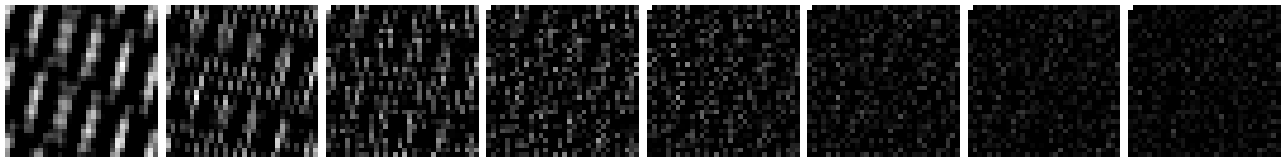
1 Ground Truth Images

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`.



(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 $m \in \{100, 200, \ldots, 1000\}$.

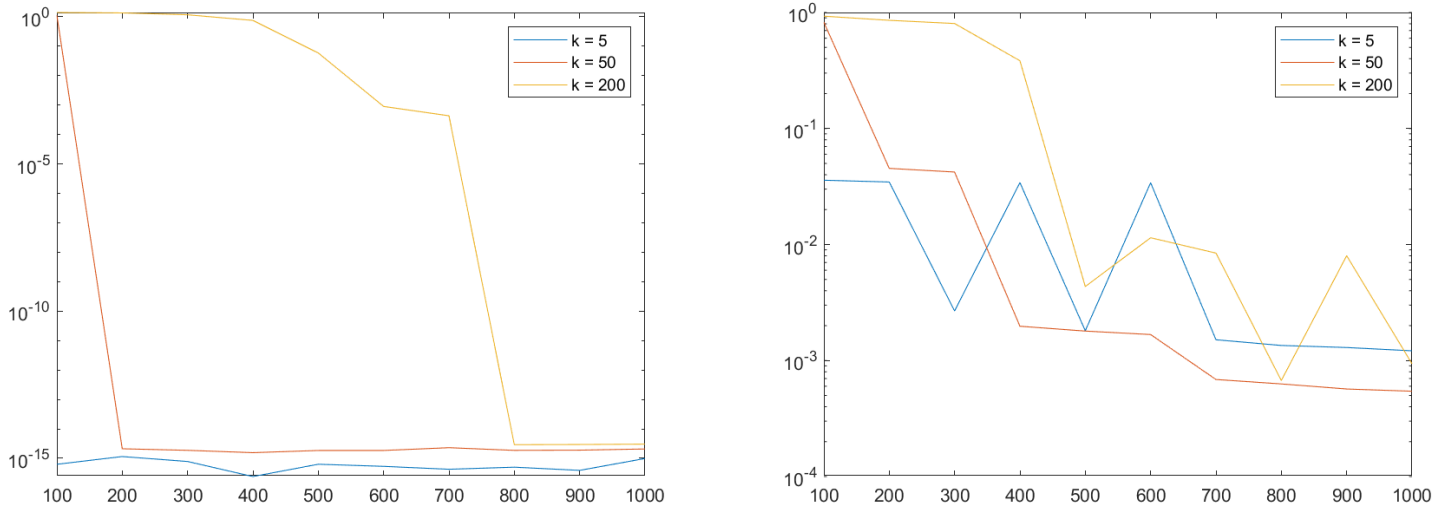
OMP and IHT algorithms are implemented in the `code` directory and the reconstructed images and the RMSE values are located in the `results` directory. RMSE values are stored as a 2-D matrix with row index corresponding to the respective k value index and column index corresponding to the respective 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, images are almost same to the actual images in all cases except for $(k, m) \in \{(50, 100), (200, 100), (200, 200), (200, 300), (200, 400)\}$. 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

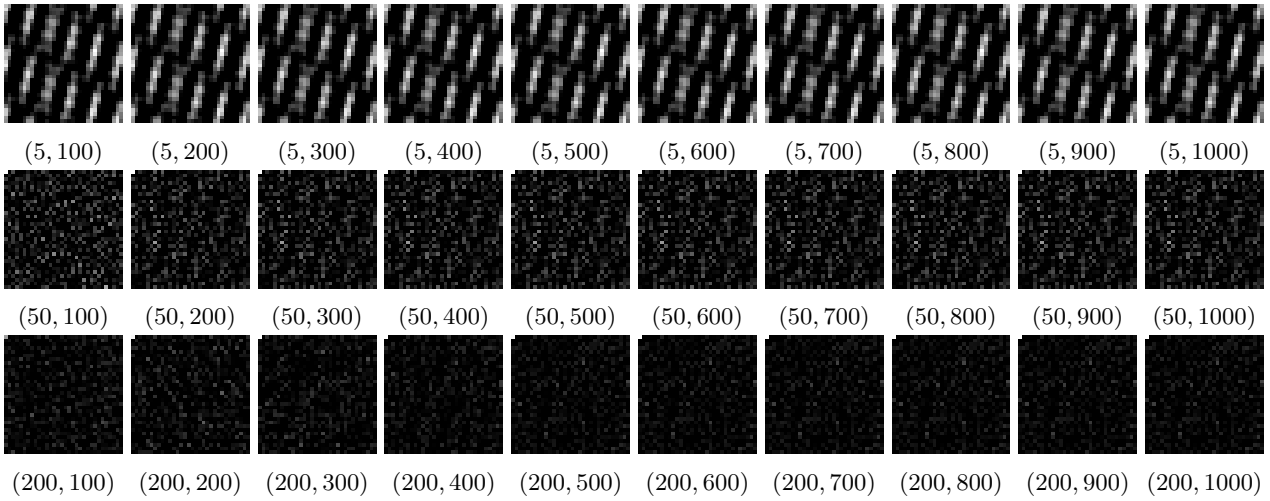


Figure 3: Each OMP image line is variation with m for a fixed k, caption format (k, m)

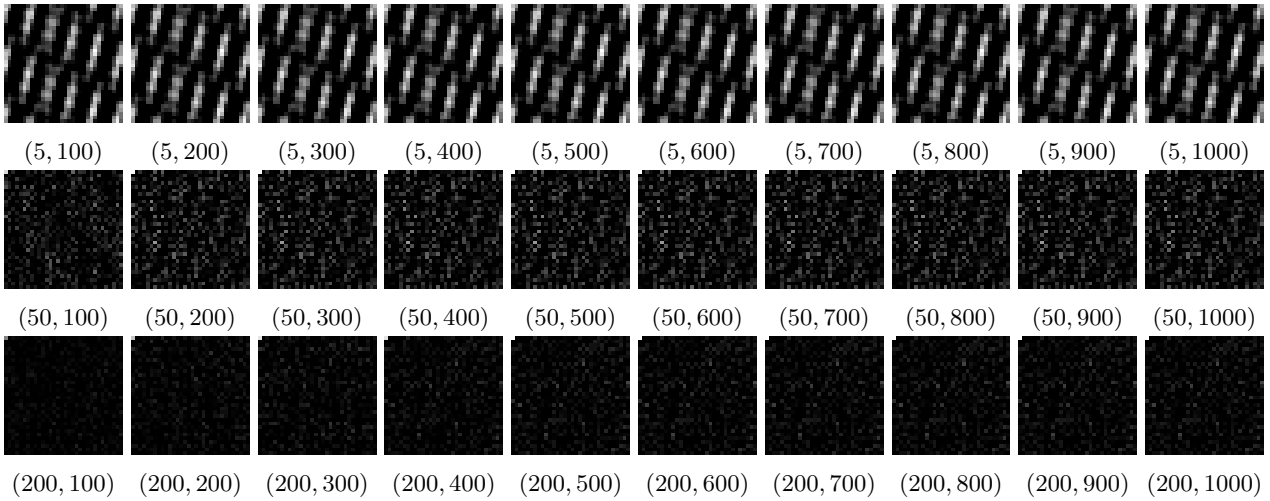


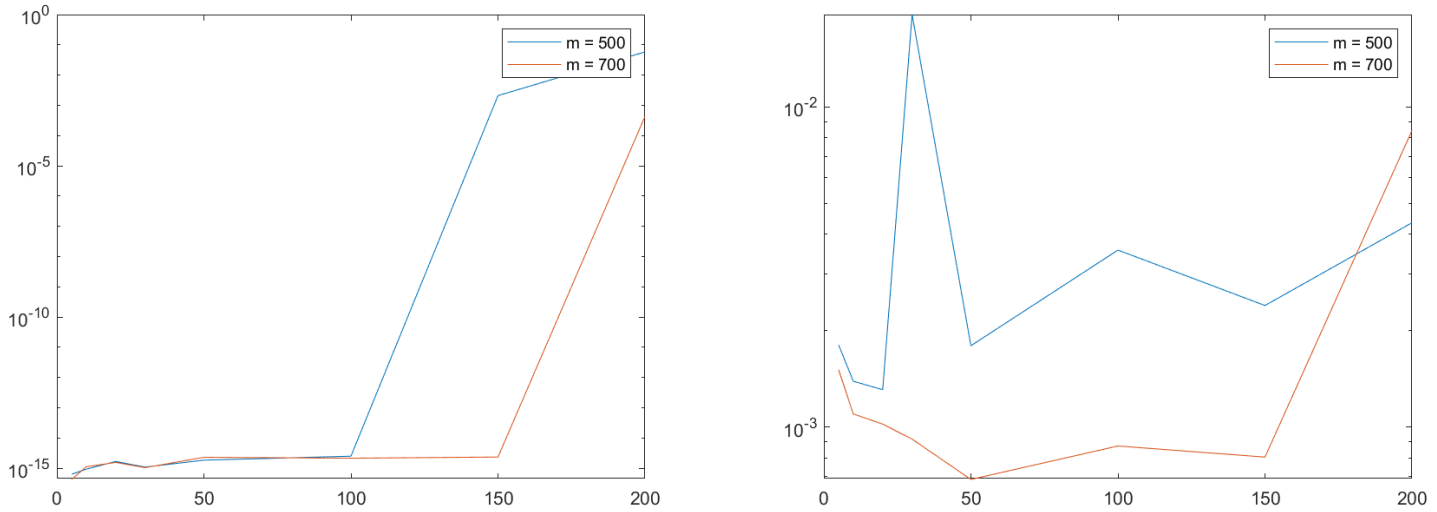
Figure 4: Each IHT image line is variation with m for a fixed k, caption format (k, m)

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.

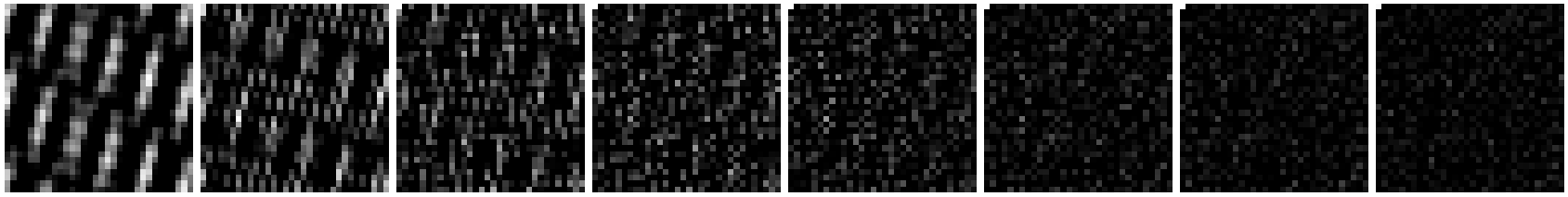
Reconstructed images are very similar to the original images and the RMSE plots indicates (with some exceptions) that for higher m, higher k (sparsity) can be handled before the RMSE increases.



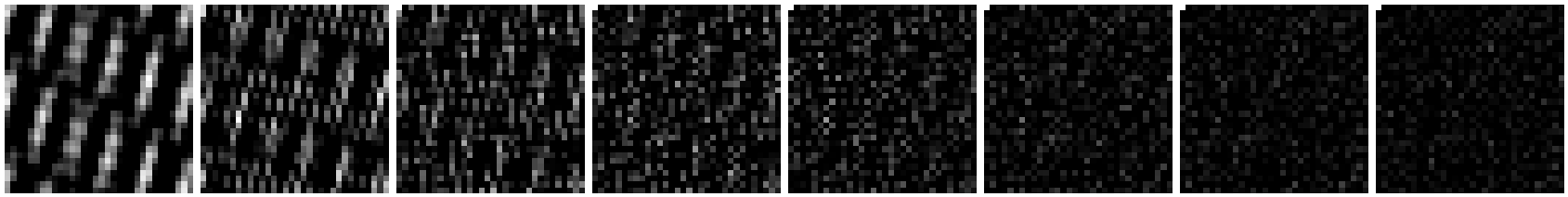
(a) OMP

(b) IHT

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

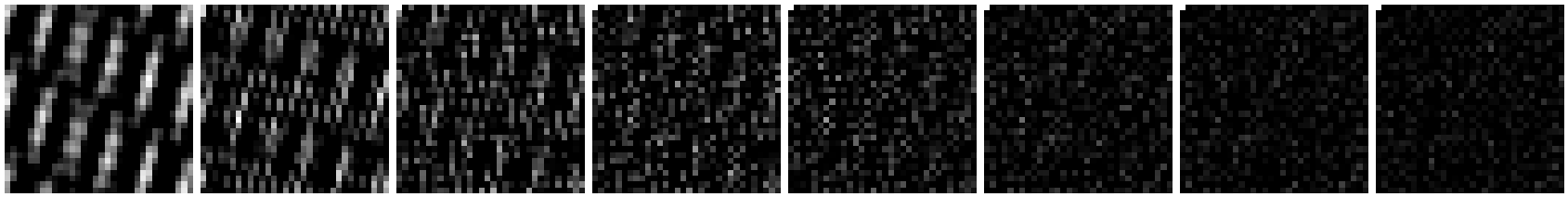


(a) $(5, 500)$ (b) $(10, 500)$ (c) $(20, 500)$ (d) $(30, 500)$ (e) $(50, 500)$ (f) $(100, 500)$ (g) $(150, 500)$ (h) $(200, 500)$

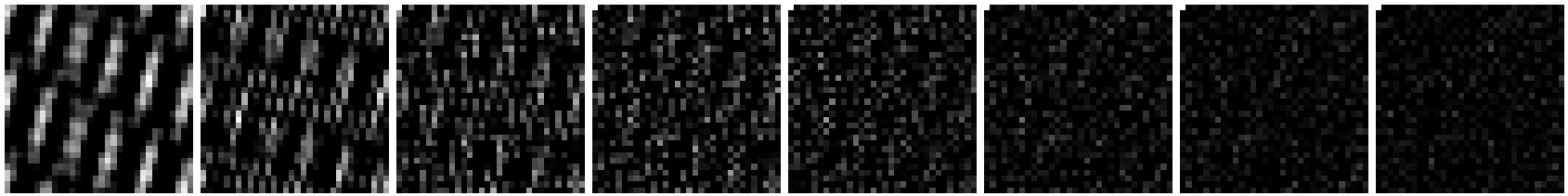


(i) $(5, 700)$ (j) $(10, 700)$ (k) $(20, 700)$ (l) $(30, 700)$ (m) $(50, 700)$ (n) $(100, 700)$ (o) $(150, 700)$ (p) $(200, 700)$

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



(a) $(5, 500)$ (b) $(10, 500)$ (c) $(20, 500)$ (d) $(30, 500)$ (e) $(50, 500)$ (f) $(100, 500)$ (g) $(150, 500)$ (h) $(200, 500)$



(i) $(5, 700)$ (j) $(10, 700)$ (k) $(20, 700)$ (l) $(30, 700)$ (m) $(50, 700)$ (n) $(100, 700)$ (o) $(150, 700)$ (p) $(200, 700)$

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