Homework 6 Solution

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This is my GitHub link: Nana Ama's GitHub Link

1 Question 1

A plot of the data of first 4 galaxies is as shown in Figure 1. we From the plot, see that the peaks of all the graphs were around 660nm which corresponds to the absorption spectra of hydrogen at the red wavelength of 656nm.

The eigenvalues and eigenvectors were found with both Singular Value Decomposition(SVD) and the Covariance Matrix. The condition number of C was found to be -335542944.0 and that of R was 43057768562688.0. SVD is better in the sense that singular values are more numerical stable than eigenvalues.

The first 5 eigenvectors were determined and plotted as shown in Figure 2.

We can see that the original flux can be written as the mean spectrum + c_i * eigenspectra * original normalization. Hence, $flux\_res$ equals c_i * eigenvalues calculated. To get the coefficient values, they were projected on the eigenvalue basis. A plot of c_0 against c_1 and c_2 is as shown in Figure 3.

For the squared residual errors, N_c was varied from 1 to 20 in steps of 1 and plotted. The result is as shown in Figure 4. For $N_c = 20$, we see that the rms residual error is about 1.5.

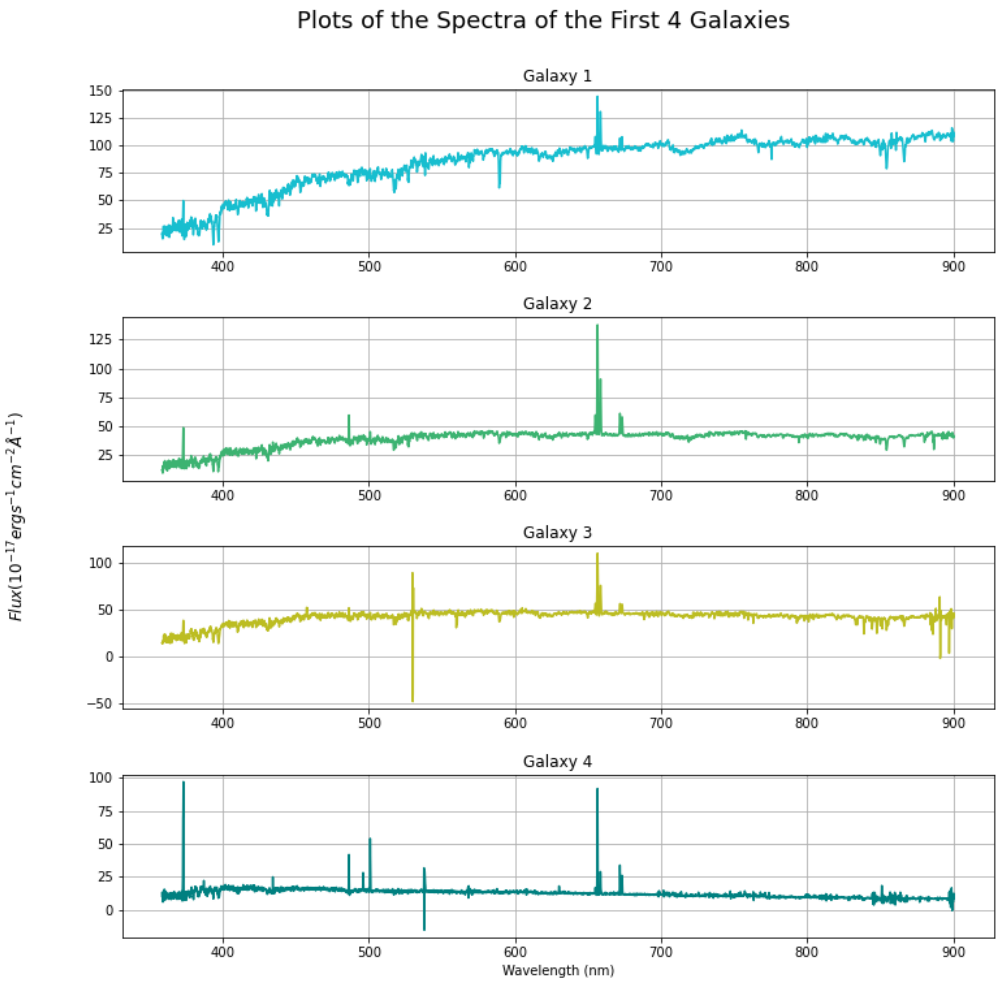

Figure 1: A plot of first 4 galaxies of the data

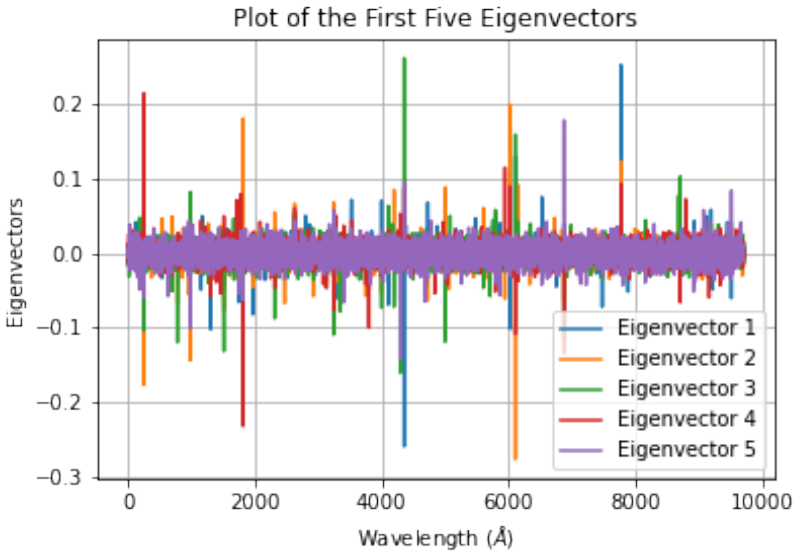

Figure 2: A plot of first 5 eigenvectors of the data

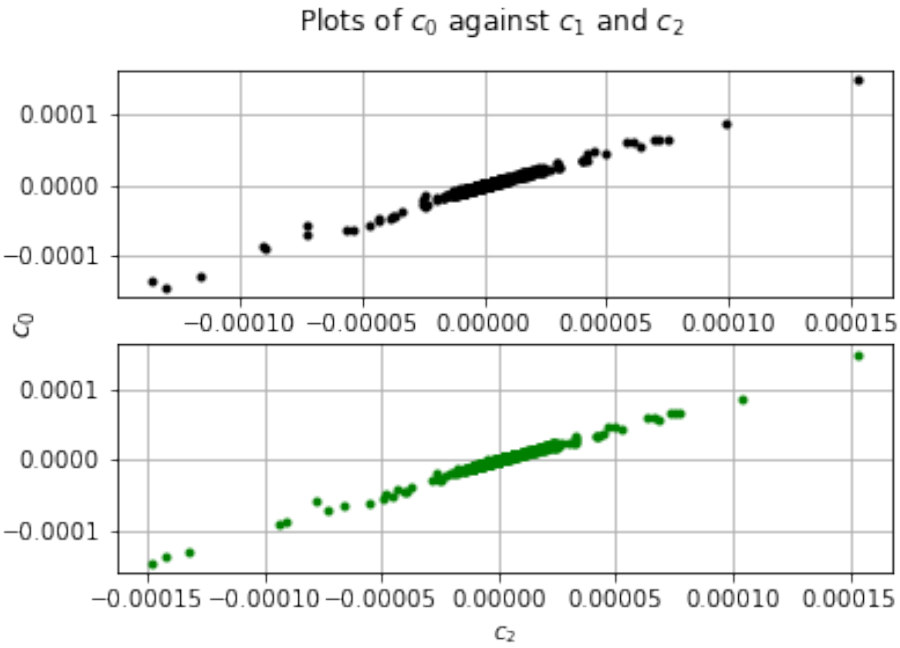

Figure 3: A plot of c_0 against c_1 and c_2

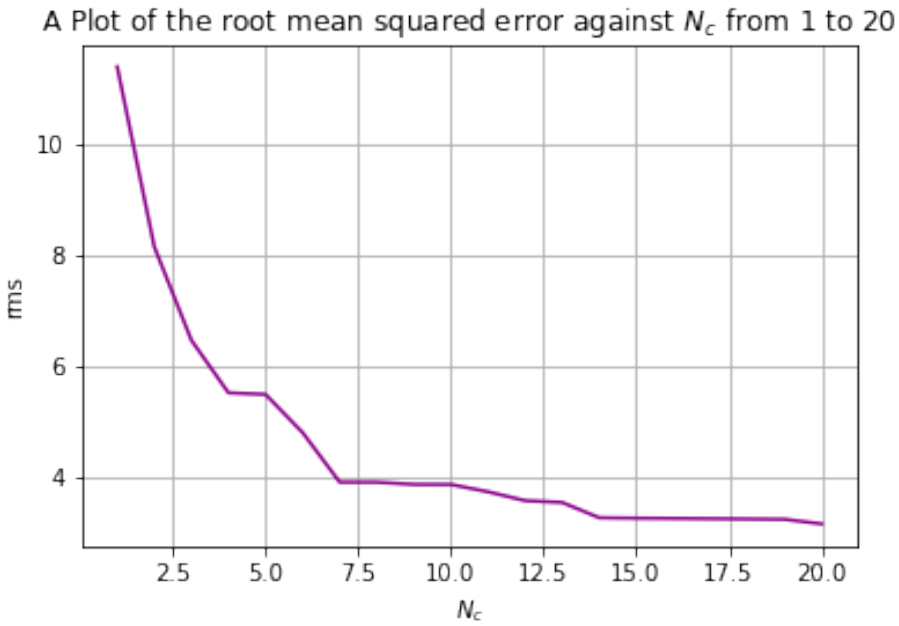

Figure 4: A plot of rms error against nc = 1 to 20