# Multidimensional Scaling (MDS)

## Preliminaries

**Distance**, dissimilarity (conversely similarity) are defined for any pair of objects in any space. A distance function is also called a **metric** when (e.g. Euclidean distance)

## Goal

Given a set of objects and its distance matrix where , **multidimensional scaling** aims to reconstruct (usually ) such that

preserves as close as possible

## Types

MDS methods include

1. Classical MDS, also known as Principal Coordinates Analysis (PCoA)
   * **seeks**
2. Metric MDS
   * **seeks for some monotonic function**
3. Nonmetric MDS (NMDS)
   * **seeks for some monotonic function , and**
   * **are qualitative (ordinal)**

## Application

library(stats)

library(MASS)

# compute dissimilarity matrix from a dataset

data.dist <- dist(data[, c(independent.variables.num, "Gic")])

# classical MDS

mds <- cmdscale(data.dist, k = 2)

# Kruskal’s Non-metric MDS

mds <- isoMDS(data.dist, k = 2)