6

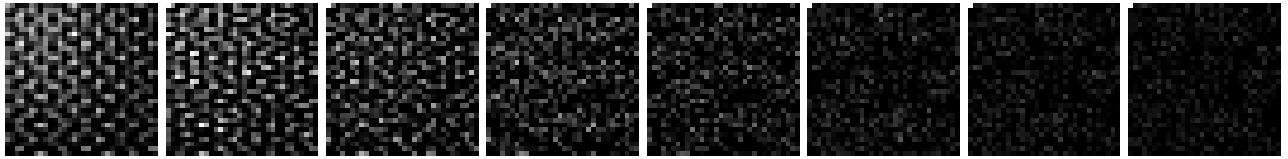
1 Ground Truth Images

Figure 1 displays the ground truth images for each k.

The selected DCT columns and their coefficients of an image with a k value are carried forward in the image generation with higher k values.

To generate a different set of images, simply change the value of variable `seed`.

Note: While running `myMainScript`, please do not close the figure window that appears after data generation completion of OMP algorithm.



(a) $k = 5$ (b) $k = 10$ (c) $k = 20$ (d) $k = 30$ (e) $k = 50$ (f) $k = 100$ (g) $k = 150$ (h) $k = 200$

Figure 1: Original images

2 Reconstructed Images

2.1 Task 1

For $k \in \{5, 10, 20, 30, 50, 100, 150, 200\}$ and $m \in \{100, 200, \ldots, 1000\}$.

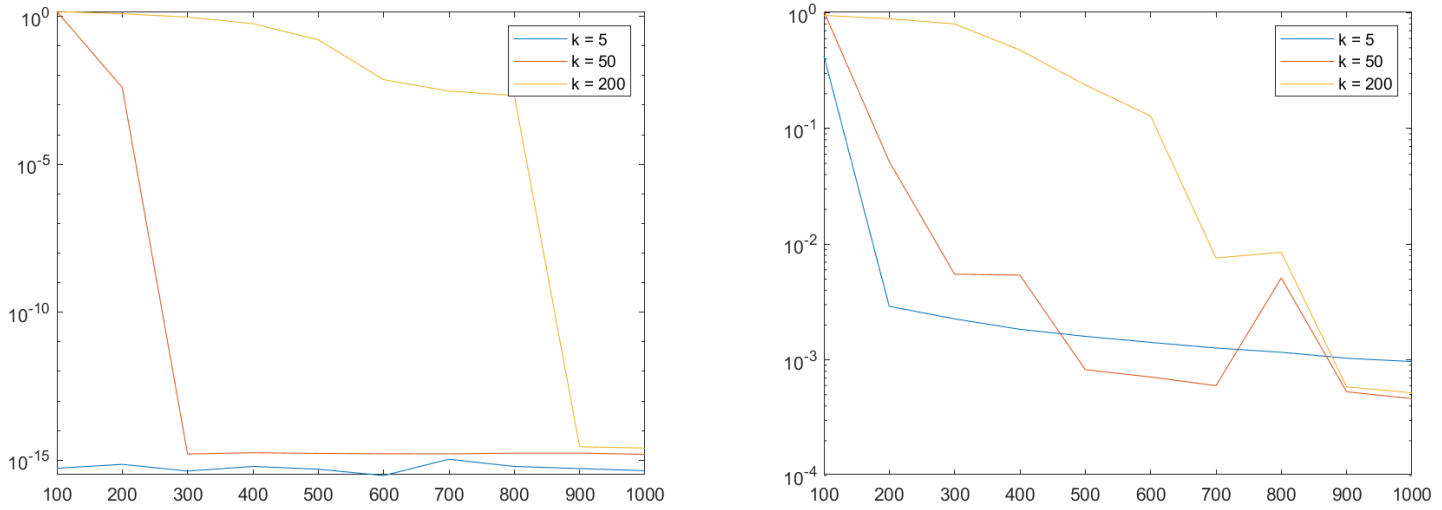
OMP and IHT algorithms are implemented in the `code` directory and the reconstructed images and the RMSE values are located in the `results` directory. RMSE values are stored as a 2-D matrix with row index corresponding to the respective k value index and column index corresponding to the respective m value index.

2.2 Task 2

For $k \in \{5, 50, 200\}$ and $m \in \{100, 200, \ldots, 1000\}$.

RMSE plots are shown in 2 and reconstructed images are shown in 3 and 4.

As seen by the plots RMSE values are lesser than 1 for both algorithms implying a good reconstruction. For OMP, they tend to zero very quickly for $k \in \{5, 50\}$ whereas the $k = 200$ case needed 800 measurements for RMSE to become very small. For IHT though RMSE values don't tend to zero as fast as OMP, images are almost same to the actual images in all cases except for $(k, m) \in \{(5, 100), (50, 100), (200, 100), (200, 200), (200, 300), (200, 400)\}$. Implying that as k increases, more measurements are required for a perfect reconstruction.



(a) OMP

(b) IHT

Figure 2: Comparison of OMP and IHT plots for variation with m for a fixed k

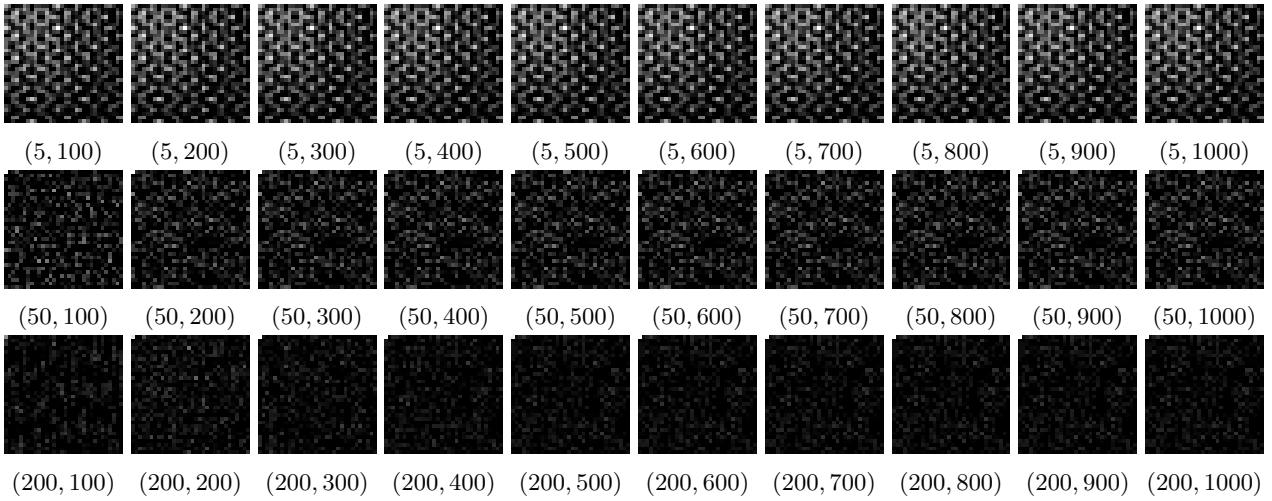


Figure 3: Each OMP image line is variation with m for a fixed k, caption format (k, m)

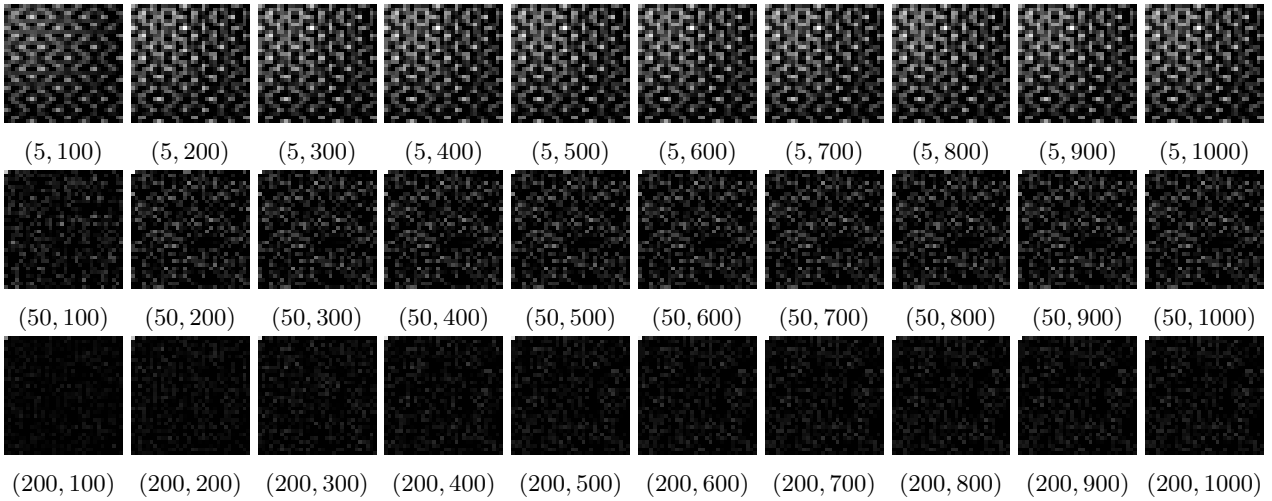


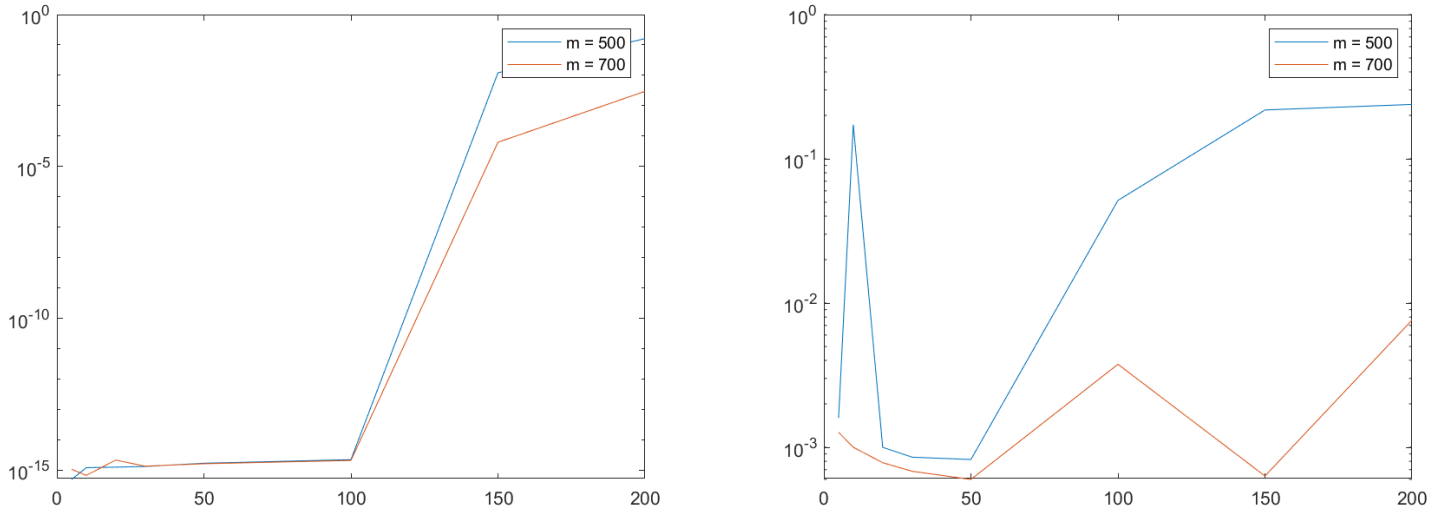
Figure 4: Each IHT image line is variation with m for a fixed k, caption format (k, m)

2.3 Task 3

For $m \in \{500, 700\}$ and $k \in \{5, 10, 20, 30, 50, 100, 150, 200\}$.

RMSE plots are shown in 5 and reconstructed images are shown in 6 and 7.

Reconstructed images are very similar to the original images and the RMSE plots indicates (with some exceptions) that for higher m, higher k (sparsity) can be handled before the RMSE increases.



(a) OMP

(b) IHT

Figure 5: Comparison of OMP and IHT plots for variation with k for a fixed m

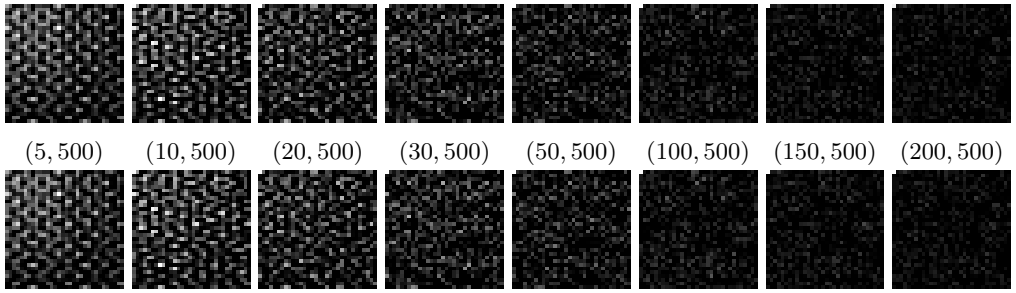


Figure 6: Each OMP image line is variation with k for a fixed m, caption format (k, m)

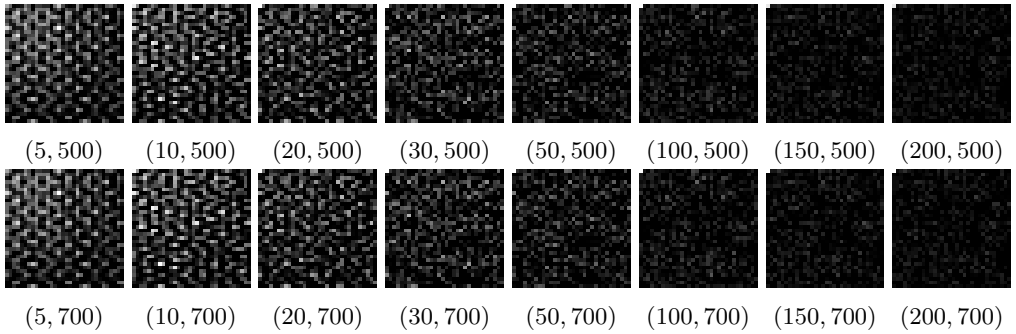


Figure 7: Each IHT image line is variation with k for a fixed m, caption format (k, m)