Image Compression using Singular Value Decomposition

Image compression using Singular Value Decomposition (SVD) involves the study of image processing, which encompasses algorithms that manipulate images. These algorithms take images as input and produce modified images as output. By utilizing image processing techniques, we can alter various properties of an image, including its display, printing, enhancing features, detecting patterns, and compressing its size.

Image compression aims to reduce the size of an image by removing redundancy while preserving its essential visual information. Singular Value Decomposition is a technique used in image compression, where a matrix representing the image is decomposed into three matrices: U, Σ, and V^T. These matrices undergo algorithmic approximation, and the resulting product matrices are combined to reconstruct an image that is similar to the original but differs in certain properties.

In the compression process, the matrix M represents the input image data. There are two methods of Singular Value Decomposition: the RGB method and the grayscale method. In the RGB method, the image's RGB channels are separated, and the SVD algorithm is applied to each channel individually. The resulting compressed channels are then combined to form the output image.

However, the RGB method may suffer from high intensity, leading to distorted images. To address this, the grayscale method is used. Grayscale images have a gray color value of 127, which is derived from the red, green, and blue channels. The grayscale method applies the SVD algorithm directly to the original image, resulting in compressed output. Furthermore, SVD finds application in image encryption, where both RGB and grayscale methods can be employed to encrypt images.