Data Compression via Singular Value Decomposition (SVD) (Project Code “C”).
You may begin by selecting one or more test images (grayscale or color) and representing them as matrices. And then you will apply SVD to decompose the image matrix into singular values and vectors, then implement a compression scheme by truncating the smaller singular values and reconstructing the image from the reduced-rank approximation. The project should analyze how the number of singular values retained affects image quality, compression ratio, and storage requirements, using quantitative error metrics (e.g., Frobenius norm error) and qualitative visual inspection. Extensions may include color image compression (applying SVD to each channel separately), comparisons with other basic compression methods, or discussions of trade-offs between efficiency and fidelity.
Note in this project you need to handwrite the SVD algorithm, meaning that you cannot import any existing SVD packages.

How effectively can SVD-based compression reduce image storage requirements while maintaining acceptable visual quality, and what are the quantitative and qualitative trade-offs between compression ratio and image fidelity?

This project seeks to implement a custom SVD algorithm from scratch and develop a compression scheme that systematically evaluates the relationship between the number of retained singular values and resulting image quality, compression efficiency, and storage requirements.