Homework 5

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MATH5473

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1 Problem1

Without loss of generality, we set the probability for $p = 0.1 : 0.1 : 1$ to be $prob = [0, \cdots, 0, 0.4]$ and the probability for $r = 1 : 20$ is $[0.4000, 0.1400, 0.0800, 0, \cdots, 0]$ where the default setting is 0.9. For simplicity, each experiment is repeated for 20 times with different settings of hyper-parameter to calculate the recovery probability. The results are given as follows.

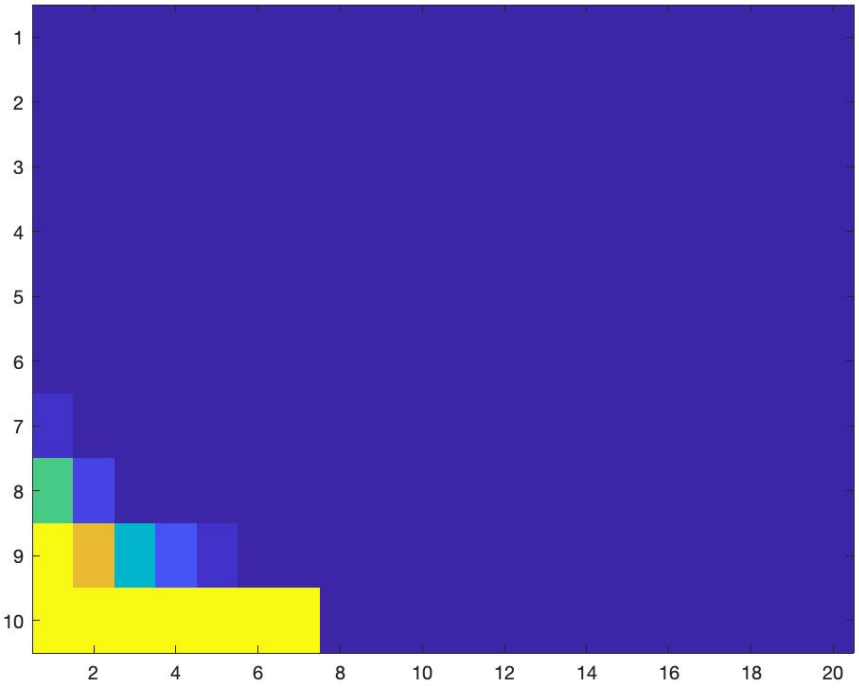

Figure 1: Phase Transition

Analysis:

a) There is a clear phase transition in the Robust PCA Algorithm.

b) We have higher probability to successfully recover the data when r is small while p is large.

2 Problem2

Since the basic outcomes of a,b,c can be easily find by running this fast script SparsePCA.m. Thus, we only provide part of the graph outcomes of d as follows.

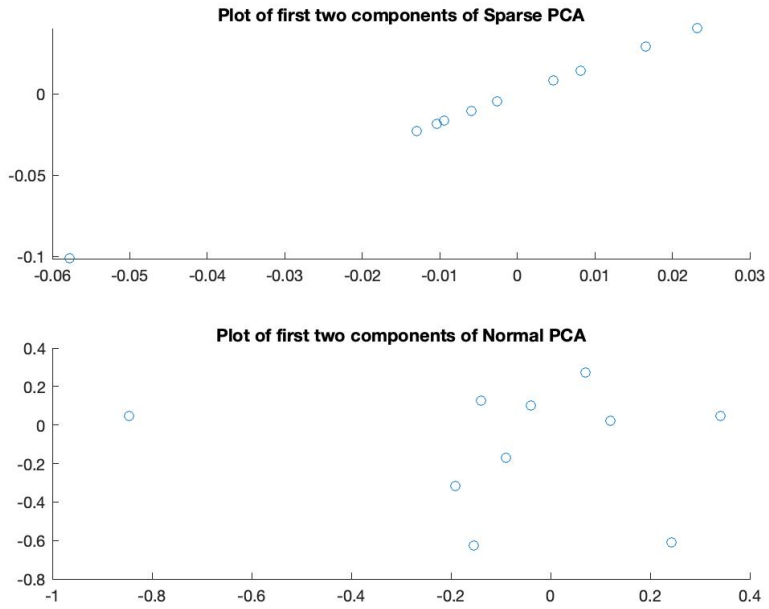

Figure 2: Comparison of Sparse PCA and Classical PCA with no extraction.

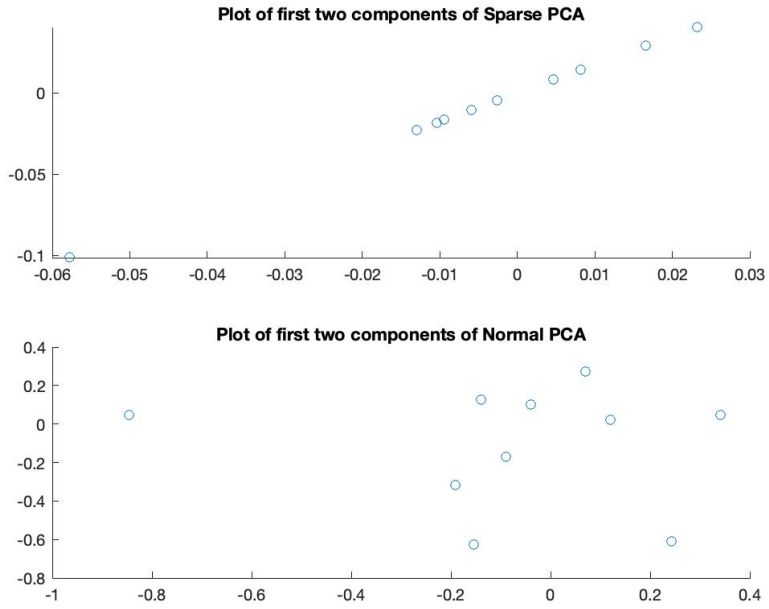

Figure 3: Comparison of Sparse PCA and Classical PCA with one extraction.

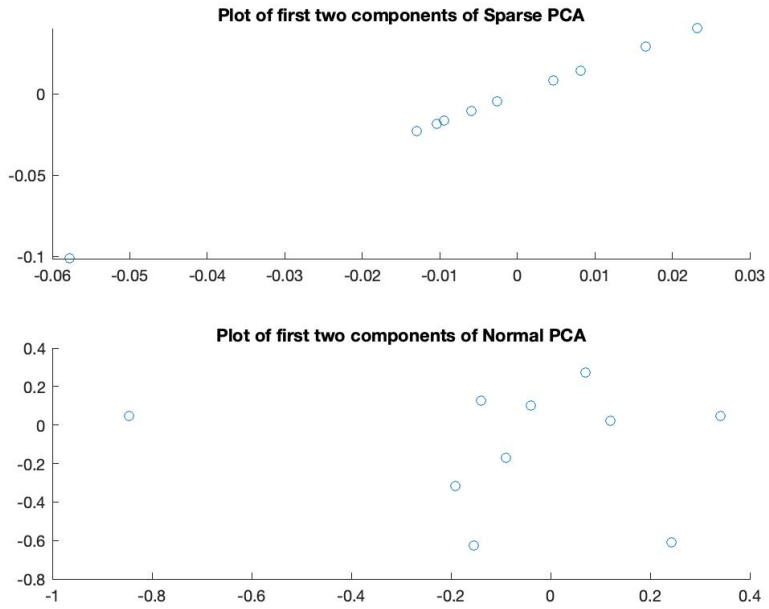

Figure 4: Comparison of Sparse PCA and Classical PCA with two extractions.

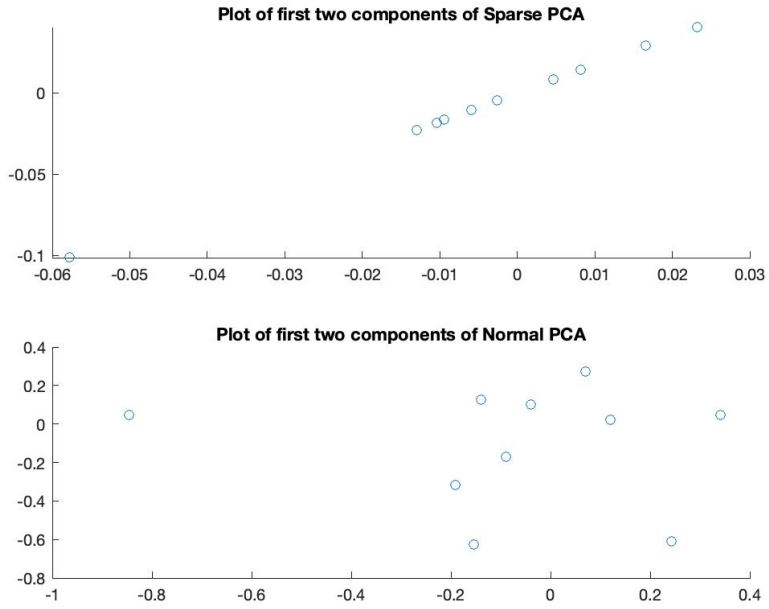

Figure 5: Comparison of Sparse PCA and Classical PCA with three extractions.

Analysis: Sparse PCA is consistently better than Classical PCA in both the experiments of changing λ and doing extractions respectively.