Data Embedding in Digital Me

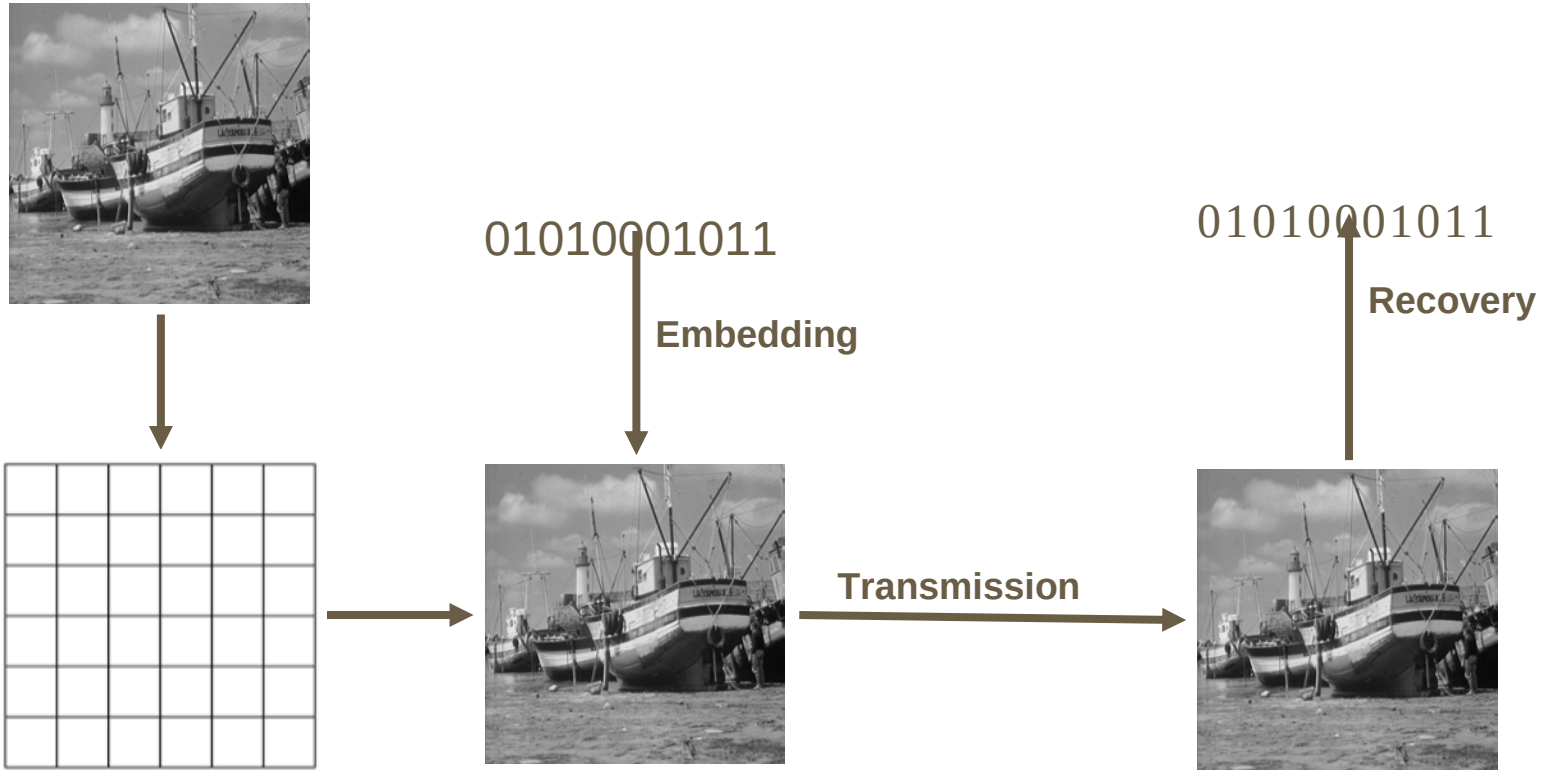
Optimal Spread -Spectrum and Least-Significant -Bit Methods

Connor Weeks
crweeks@knox.edu

Project Summary

- Steganography
- Digital Steganography
- Least-Significant Bit Method
- Optimal Spread Spectrum Method

OSS Algorithm Summary



Math

1. Auto-Correlation Matrix
2. Calculate Eigenvectors and Values
3. Calculate S_opt and C_opt
4. Calculate A values
5. Calculate Projection Matrix

Embedding Equation

$$Y = SAB + TX + N$$

Output — Pattern

Amplification — Hidden bits

Projection Matrix

Noise — Transformed Image

Equations:

```
R = TX*TX'/size(TX,2)

[Q,lambda]=eigsort(R)

S_opt = Q(1:k)

C_opt(k)=(lam(k)+sigma^2+D-
sqrt((lam(k)+sigma^2+D)^2-
4*lam(k)*D))/(2*lam(k))

A(k)=sqrt(D-c(k)^2*lam(k))

T=eye(L)-S*C*S'
```

Comparison

Optimal Spread Spectrum

- Works with lossy compression
- Harder to detect with steganalysis
- Works with additive noise

Least Significant Bit Replacement

- No bit errors (lossless compression)
- 4 -12 times more storage
- No recovery key
- Computationally faster
- Less distortion

References

M. Gkizeli, D. A. Pados, and M. J. Medley, “Optimal signature design for spread -spectrum steganography,” IEEE Trans. Image Process., vol. 16, pp. 391 -405, Feb. 2007.

Ming Li, Ngwe Thawdar, Dimitris A. Pados, Stella N. Batalama, and Michael J. Medley, “Minimum -Distortion Data Embedding in Video Streams” IEEE ICC 2014.