EE5175: Image Signal Processing

Lab-8

Singular Value Decomposition (SVD)

1. Compute SVD for the given 8×8 image $\mathbf{g}$ (provided in `imageFile.mat` and also given below) using the following steps:
   (a) Perform eigen-value decomposition of $\mathbf{g}^T\mathbf{g}$ and $\mathbf{g}\mathbf{g}^T$.
   (b) Find the singular value matrix $\mathbf{\Sigma}$.
   (c) Reconstruct the image using $\mathbf{\Sigma}$ and the eigen-vector matrices.
2. Remove one singular value at a time from $\mathbf{\Sigma}$ and reconstruct the image ($\widehat{\mathbf{g}_k}$). Compute $\|\mathbf{g} - \widehat{\mathbf{g}_k}\|^2$ and compare it with the sum of the squares of the first k singular values.

$$\text{Image } \mathbf{g} = \begin{bmatrix} 255 & 255 & 255 & 255 & 255 & 255 & 255 & 255 \\ 255 & 255 & 255 & 100 & 100 & 100 & 255 & 255 \\ 255 & 255 & 100 & 150 & 150 & 150 & 100 & 255 \\ 255 & 255 & 100 & 150 & 200 & 150 & 100 & 255 \\ 255 & 255 & 100 & 150 & 150 & 150 & 100 & 255 \\ 255 & 255 & 255 & 100 & 100 & 100 & 255 & 255 \\ 255 & 255 & 255 & 255 & 50 & 255 & 255 & 255 \\ 50 & 50 & 50 & 50 & 255 & 255 & 255 & 255 \end{bmatrix}$$

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