What is MDS?

By
Zichan Wang

JHU AMS 2012 FALL

Last Complied on December 19, 2012

Outline

Definition

Multidimensional scaling (MDS) is a set of related statistical techniques often used in information visualization for exploring similarities or dissimilarities in data.

Types

MDS algorithms has the following types:

1. Classical multidimensional scaling
2. Metric multidimensional scaling
3. Non-metric multidimensional scaling
4. Generalized multidimensional scaling

Mathimatical Explanation

The data to be analyzed is a collection of I objects on which a distance function is defined, these distances are the entries of the dissimilarity matrix:

$$\Delta := \begin{pmatrix} \delta_{1,1} & \delta_{1,2} & \cdots & \delta_{1,I} \\ \delta_{2,1} & \delta_{2,2} & \cdots & \delta_{2,I} \\ \vdots & \vdots & & \vdots \\ \delta_{I,1} & \delta_{I,2} & \cdots & \delta_{I,I} \end{pmatrix}.$$

The goal of MDS is to find vectors x1, ..., xI such that

$$\|x_i - x_j\| \approx \delta_{i,j}$$

Procedure

There are several steps in conducting MDS research:

1. Formulating the problem
2. Obtaining input data
3. Running the MDS statistical program
4. Decide number of dimensions
5. Mapping the results and defining the dimensions
6. Test the results for reliability and validity
7. Report the results comprehensively

Applications

Applications include scientific visualisation and data mining in fields such as cognitive science, information science, psychophysics, psychometrics, marketing and ecology.