Overview

In this project we will explore the design of quantizers to effectively and efficiently represent samples of an information source.

Project Description

Your task is to design several quantization algorithms to effectively compress samples of several different information sources. Your quantizers should be general enough to allow for efficiently representing an information source at different code rates.

Your data sources consist of the following:

1. A source that generates samples of a \( N(0, 1) \) random variable.
2. A vector of 500 data points that is provided on the course website. (Note: No information about the source will be provided. It's up to you to build an effective coder based on the samples provided.)
3. A .ppm file containing the 512×512 Lena image (also located at the course website). Documentation for reading ppm format can be found on the web.

There are a few additional constraints: (1) No form of entropy coding (e.g., Huffman, arithmetic coding) may be used following the encoding of the input data into index values; and (2) No form of wavelet or DCT based coding may be used to compress Lena.

You are encouraged to explore whatever quantization techniques you may find. At a minimum, it is expected that students will implement a uniform quantizer with variable limits and a variable amount of output levels.

What to Turn In

Having implemented your methods in your favorite computer language, evaluate the performance of your schemes based on the MSE. You should seek to optimize the tradeoff between MSE and coderate. Your quantizer’s performance will be compared against the performance of your classmate’s. Therefore, it is of critical importance that you follow the engineering cycle of design, evaluate, and re-design.

Explain your investigation in a report that clearly details your reasons for choosing the quantizers you developed, their performance, and any additional behavior you observed. Your report is limited to 10 pages, and an effort should be made to provide a clearly written document. Attached to the end of your report, turn in print outs of your source code (not counted as part of the 10 pages).

Your grade will be based upon the clarity and thoroughness of your investigation. There is no ultimate answer, so continue to try to improve on your design!