CS 4485 / Fall 2024
Department of Computer Science
Erik Jonsson School of Engineering & Computer Science
The University of Texas at Dallas
Richardson, TX 75080, USA

Digital Steganography

Faculty Advisor
Prof. Miguel Razo

Eman Abu-Ali
exa200013@utdallas.edu

Obed Lastick
oxl200001@utdallas.edu

Jordan Scott
jms200015@utdallas.edu

Collin Tran
ctt200001@utdallas.edu

Kenneth Vo
kxv200021@utdallas.edu

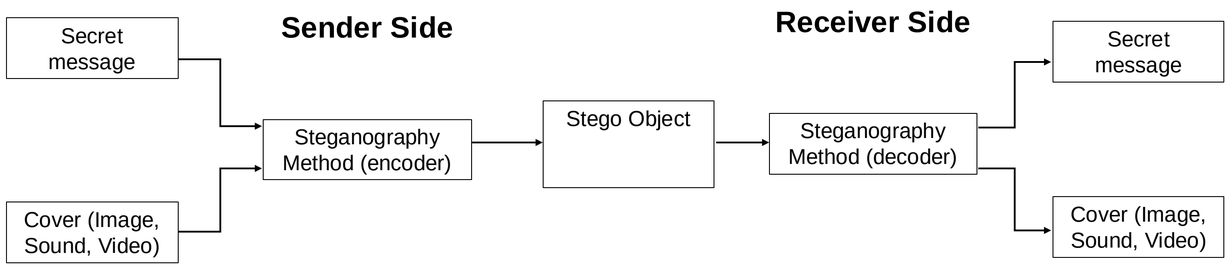
Abstract

Digital steganography involves concealing information within a cover medium, such as an image, to keep data undetected.

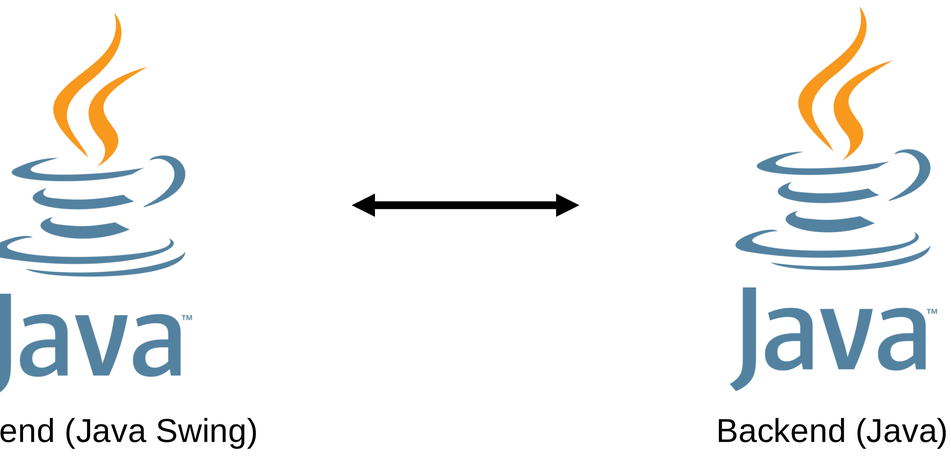
This project focuses on image-based steganography using Least Significant Bit (LSB) encoding, a widely used technique that modifies the least significant bits of pixel values to embed data without altering the visual quality of image.

Implemented in Java, this project aims to create a practical solution for securely embedding messages within images while preserving the image's integrity.

Keywords: Encoding, Decoding, Cybersecurity, LSB



Architecture



Frontend (Java Swing) — Backend (Java)

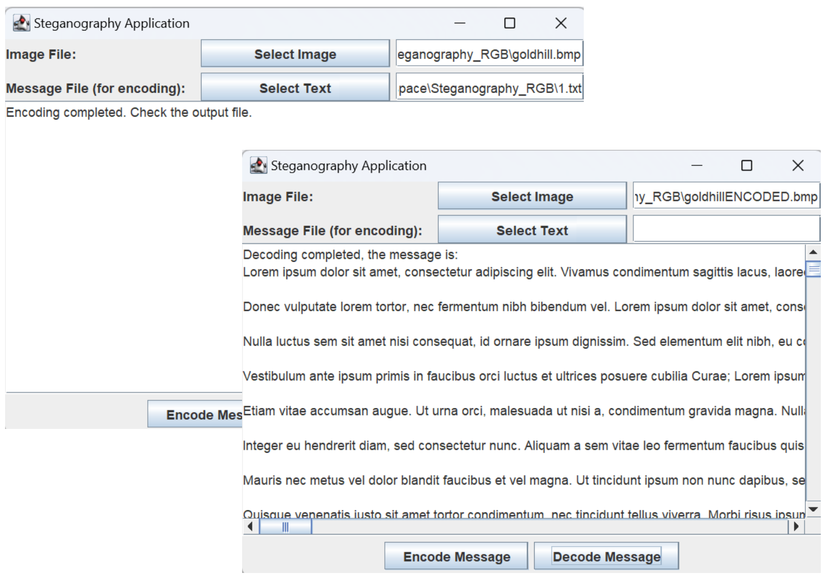
Frontend

Our frontend is implemented as a graphical user interface (GUI) using Java Swing. Users can choose messages to encode and decode using a file explorer interface.

Backend

Our backend is implemented in Java and uses classes for encoding, decoding, and the GUI.

Application

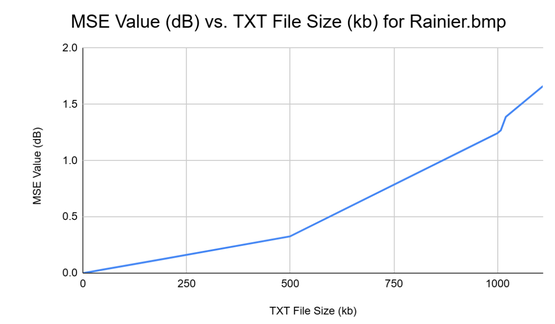


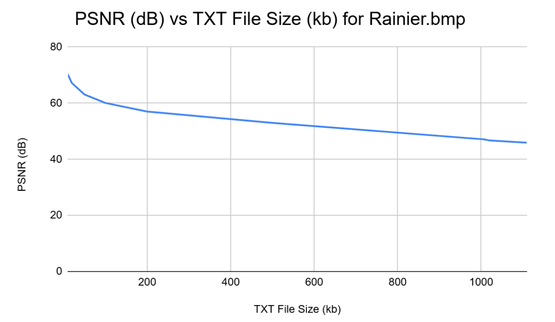
Results

Image: Rainier.bmp (1920 x 1080) from:
https://www.kaggle.com/datasets/saeedehkamjoo/standard-test-images

TXT File Size	Visible Distortion?	Stego-Image PSNR Value	MSE Value
0 kb	No	Infinity dB (identical)	0 dB
9.29 kb	No	70.40 dB	0.006 dB
19.26 kb	No	67.23 dB	0.012 dB
49.35 kb	No	63.13 dB	0.032 dB
99.79 kb	No	60.07 dB	0.064 dB
199.33 kb	No	57.02 dB	0.129 dB
499.29 kb	No	53.00 dB	0.326 dB
999.40 kb	No	47.19 dB	1.243 dB
1007.96 kb	No	47.10 dB	1.269 dB
1.02 mb	Yes	46.71 dB	1.388 dB
1.11 mb	Yes	45.92 dB	1.663 dB

Table Detailing Encoding Results





File Size vs. Test Metrics

Original Image

Encoded Image (99.79 kb TXT File)

Impact

The project has applications in multiple sectors including cybersecurity & intellectual property management and provides users with a way to increase personal privacy in a world so reliant on data.

Throughout the development process no personal or sensitive user data will be involved, and all testing will use publicly available/non-confidential files.