

MATH5473/CSIC5011 - Topological and Geometric Data Reduction and Visualization (Homework #4)

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- 1. SNPs of World-wide Populations.

We have explored the genetic variation of those person with their geographic variations, the numerical results are summarized in Fig. ??.

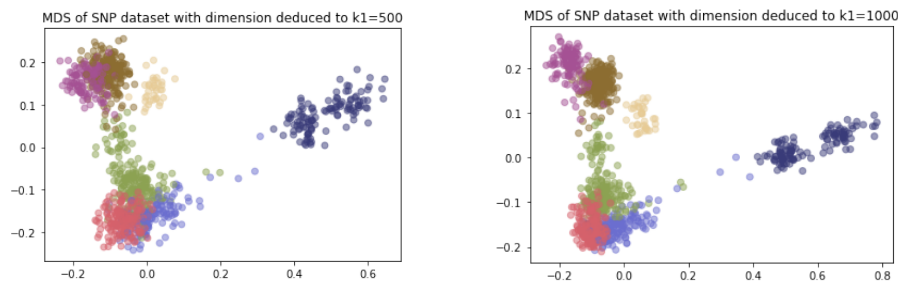


Figure 0.1: Geographic variations.

According to the two graphs above, we can reach the same conclusion as introduced in class about the SNP dataset. In this exercise, k is constrained to a small number because of computing power.

- 2. Phase Transition in Compressed Sensing.

The visualization of the observed probability of success is given as Fig. 0.2. The brightness of each dot reflects the observed probability of success, ranging from definite failure (indigo) to definite success (bright yellow).

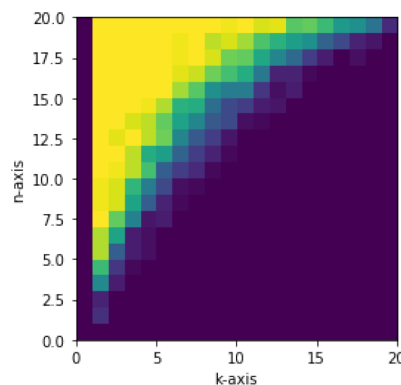


Figure 0.2: The observed probability of success.

With the minimal assumption, the reference paper shows that there is a phase transition when the regularized formulation is used to solve the linear inverse problem with random measurements. The transition occurs where the number of measurements equals the statistical dimension of the descent cone.

Besides, there are two useful observations from the given referenced paper:

Firstly, it ensures the minimum amount of information we need before we can use the convex method to solve the linear inverse problem. Secondly, it shows that once the quantum information is acquired, we can solve the inverse problem reliably .