithm: Features

- One channel as **indicator**
- Data in **one** of the other channels
- Variable-bits per channel
  - Lower color value – Higher no of bits

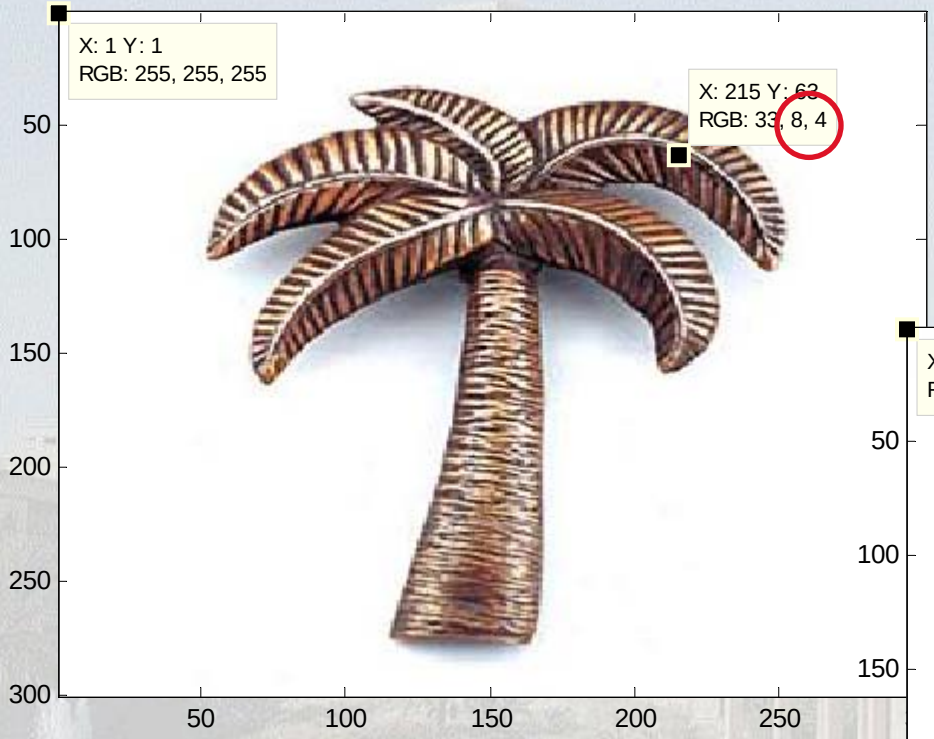
Algorithm Outline



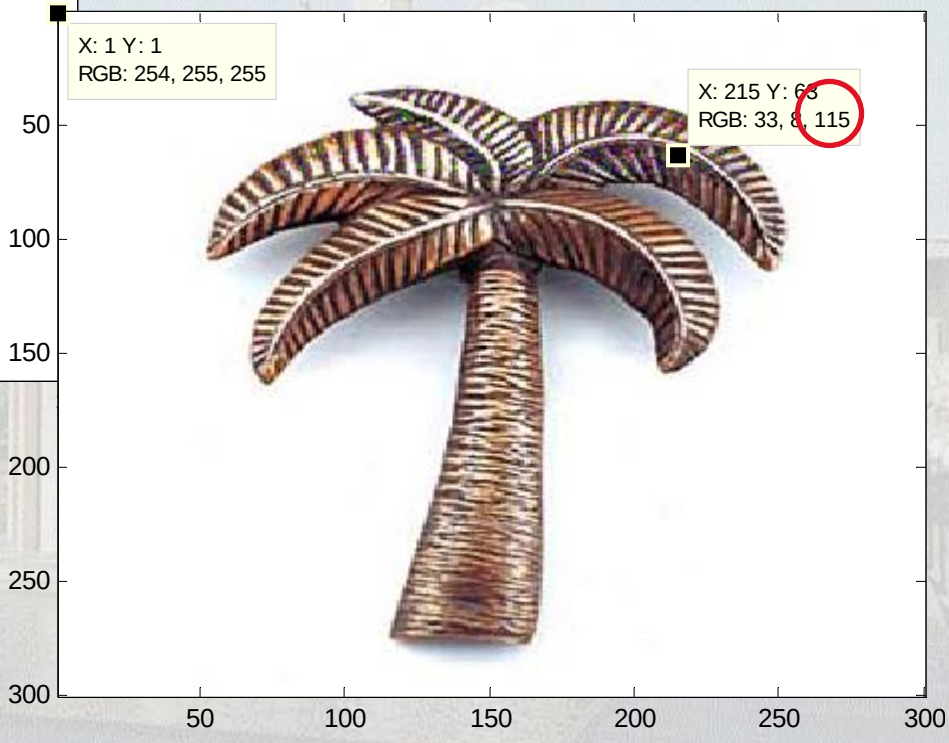
The Algorithm

1. Chose an indicator
2. Chose the channel
3. Decide no of data bits
   - Partition scheme
4. Get & store the data [say 1101]
5. Modify the other channel (if needed)

Example



Up to 7 bits have been modified



Expectations

- Secure
  - Random indicator sequence
- Statistically undetectable
  - Only lower bits are changed
- High capacity

How much of these can be achieved?

Experimentations

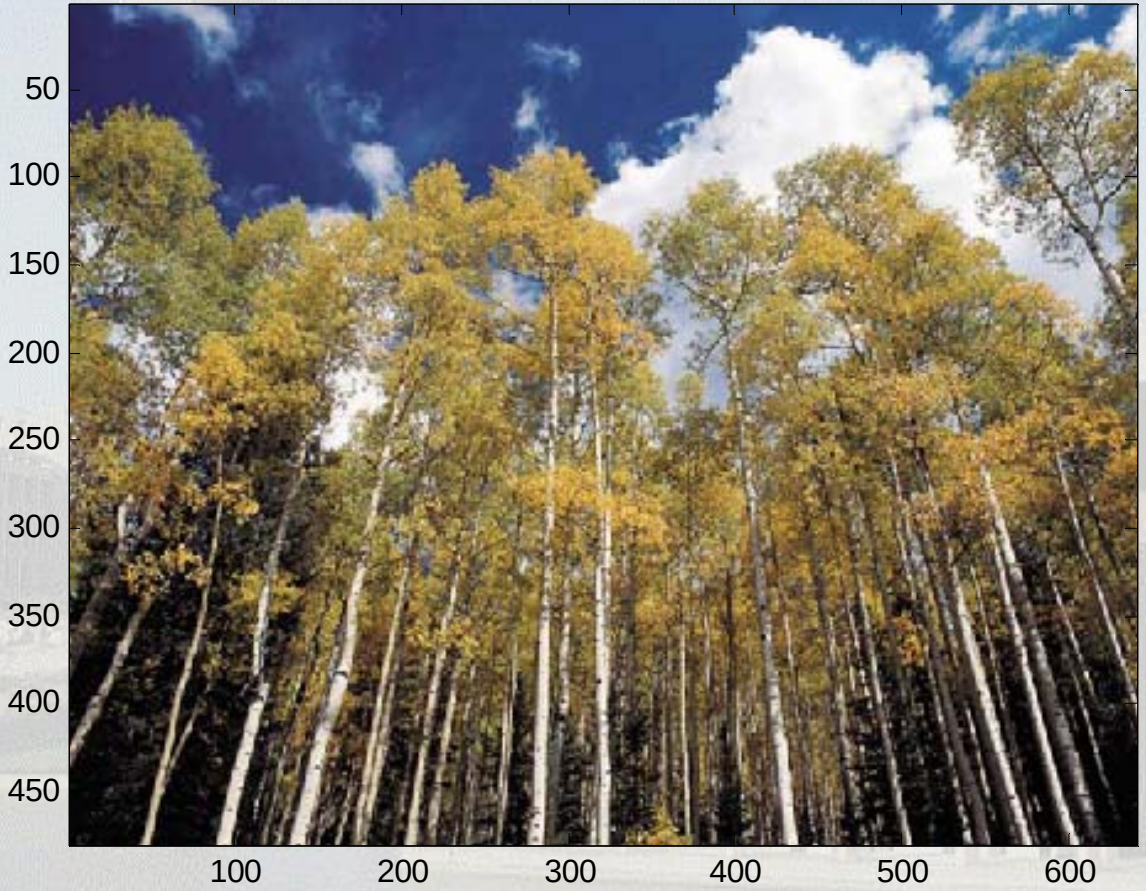
Cover Image

Image size: 640 X 480, Bit depth: 24
No of pixels = 307200

Data File

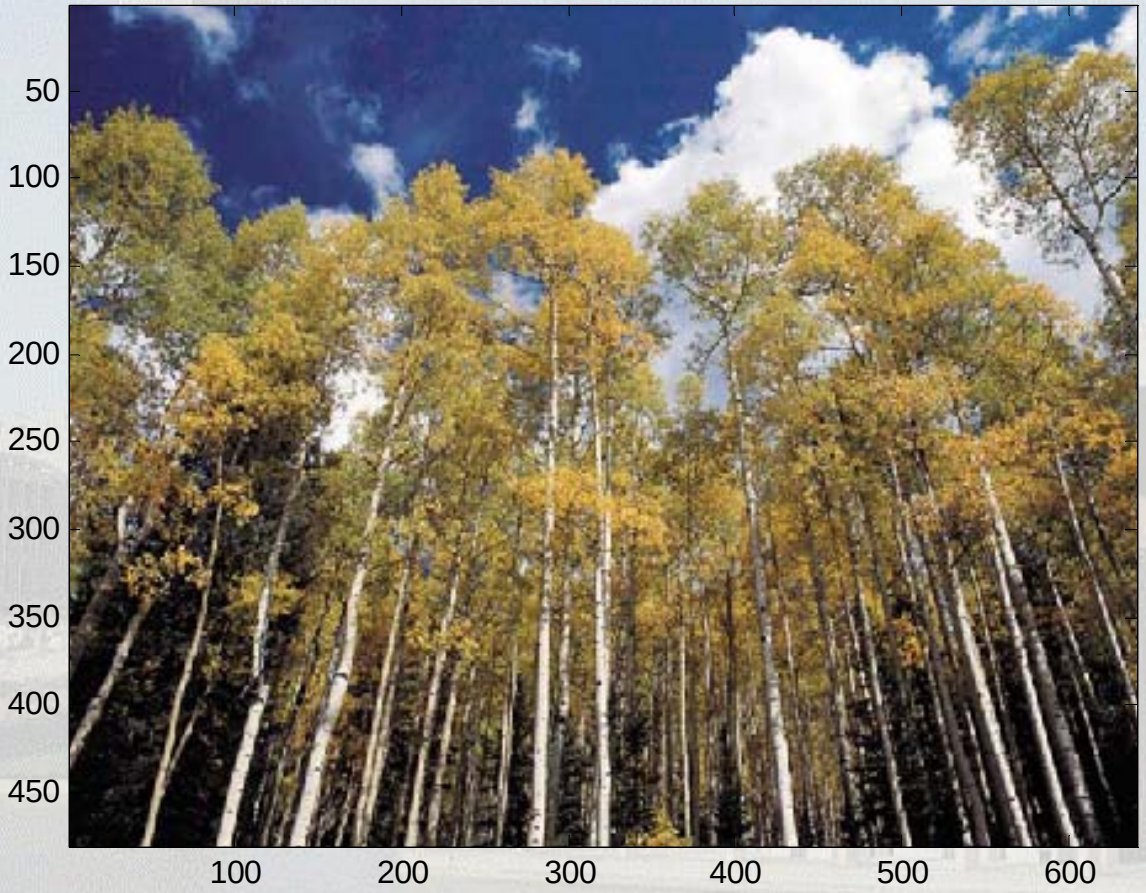
Image size: 150 X 117, Bit depth: 24
Data length = 150896 bits

Experimentations



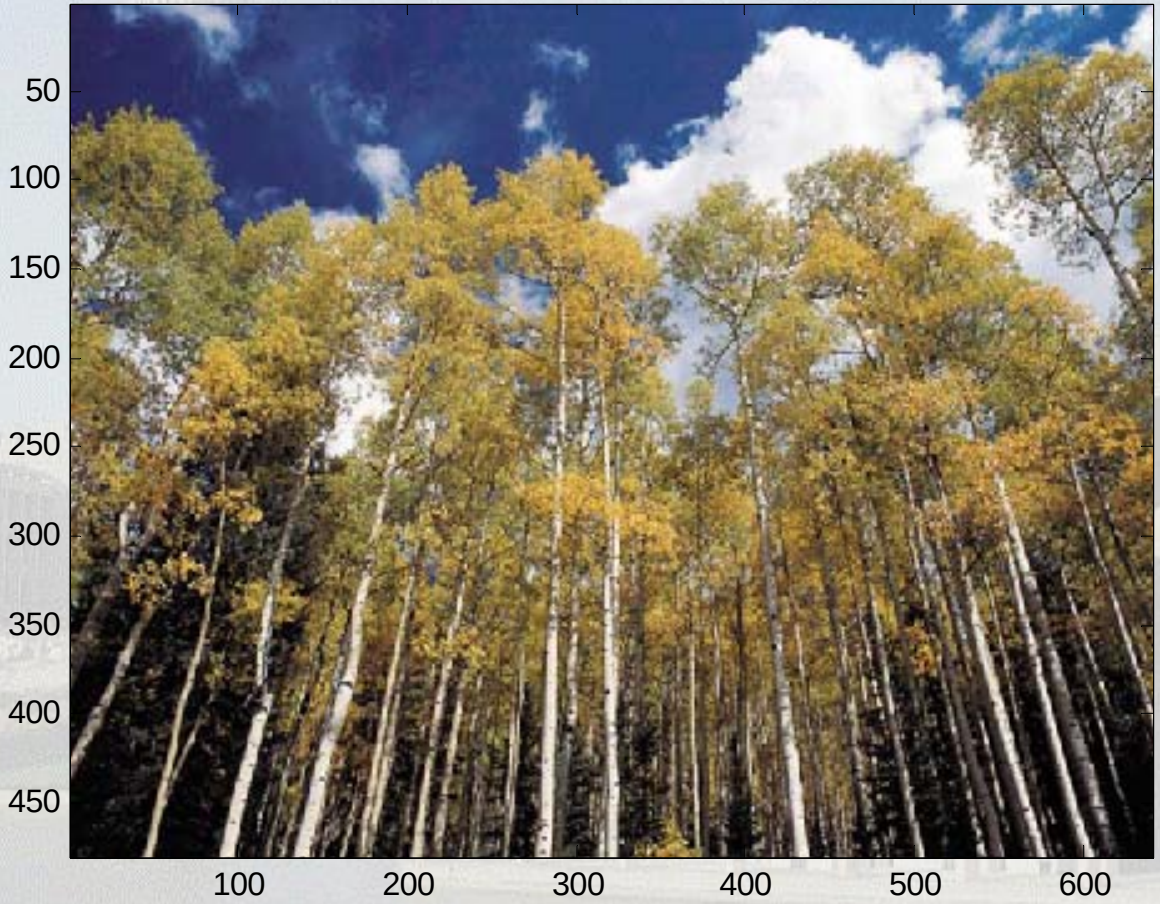
Pixels utilized: 50939
Constant 3 bits per channel

Experimentations



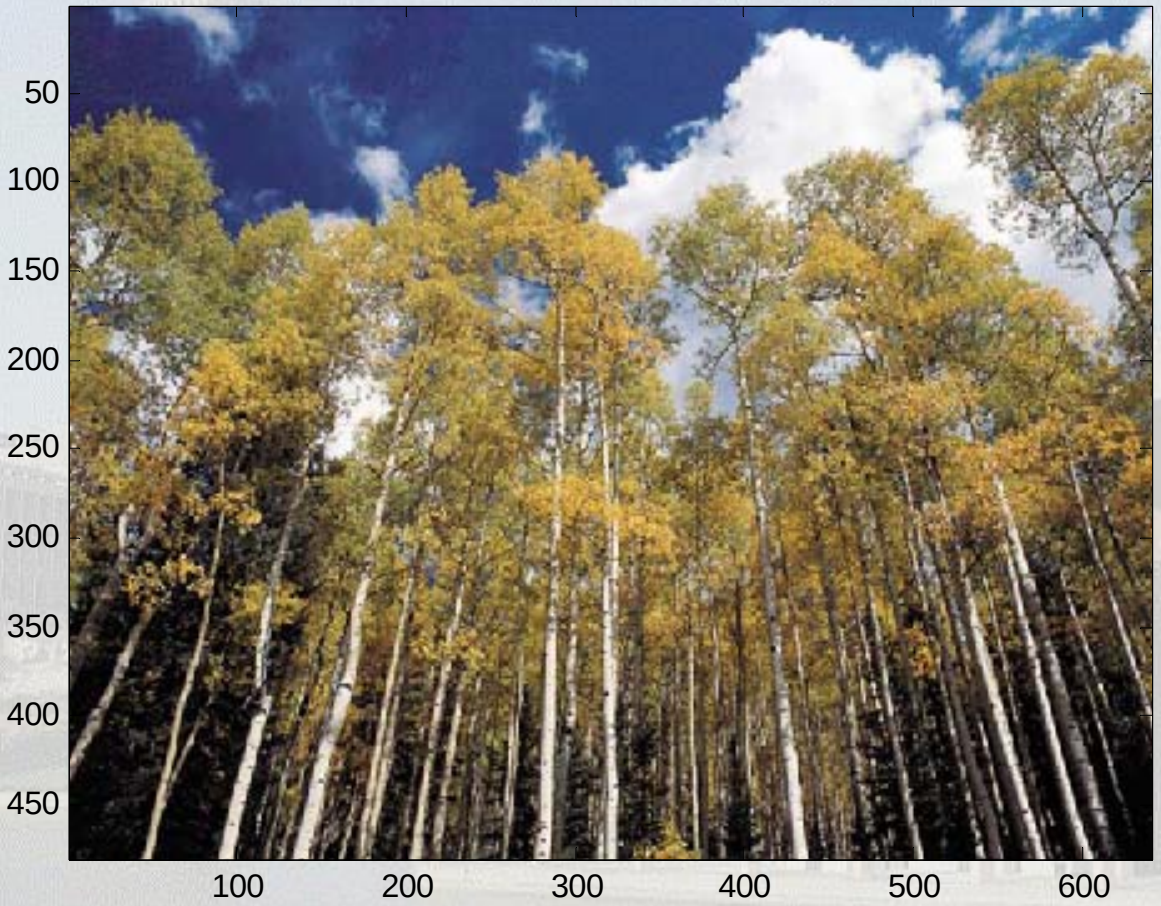
Pixels utilized: 41061
3/4 bits per channel

Experimentations



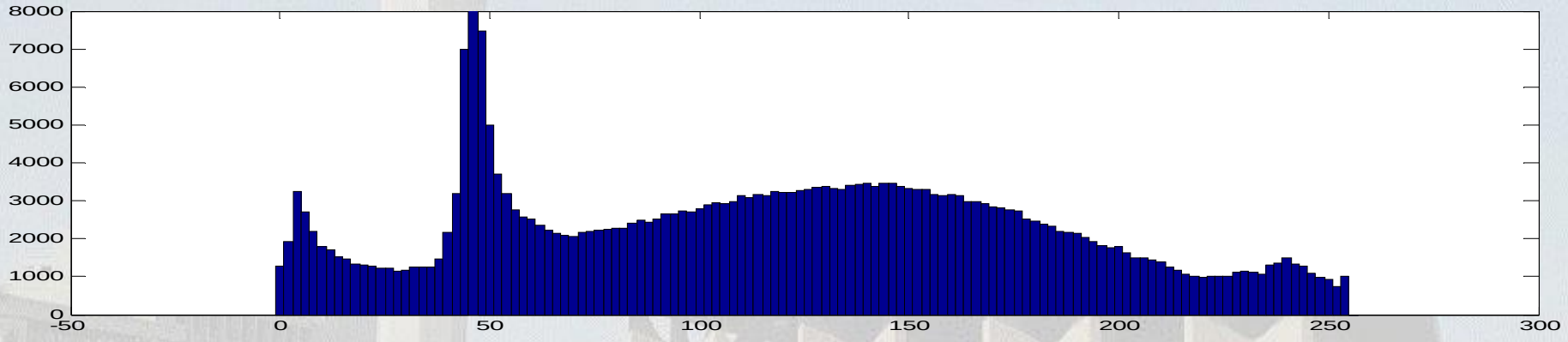
Pixels utilized: 38364
Constant 4 bits per channel

Experimentations

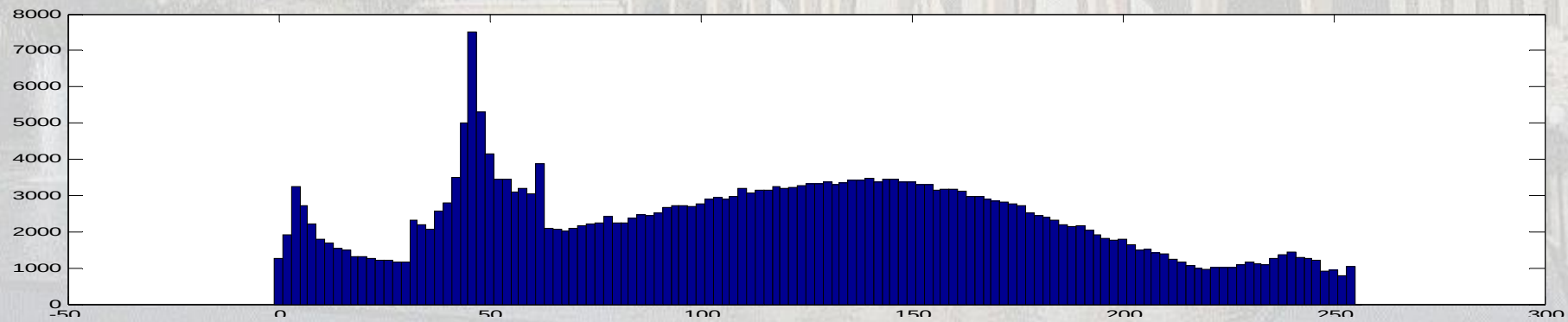


Pixels utilized: 35791
4/5 bits per channel

Histograms

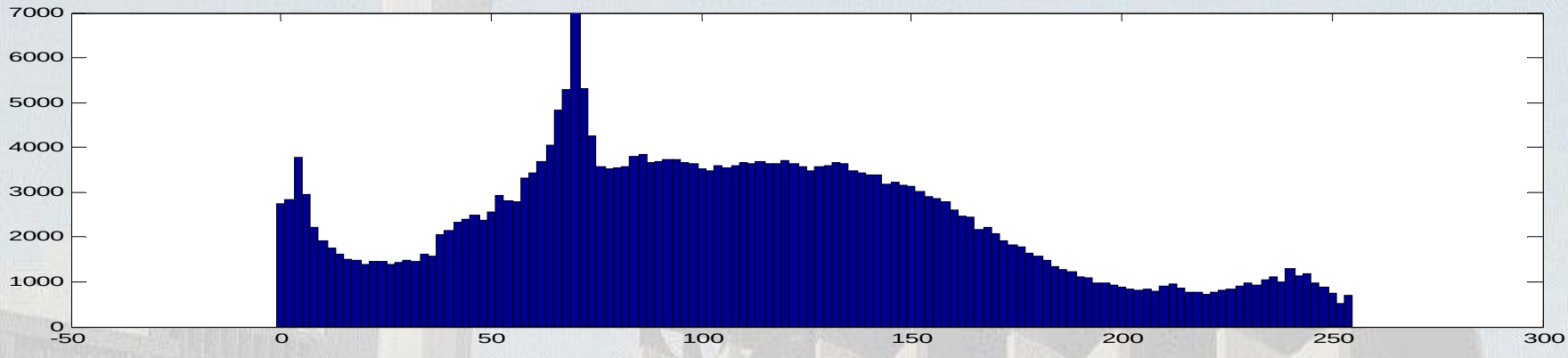


Histogram of Red channel: cover image

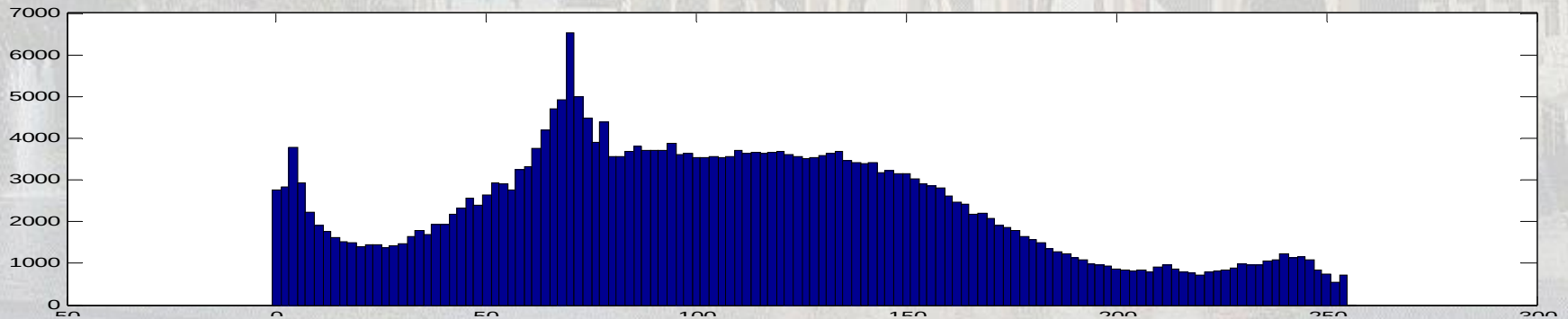


Histogram of Red channel: stego file

Histograms

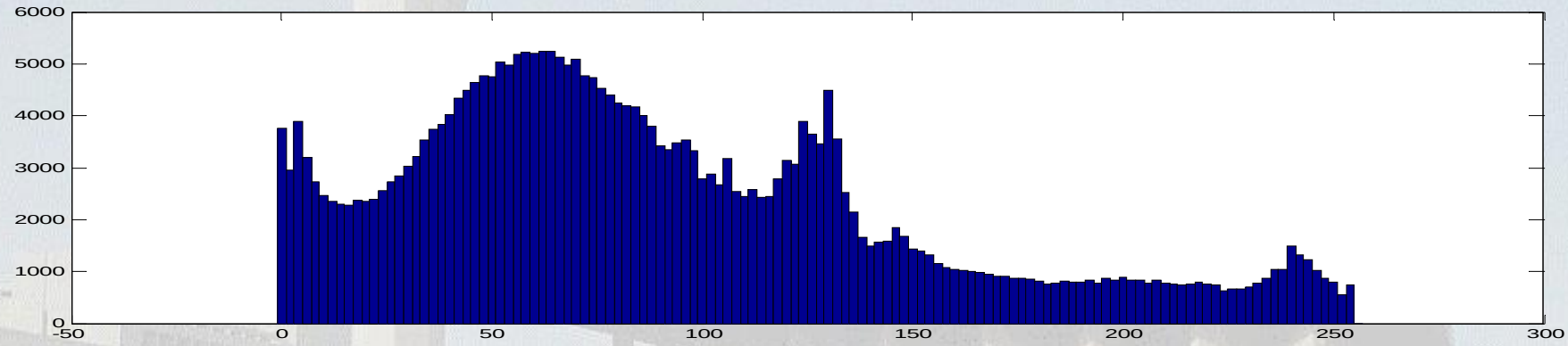


Histogram of Green channel: cover image

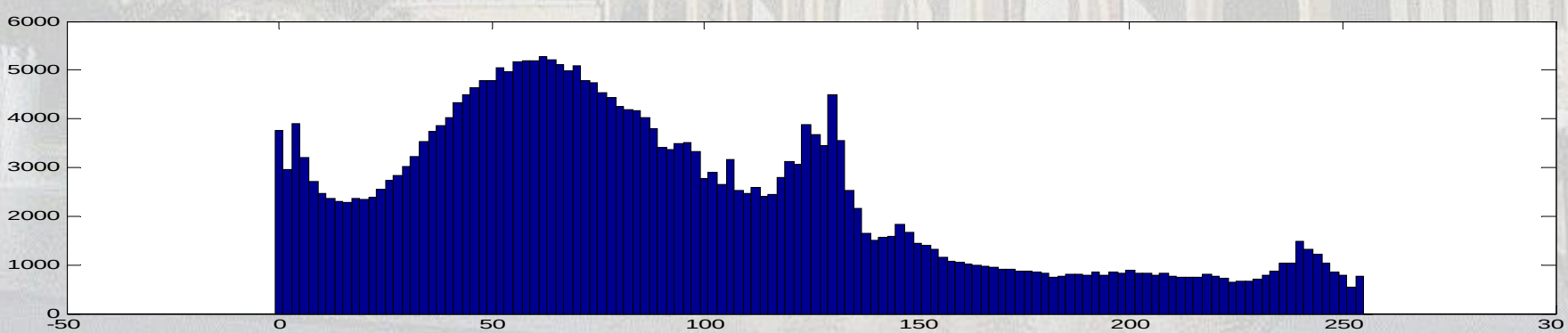


Histogram of Green channel: stego file

Histograms



Histogram of Blue channel: cover image

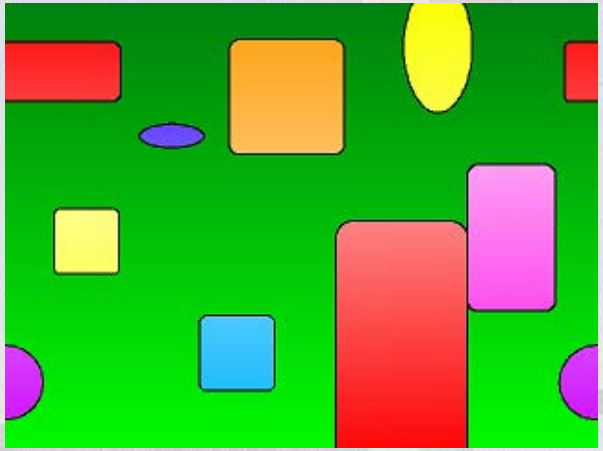


Histogram of Blue channel: stego file

Comparison

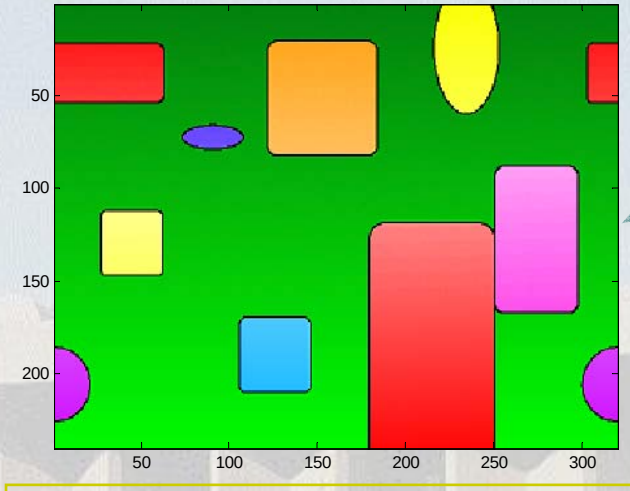
Technique	No of data bits per channel (bits)	No of pixels of cover media utilized (pixels)	No of pixels of cover media utilized (percentage)
Intensity Based Variable-Bits	3	50939	16.58%
	3 or 4	41061	13.37%
	4	38364	12.49%
	4 or 5	35791	11.65%
Pixel Indicator	2 + 2	77578	25.25%
	3 + 3	59051	19.22%
	4 + 4	44687	14.55%

Comparison: High Capacity



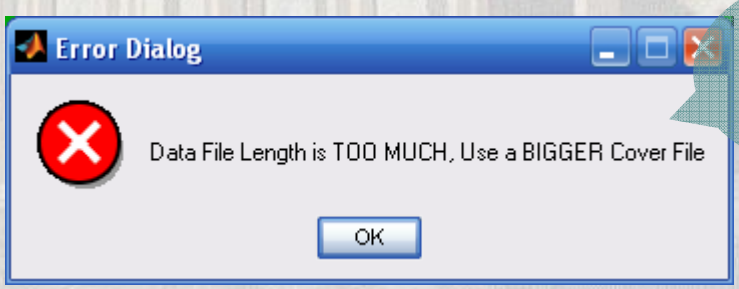
Cover Image

Data File



Our Algorithm

Pixels utilized: 16.5%
Constant 3 bits per channel



Pixel Indicator Algorithm

Summary

- New idea in image based steganography
  - Variable-bits per channel
- High capacity algorithm
- Secure
  - Random indicator sequence