

ISOMAP

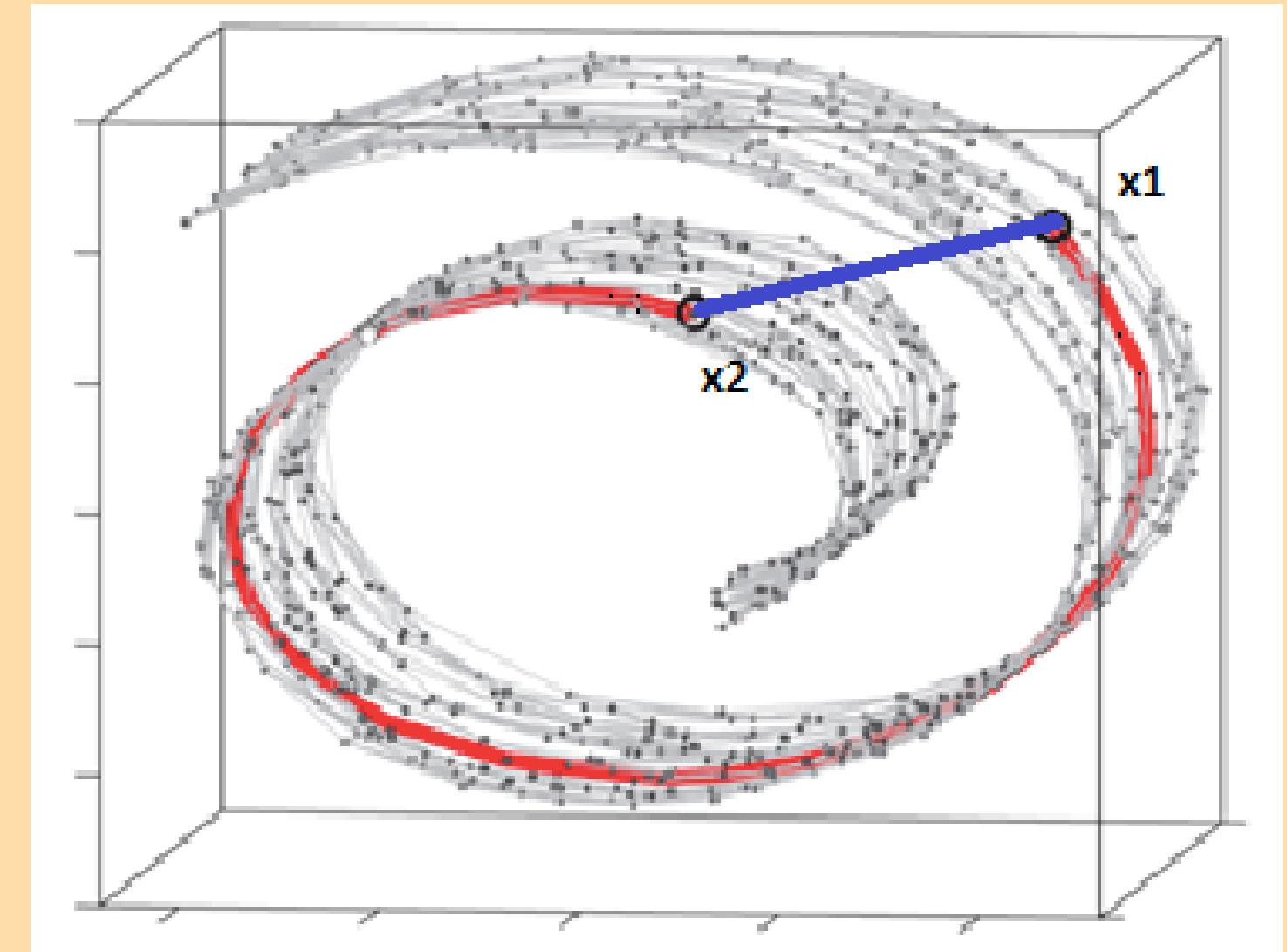
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Introduction

Isometric mapping

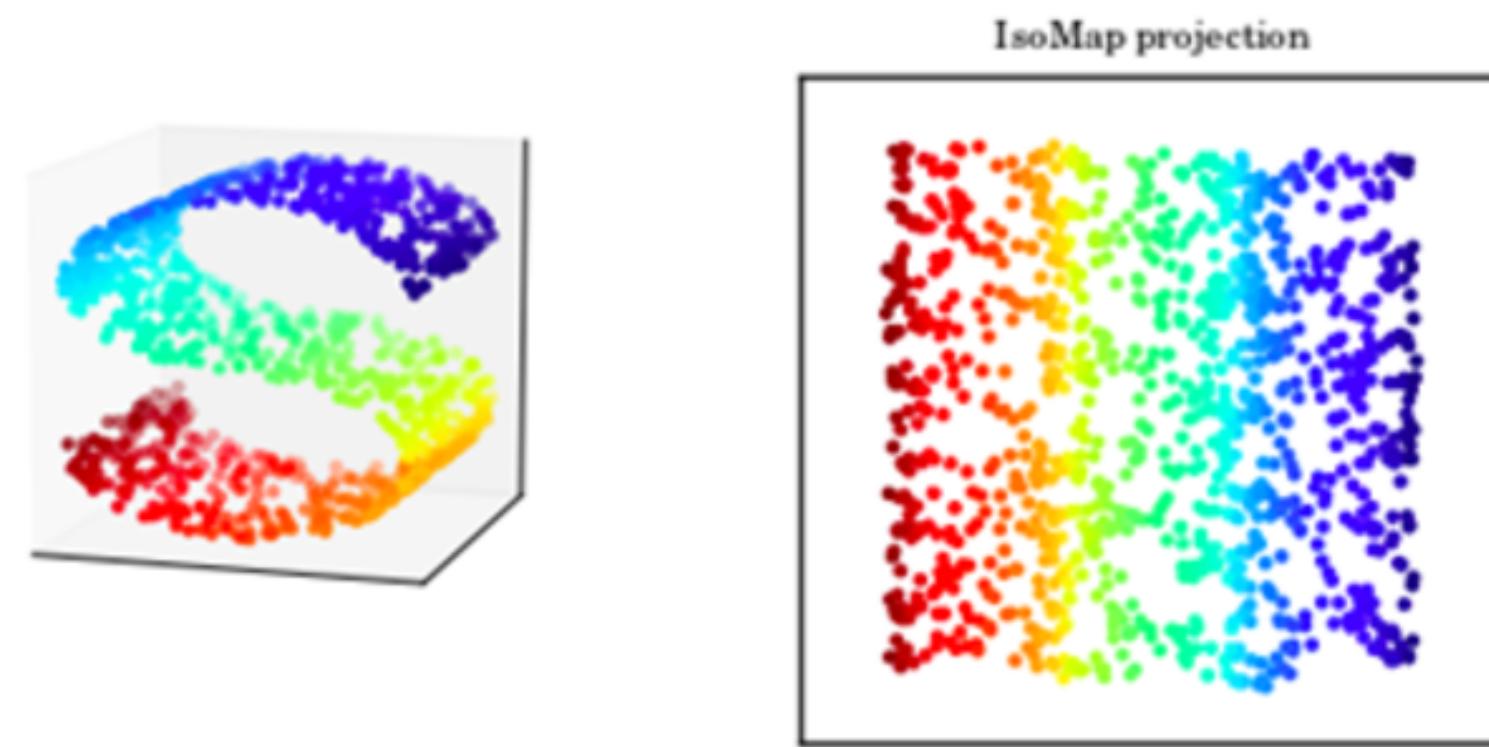
Solves nonlinear dimensionality reduction

Maintain a geodesic distance between
two points



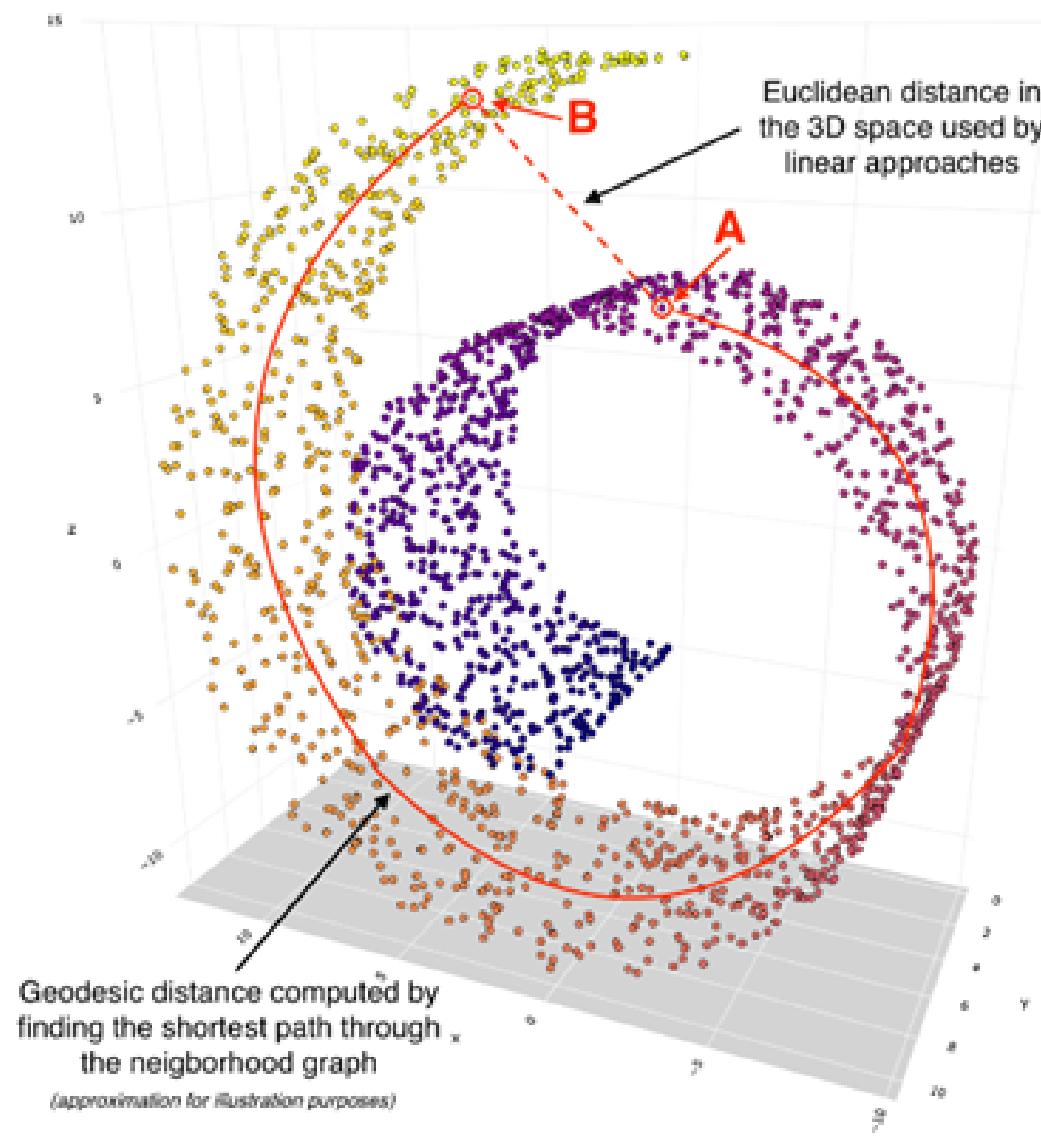
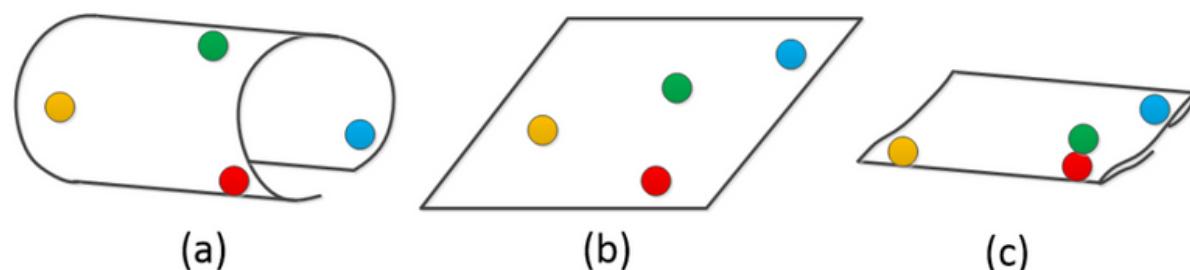
Dimension Reduction based on the way data is projected.

High-dimensional datasets can be very difficult to visualize and are much less intuitive. To aid visualization of the structure of a dataset, the dimension must be reduced in some way.



Isomap seeks a lower-dimensional embedding which maintains geodesic distances between all points.

- Captures the true, nonlinear geometry corresponding to the curved dimension;



- The geodesic distance of two data points on a manifold is the shortest distance along the manifold.

How Isomap works:

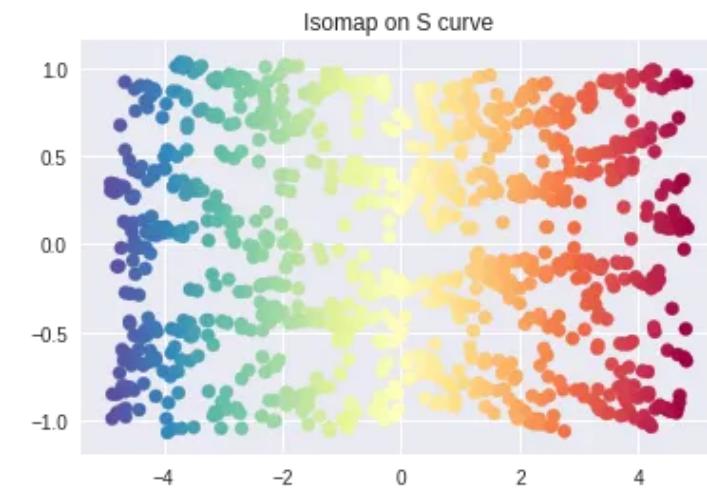
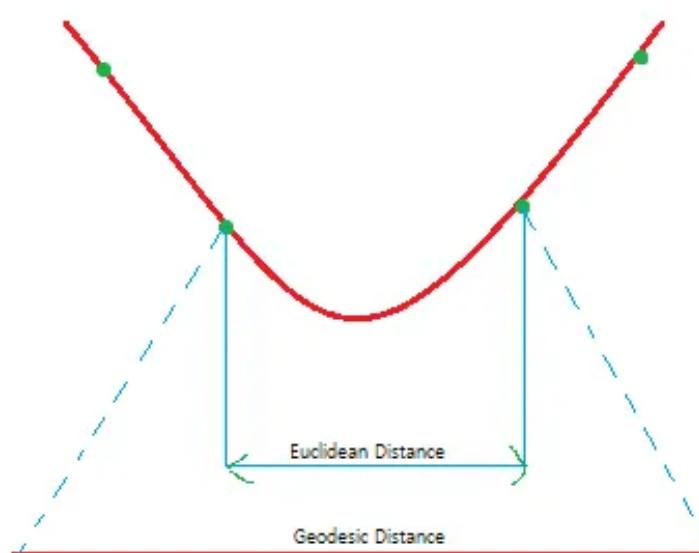
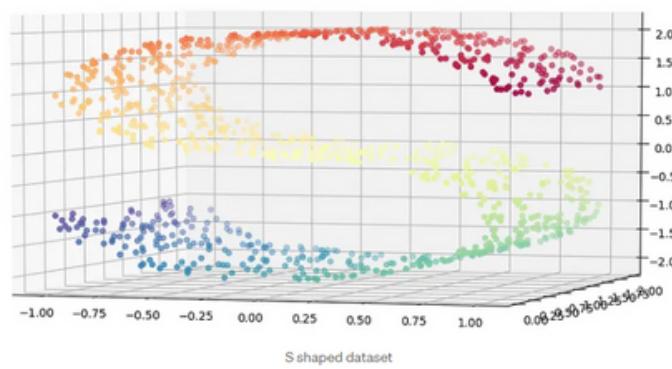
1. Input Data:
You start with
a dataset that
has data points
in a high-
dimensional
space.

2. Construct a
Neighborhood
Graph.

3. Compute
Geodesic
Distances: The
Dijkstra or Floyd-
Warshall
algorithm is used
to find the
shortest paths.

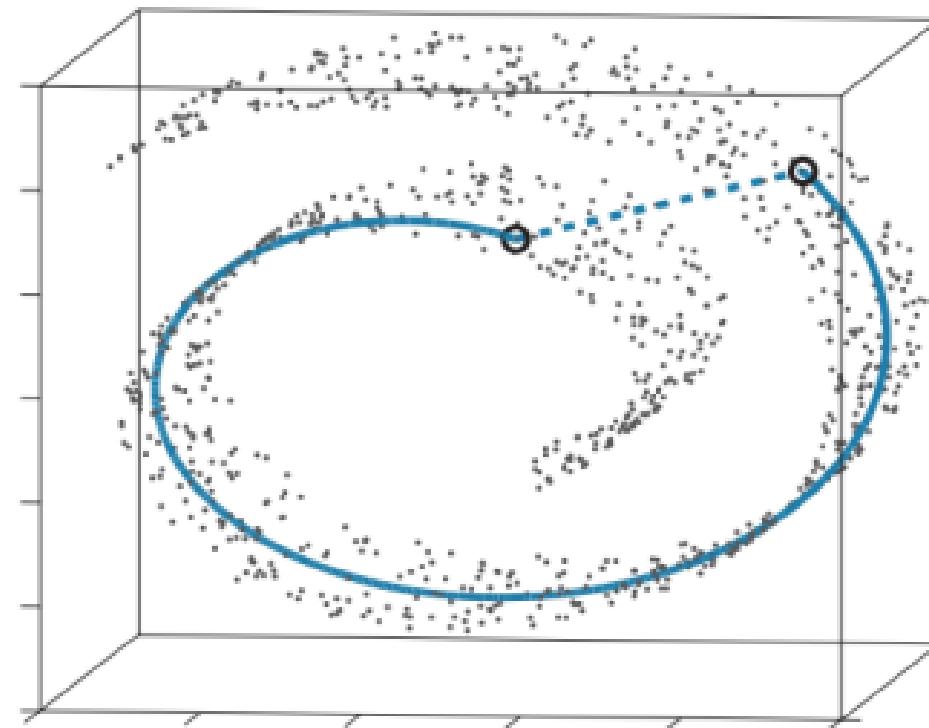
4. Construct
the Lower-
Dimensional
Embedding

5. Visualization
and Analysis: You
can often reveal
hidden patterns
and structures
that were not
apparent in the
high-dimensional
space.

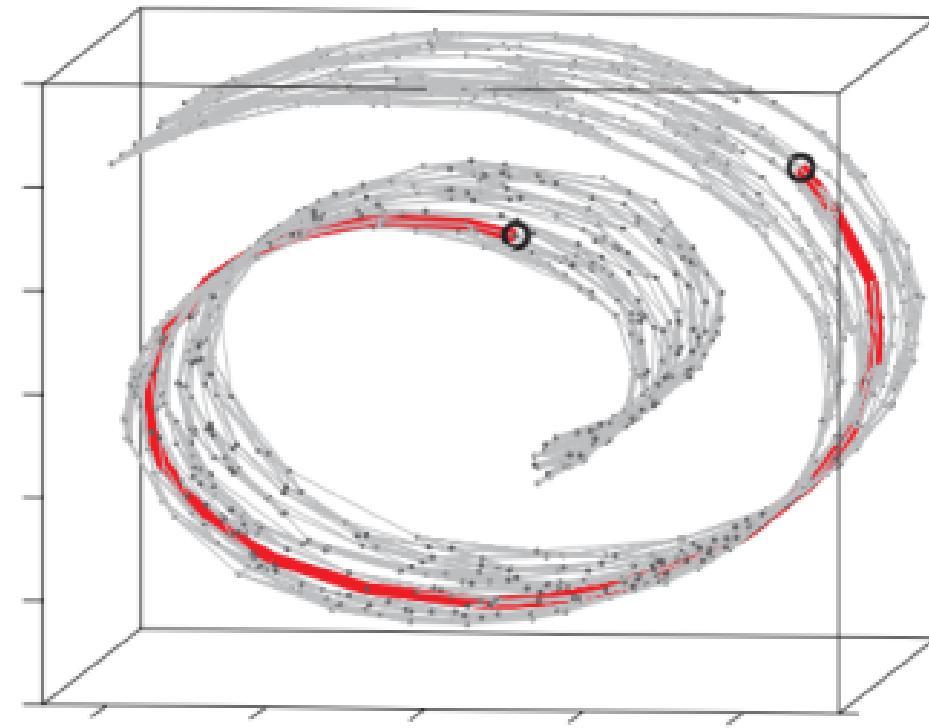


Manifold learning with Isomap is particularly useful when dealing with high-dimensional data, as it helps reduce the complexity of the data while preserving its essential structure.

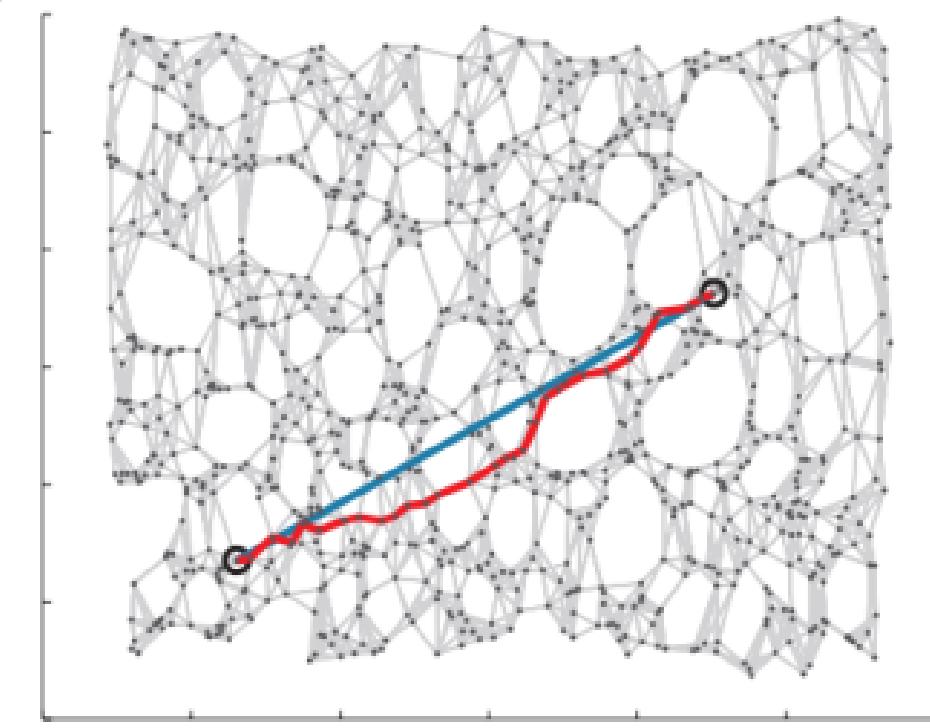
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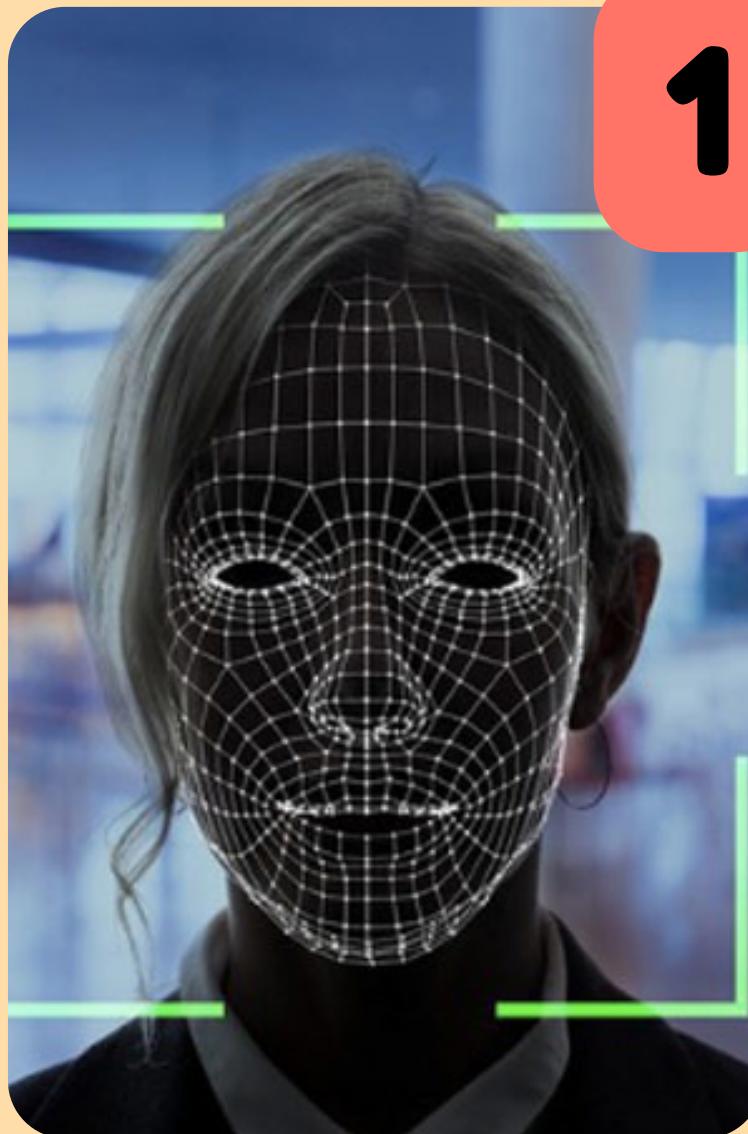
B



C



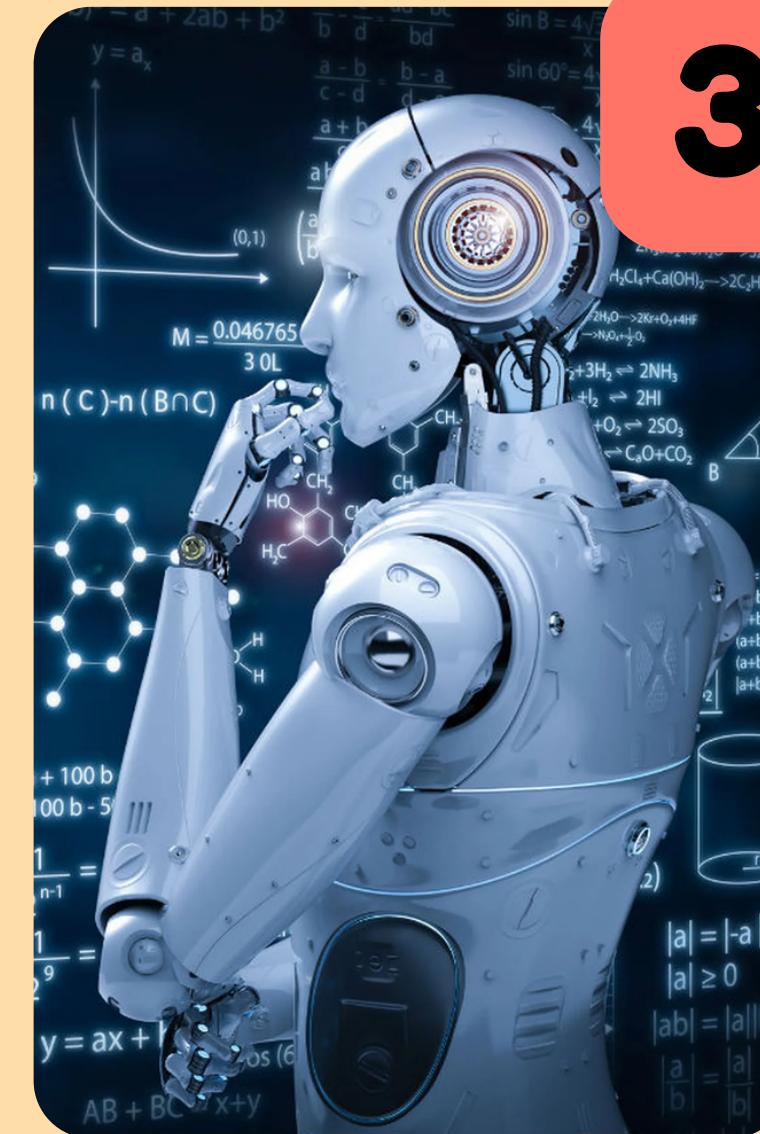
Where it applies



1



2



3



4

Example 1

- Viewing face data in 3D
- Points in the face
- Information lost



Procedure

1

Data collection:

Collection of 30 data

3

Calculating Geodesic Distances:

- Nearest neighbors graph to calculate geodesic distances,

4

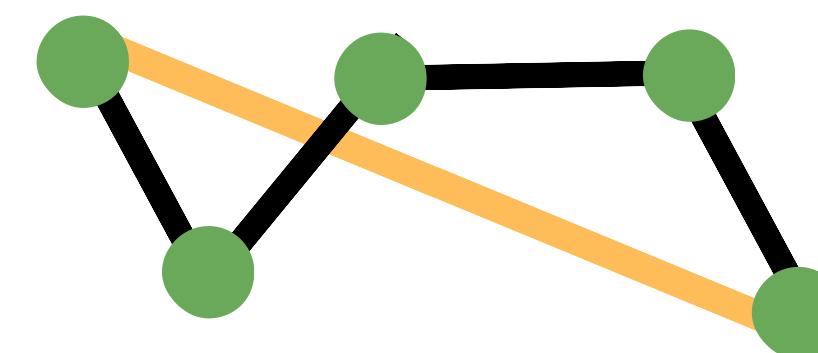
Dimensionality reduction with ISOMAP:

we use ISOMAP to project the 30 data into a 2D space.

2

Nearest neighbor graph construction:

- KNN method to “guess” the a new point or face in a data



Conclusion

**Thank
you**

References

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