Error Concealment in Images

Introduction

In this project, error concealment algorithm was implemented for the images. It allows recovery of images if some rows are corrupted during transmission.

It is based on saving the downsampled multiple copies of image in least significant bits of original image.

Algorithm Implementation

The image processing algorithm was implemented in MATLAB and the intermediate and final results were verified with successful recovery of images after corruption of original image

Three Root Mean Square Errors (RMSEs) were calculated for each image.

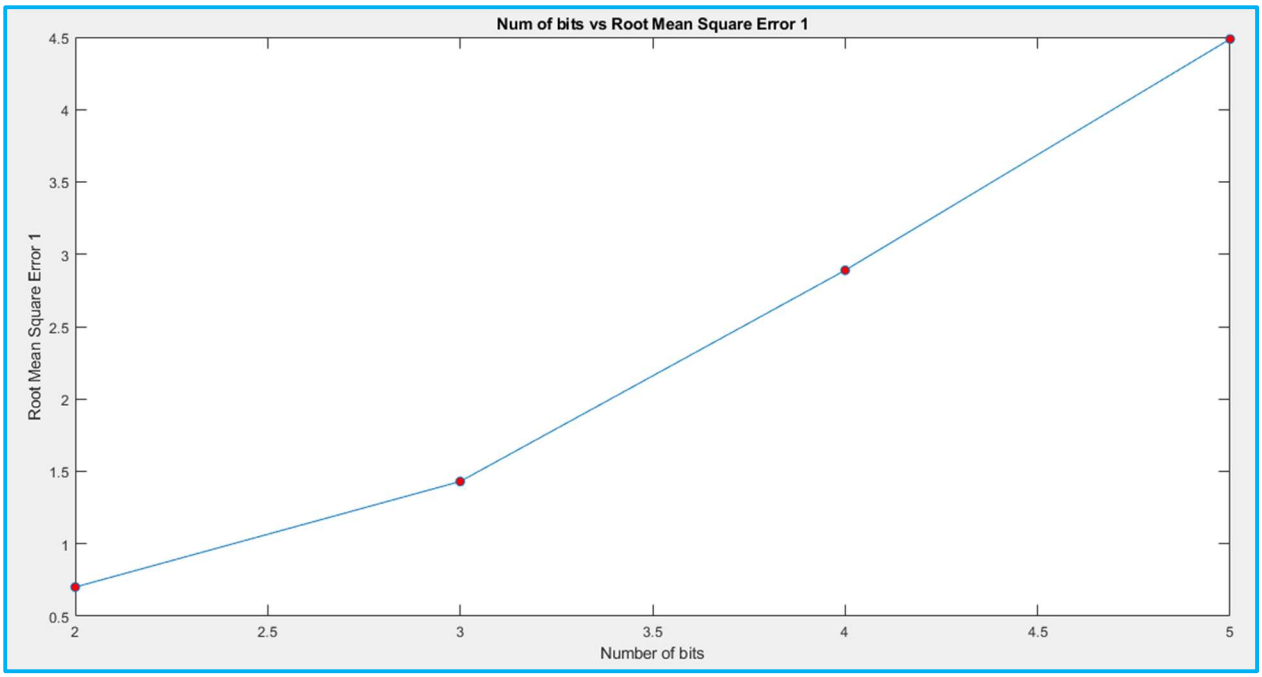
- RMSE 1 is in between original grayscale image and transmitted image
- RMSE 2 is in between original grayscale image and corrupted transmitted image.
- RMSE 3 is in between original grayscale image and recovered image.

Results of Algorithm

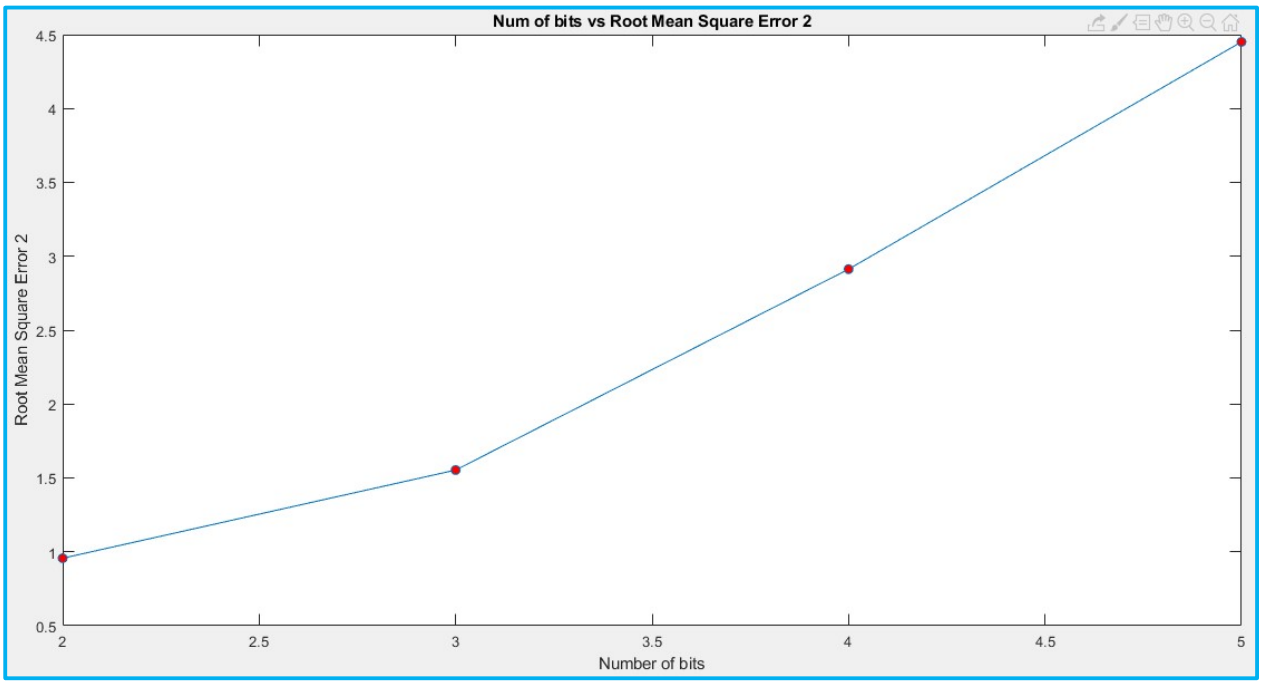
Image: Dog

Num of Bits	RMSE 1	RMSE 2	RMSE 3
2	0.70088	0.9567	1.04023
3	1.4305	1.5533	0.8850
4	2.8894	2.9129	1.34203
5	4.4871	4.4511	2.6340

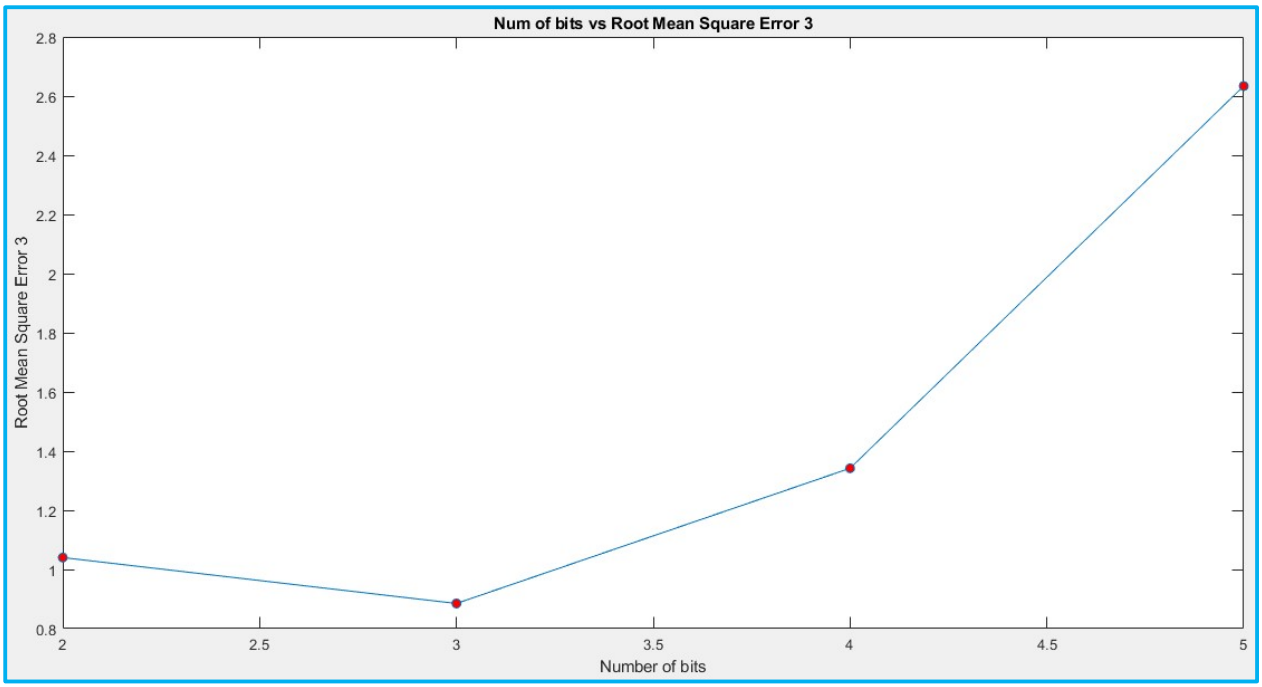
Comparison Table



Num of bits vs Root Mean Square Error 1



Num of bits vs Root Mean Square Error 2

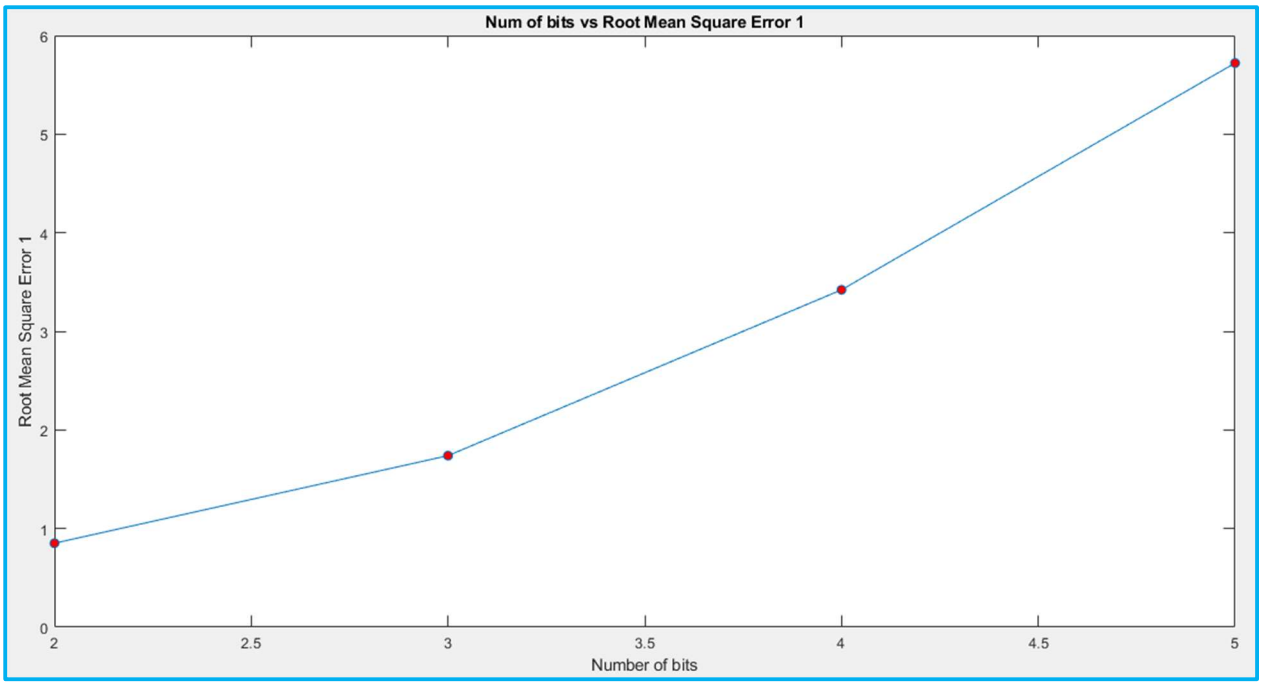


Num of bits vs Root Mean Square Error 3

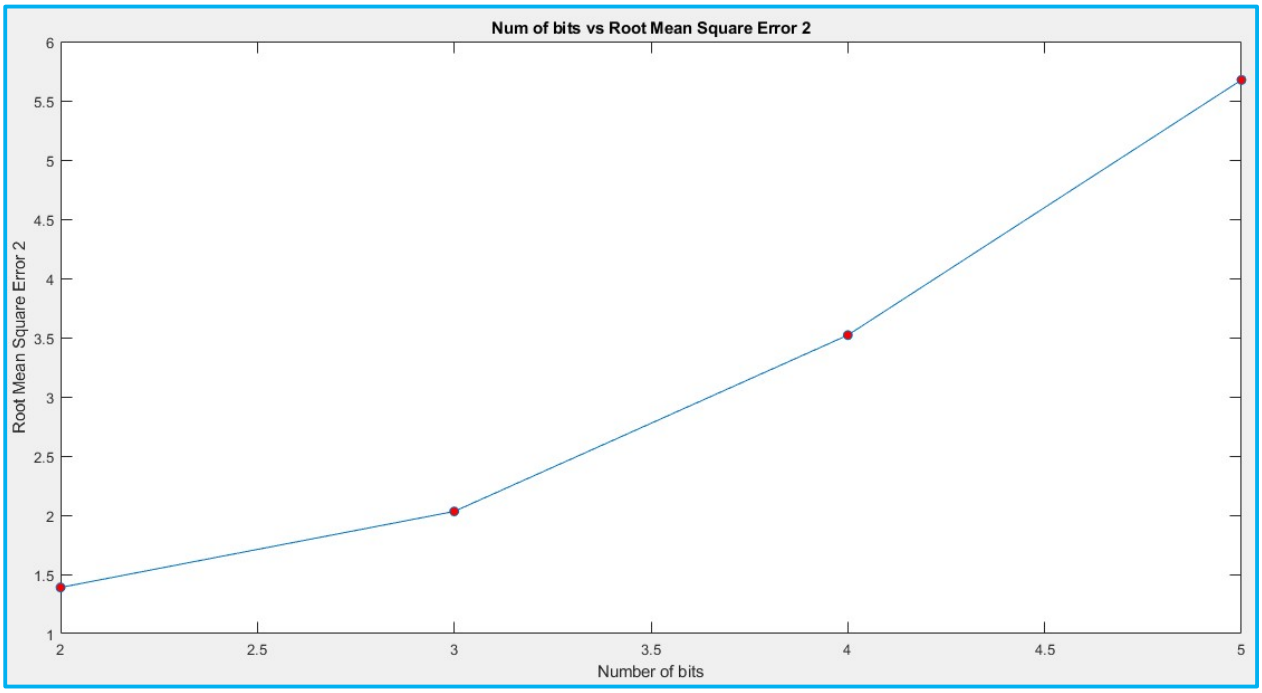
Image: Cat

Num of Bits	RMSE 1	RMSE 2	RMSE 3
2	0.8512	1.38995	1.2539
3	1.7393	2.0317	1.18093
4	3.4214	3.5206	1.65256
5	5.7214	5.6756	3.56507

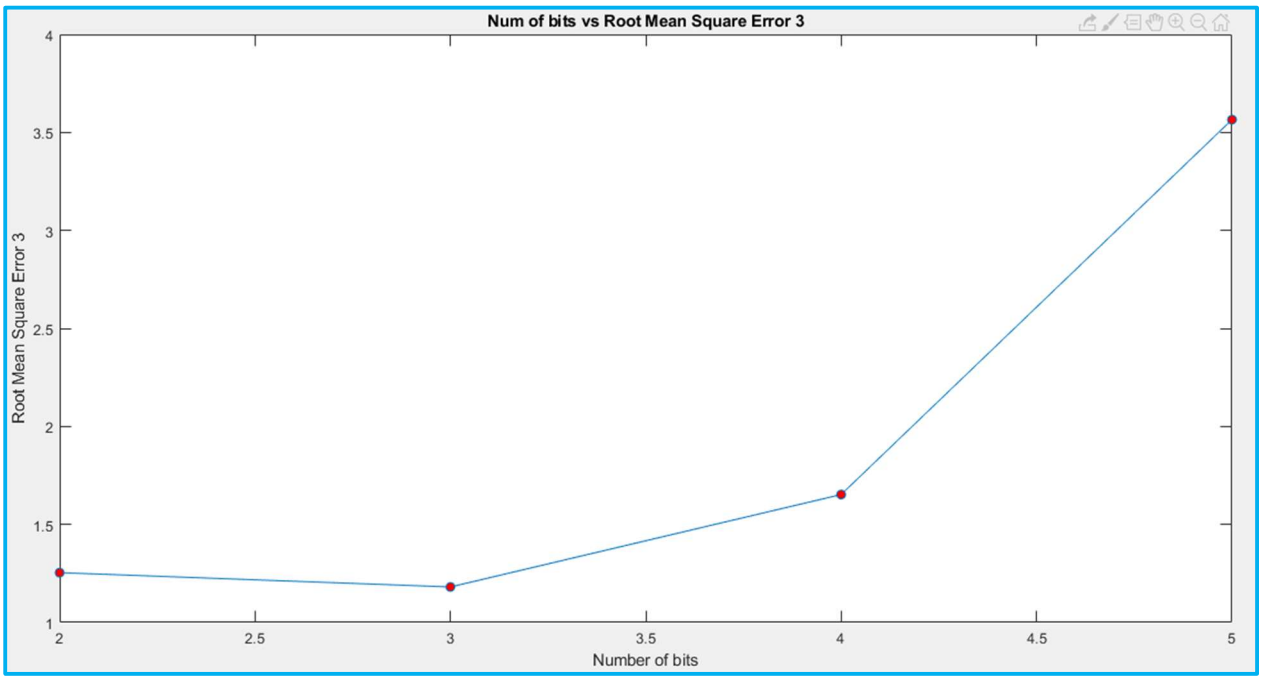
Comparison Table



Num of bits vs Root Mean Square Error 1



Num of bits vs Root Mean Square Error 2

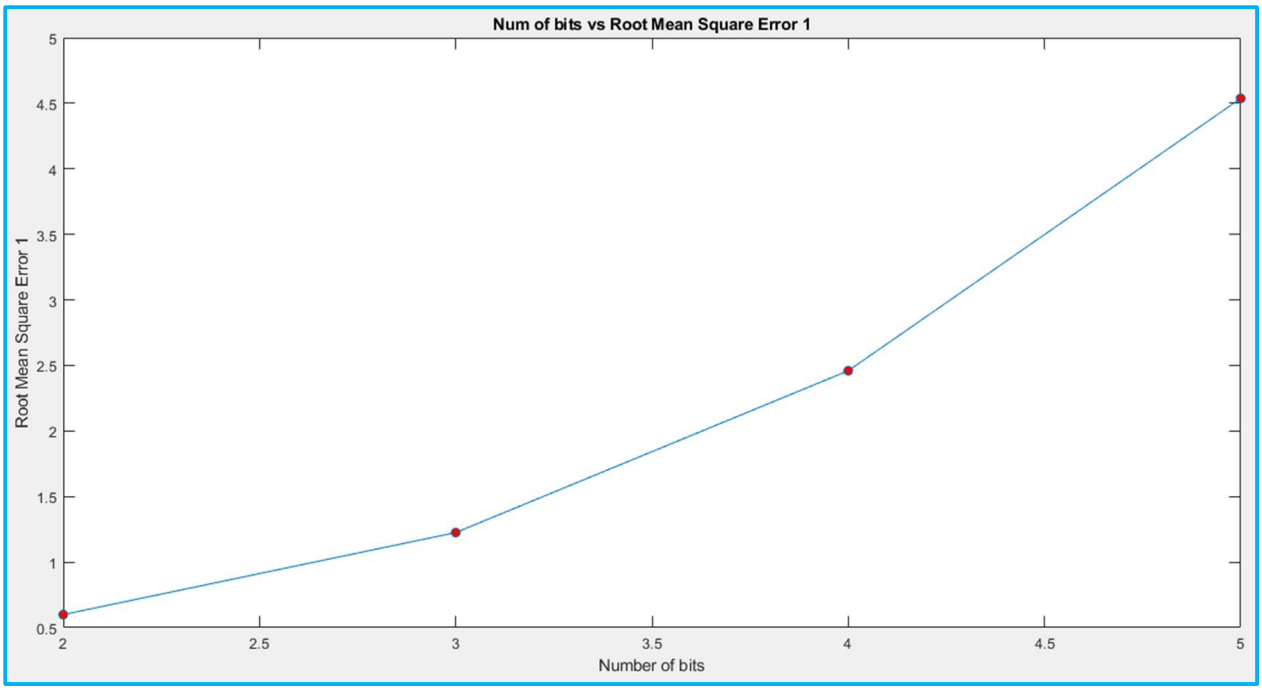


Num of bits vs Root Mean Square Error 3

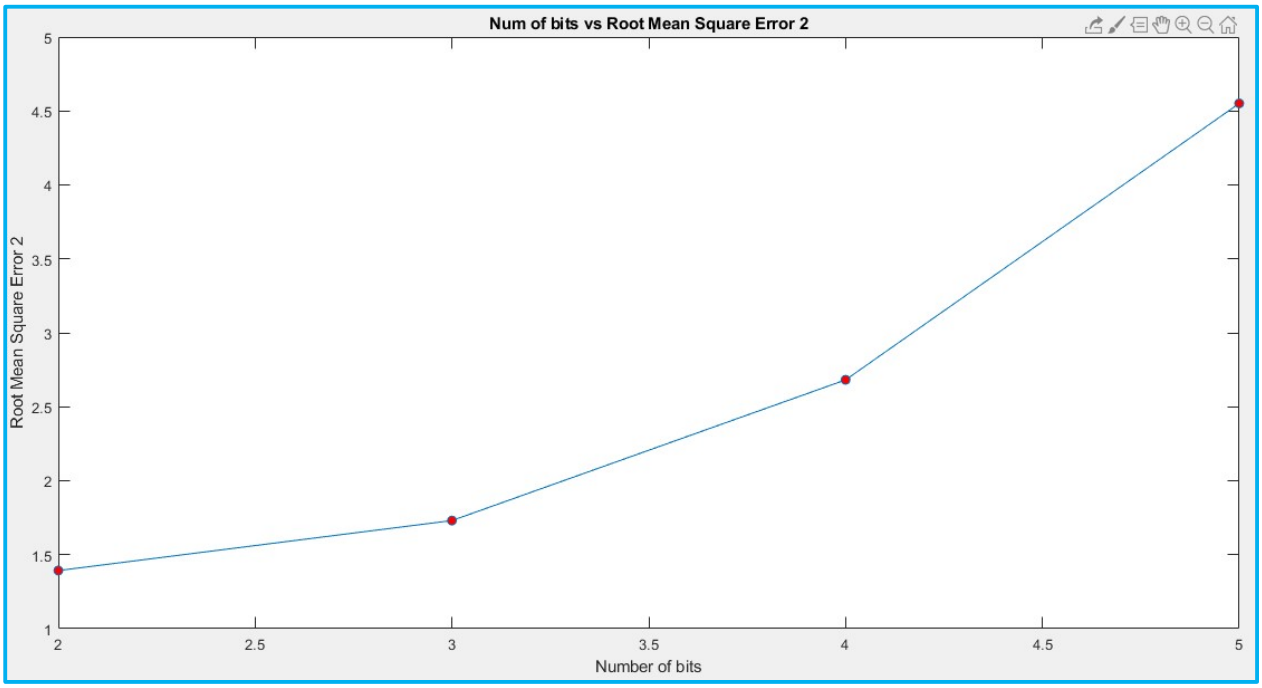
Image: Otter

Num of Bits	RMSE 1	RMSE 2	RMSE 3
2	0.5994	1.39279	0.87104
3	1.2253	1.7307	1.15247
4	2.4595	2.6821	1.76213
5	4.5372	4.5513	3.43229

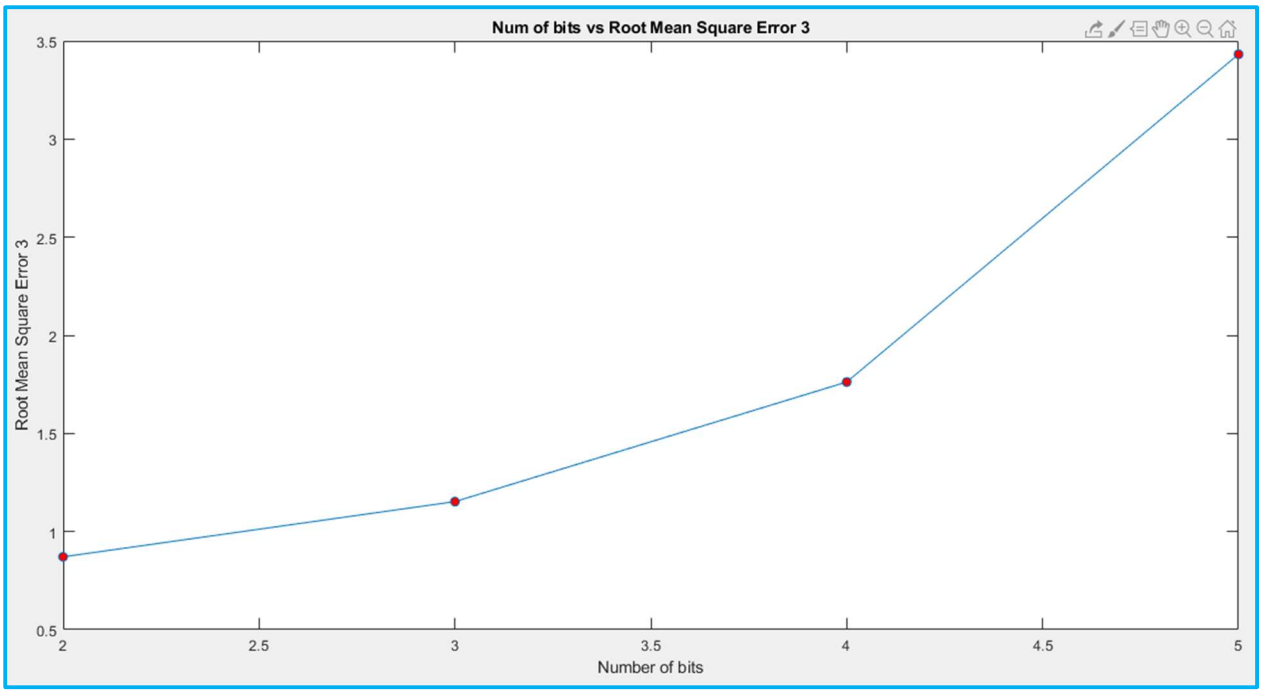
Comparison Table



Num of bits vs Root Mean Square Error 1



Num of bits vs Root Mean Square Error 2



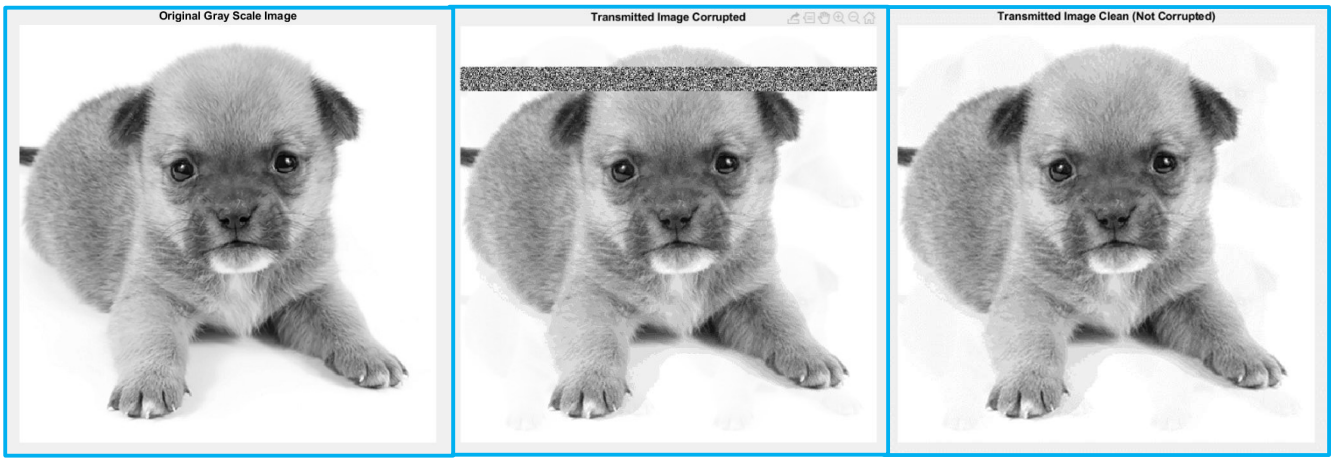
Num of bits vs Root Mean Square Error 3

Steps for Recovery

Number of Bits = 4

Number of Corrupted Rows = 30

Corrupted Row Starting Index = 51



Recovered Images

Image: Dog

Image: Cat

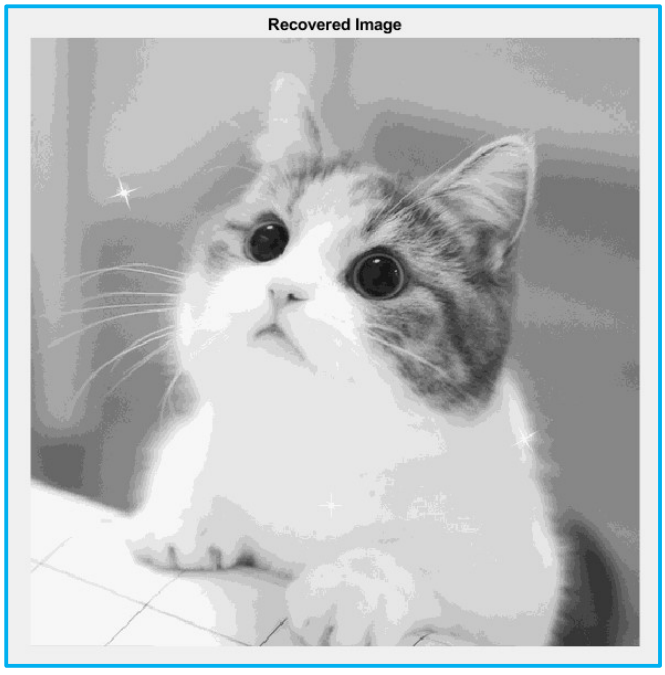
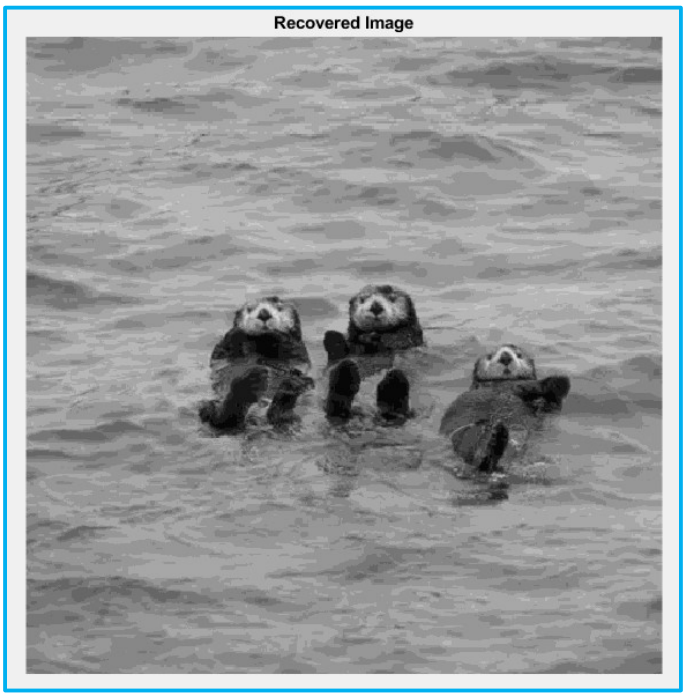


Image: Otter



Conclusion:

Overall Root Mean Square Error (RMSE) increases with significant n bits of the downsampled image. However, RMSE decreases after recovery of image via proposed algorithm which can also be seen from recovered images and the tables.