

Antonio Aodong Chen Gu, Leo Lin

Dr. Xiaoli Ma

ECE 4271

April 6, 2024

Final Project Abstract

JPEG is a commonly used loosely image compression algorithm used to save images. The process begins with a 2D Discrete Cosine Transform (2D-DCT), a mathematical technique that analyzes an image in small blocks, converting spatial information into frequency components. This transformation separates the image into its fundamental frequency components, enabling the removal of high-frequency information that is insensitive to human perception.

Along with the 2D-DCT is a quantization stage where the transformed coefficients are divided by values from a quantization table. This step allows for the reduction of precision in less critical frequency components, further enhancing compression. The choice of quantization table values can significantly impact the visual quality of the compressed image as well as the file size of it

Following quantization, the resulting coefficients are compressed using run-length encoding (RLE) and Huffman encoding. RLE efficiently represents repeated values by encoding sequences of identical coefficients as a single value and its count. Huffman encoding then assigns variable-length codes to different symbols based on their frequency of occurrence, resulting in a more compact representation of the data.

This project aims to develop an adaptive compression algorithm that controls the quality factor depending on the amount of information the block contains, hoping to further shrink the file size while resulting in a more visually satisfactory image. After DCT, we will explore different methods to quantify the amount of information the block contains. Our potential criteria will be the variances of the blocks. With a high variance, a higher quality factor would be used to maintain the information. However, there will be many other candidates that might be better. In this project, we will compare the performances of different criteria. To decide if a block is a high information block, one possible option is to leverage machine learning. We will explore different algorithms and discuss the tradeoff between them.