UQ 6310 Homework7, Yu Wang

Given the 500 temperature data points where each data point has 81 temperature features, we select the 1st 450 points for SVD and get the principal components. The other 50 points are used to test how much of the variability can the chosen principal components explain.

From the eigenvalue of the covariance matrix of the 1st 450 data points, it can be clearly seen that the 1st five eigenvalues are greater than the others, which can be chosen as the principal components.

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[5.4471e+01, 1.3197e-01, 8.4698e-02, 4.7282e-02, 1.0279e-03,
 5.2770e-04, 3.3584e-04, 1.6443e-04, 3.1636e-05, 2.2515e-05,
 2.1088e-05, 1.0275e-05, 8.4431e-06, 6.5142e-06, 5.4954e-06,
 3.5473e-06, 2.8980e-06, 2.6721e-06, 1.7692e-06, 1.5151e-06,
 9.3762e-07, 8.3029e-07, 7.7013e-07, 7.4381e-07, 6.5920e-07,
 6.1139e-07, 5.9033e-07, 5.2462e-07, 4.6847e-07, 4.7764e-07,
 4.2994e-07, 4.2369e-07, 3.9925e-07, 3.8530e-07, 3.5927e-07,
 3.5497e-07, 3.4304e-07, 3.1264e-07, 3.0011e-07, 2.8838e-07,
 2.7605e-07, 2.6547e-07, 2.5111e-07, 2.3123e-07, 2.1379e-07,
 2.0762e-07, 2.0518e-07, 1.8464e-07, 1.5906e-07, 1.6874e-07,
 1.3266e-07, 1.3885e-07, 1.1775e-07, 1.1106e-07, 1.0606e-07,
 9.4345e-08, 8.5327e-08, 7.6683e-08, 7.1173e-08, 5.6062e-08,
 5.5182e-08, 5.3210e-08, 4.8765e-08, 4.5334e-08, 3.9126e-08,
 3.2194e-08, 2.7892e-08, 2.4631e-08, 3.6710e-14, 3.8253e-09,
 7.3720e-09, 1.8853e-08, 2.1540e-08, 1.7007e-08, 1.1950e-08,
 1.8157e-10, 1.0912e-09, 2.2898e-09, 9.7548e-09, 1.4030e-08,
 1.7274e-09]
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Figure 1: Eigenvalue of the var matrix

Using the corresponding eigenvectors to transform the left 50 data, we can clearly seen that the variability of most features have been explained. And the newly constructed data is pretty close to the origin data.

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[1.0552, 0.9013, 0.9538, 1.0109, 0.9984, 1.0323, 0.9561, 1.0476,
 1.2875, 1.0628, 1.1427, 0.9568, 1.1097, 0.968 , 1.1142, 1.021 ,
 1.1418, 1.0766, 1.0464, 1.0507, 0.8018, 0.9571, 0.8613, 1.0009,
 0.9202, 1.071 , 1.0083, 0.9875, 1.054 , 1.0218, 0.9893, 0.9923,
 0.9707, 0.9956, 1.0258, 0.9744, 0.9385, 0.9787, 0.9585, 0.9267,
 0.8757, 0.9307, 0.9689, 1.0287, 0.9911, 0.9574, 1.0866, 1.0447,
 1.0485, 1.0268, 1.0012, 1.0307, 1.0285, 1.0074, 0.9486, 1.0202,
 1.0182, 0.9525, 0.9627, 0.9682, 0.8878, 0.9685, 0.9342, 0.9607,
 1.0636, 1.0416, 0.9826, 1.0046, 0.9308, 1.0311, 1.066 , 0.9623,
 1.1742, 0.9934, 0.9137, 0.9392, 0.9132, 0.829 , 0.9118, 0.9025,
 1.0427])
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Figure 2: Percent of variability that can be explained