CS5691 : Pattern Recognition and Machine Learning

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1 Motivation

In this assignment it is required to compress an 156x256 black and white image using Singular Value Decomposition and Eigen Value Decomposition.

2 EVD/ SVD

For both compressing methods we will be first converting the .jpg to a 256x256 double matrix. And then the images are decomposed and reconstructed to show the output. For Singular Value Decomposition we will be decomposing the matrix into three matrices $U_{m \times m}$, $S_{m \times m}$ and $V_{m \times m}$.

$$\left(U \right) \left(S \right) \left(V^T \right)$$

For compressing we use Low Rank SVD i.e. only the top k Singular Values are taken to the consideration and thus converting the matrices to $U_{m \times k}$, $S_{k \times k}$ and $V_{m \times k}$. Thus the compressed size is k(1 + 2m).

A similar method is done for Eigen Value Decompostion where the matrix is decomposed to its Eigen Values and Vector and for compressing only the top k Eigen Values are taken and reconstructed. The errors between the original and the compressed images are stored and later plotted as a graph.

Figure 1: K = 1

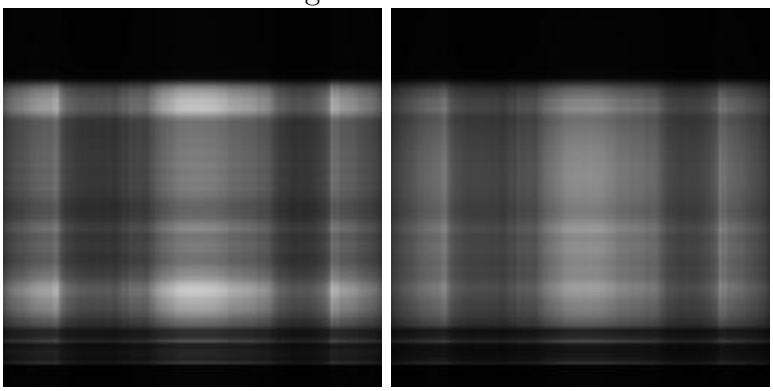


Figure 2: K = 18

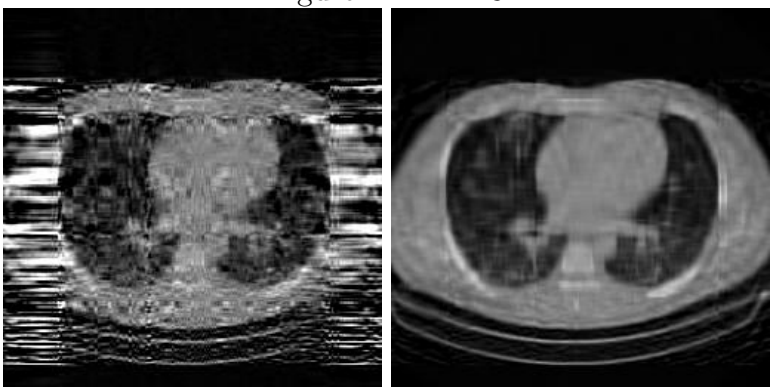


Figure 3: K = 52

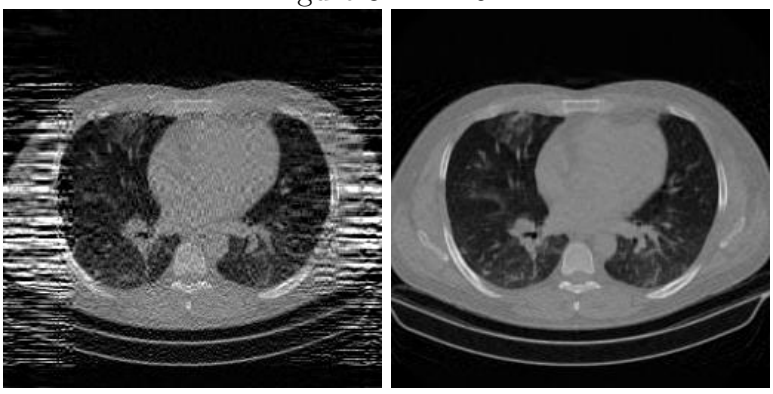


Figure 4: K = 239

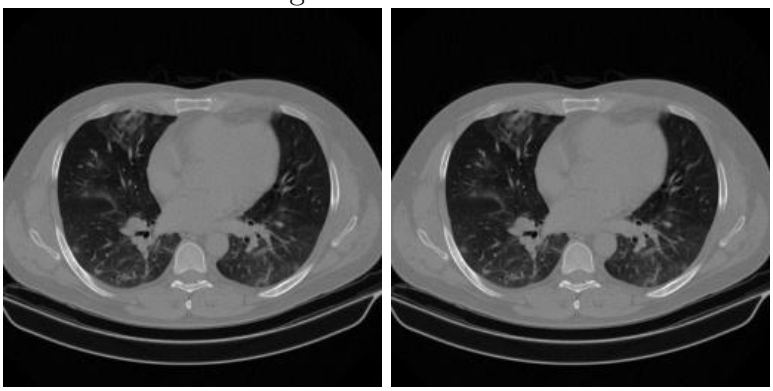
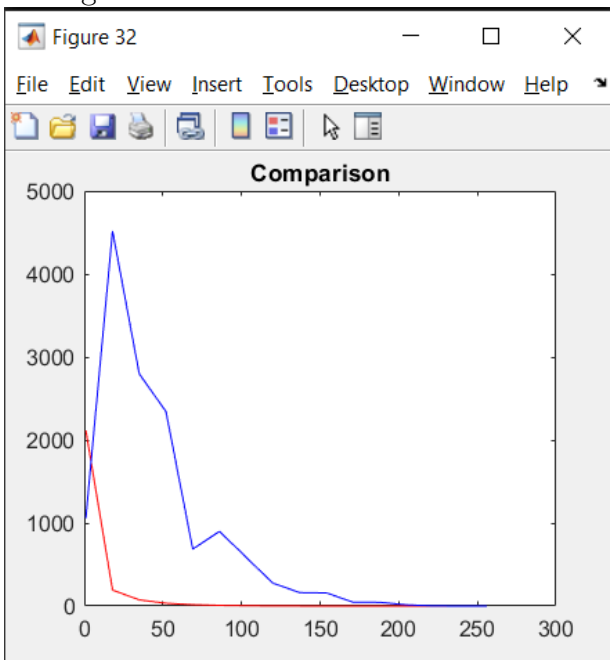


Figure 5: Frobenius Norm Error Plot



3 Experimental Results

4 Inferences

The Error keeps on decreasing at an exponential rate for SVD but the EVD has some peaks but is overall reducing at a very fast rate and at about 200 which is 78% of 256 both the errors tend to be nearly same.