ML 547
Assignment 4
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1.)

1.) It is *lossy* compression. No you could not recover the original image from the compressed one. You have lost information.

2.) My image has N = 46800 vectors of length D=3, and number of bits per scalar C = 8.
This image takes up some function of (N*D*C) space. → O(NDC) → 46,800*3*8 = 1.1 mega bits

The compressed image has N=46,800 vectors of length D=3, and number of bits per scaler C=8 and number of clusters K=8.
Compressed image takes up O(N log2 K + KDC) bits. → 46,800*3 + 8*8*3 → 140592 bits → .14 mega bits

1.1/.14 = 8 compression factor!

2.)

As we increase the degree of the polynomial basis function we are better able to fit the test data and thus we see a reduction in the Root Mean Square Error. However, we are getting farther away from the true relationship of chirps and temperature, and therefore, when we present new data we have a poor fit (RMSE goes up). When training for the ideal parameters it's as if we are fitting the noise more than the signal. We have *overfit* the data.

3.)

As we increase the gamma value, the training RMSE raises a bit. This is because we aren't able to fit every point perfectly when we start limiting the parameter size of our OLS fit and decrease the model complexity. However, the testing RMSE drops precipitously when penalizing complex models. This is because we are penalizing high order basis functions (incidently by penalizing large parameter values) and are less likely to overfit to the training data. If we are going to assume a ninth order polynomial is a good basis function for the chirp data, we better make sure we are using high gamma values to lessen the impact of the higher order bases.