# Image Encryption Tool Report

## Project Title:

Simple Image Encryption Tool Using Pixel Manipulation

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## Overview:

This project demonstrates a basic image encryption and decryption tool using pixel manipulation techniques. It supports operations like swapping pixel values and applying simple mathematical operations to modify pixel intensity, offering a basic level of security for image data.

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## Key Features:

- **Pixel Value Manipulation:** Adds or subtracts a fixed key value to each pixel.
- **Pixel Swapping:** Simple row inversion to change pixel positions.
- **Encryption & Decryption:** Ensures that the original image can be restored after decryption.

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## Technologies Used:

- **Python**
- **OpenCV (cv2)**
- **NumPy**
- **Matplotlib (optional for visualization)**

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## How It Works:

1. **Encryption:**

2. Each pixel value (R, G, B) is incremented by a key and wrapped around using modulo 256 to stay within valid pixel value limits.

3. **Decryption:**

4. The encrypted pixel values are decremented by the same key and wrapped using modulo 256 to retrieve the original image.

5. **Pixel Swapping (Optional):**

6. Pixels can be rearranged (e.g., flipping vertically) for an additional layer of obfuscation.

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## Example Steps:

1. Load an image (e.g., `sample_image.jpg`).
2. Apply encryption with a chosen key (e.g., key = 100).
3. Save the encrypted image.
4. Decrypt the image using the same key.
5. Optionally, apply pixel swapping and save the swapped image.

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## Applications:

- Basic data protection for images.
- Teaching and learning cryptographic principles.
- Lightweight image obfuscation.

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## Limitations:

- This is not a secure encryption standard for sensitive data.
- Intended for educational and demonstration purposes.

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✅This project is free to use, modify, and share.