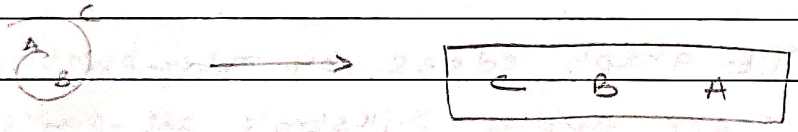
M2 L3 (Lab)

* Manifold learning methods
(non-linear dim reduction)
↳ Any space ie; locally euclidean.

Ex: Earth is a manifold : locally flat
globally sphere

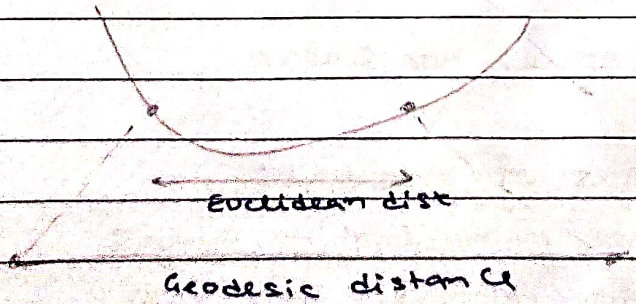
∴ Manifold learning performs dimensionality reduction by representing data as low-dimensional manifolds embedded in a higher dim space.

→ Apart from swiss roll, it can be S-curve dataset, Spiral dataset, MNIST, faces, speech dataset.



* ISOMAP (Isometric feature mapping)
↳ Is a non-linear dimensionality reduction method based on the spectral theory which tries to preserve the geodesic distances in the lower dimension.

devise a matrix



Q. How to compute geodesics without knowing the manifold?
- Build an adjacency graph & approximate geodesic dist by shortest paths through the graph.

Steps for ISOMAP:

Step 1: Build the adjacency graph over the points using a neighbourhood selection method. (KNN).

Step 2: Compute approximate geodesics: weight graph edges by inter-point distances & then apply Dijkstra's all pairs shortest paths algo.

Step 3: Take the top d e.vectors of gram matrix

Step 1a: Compute the distance matrix (pairwise euclidean distances) from the data.

1b: Keep only k nearest-neighbors for each point in the distance matrix.

Step 2: weight graph edges by inter-point distances and then apply Dijkstra's all-pairs shortest paths algorithm.

Step 3: Take the top d e.vectors of the gram matrix.

Transformation space: non-linear

Ex: Multiple images of presidents.

Captured face orientation → x-axis

colour of image → y-axis
(Image darkness)

2D space.

image pixel
2914 values
⇓
2 values

For every given point

i 2914 dim space →

2D subspace

non-linear distribution in subspace

Transformed points give much better accuracy compared to points in original subspace.

Good transformation subspace → explain highest variance.

highest accuracy.
(along dir^n's of e.vectors that help us get most relevant transformations.).

a very good method to note the variances in most images.

linearly seperable: how are the points seperated