

## Assignment 10 - Math 448

**Assignment 10:** Due 4/7 by email

The goal of this assignment is to implement multidimensional scaling algorithm and use it on given data.

The file “Constitutional\_Convention\_Votes.csv” is a record on each of the first 13 states constitution convention delegations voted on all the issues. In this assignment you will design a multidimensional scaling algorithm to scale this 13 data set into 1, 2 and 3 dimensions.

To do this first you will need to process the given vote matrix into an agreement matrix. The agreement matrix  $A$  records the percentage of issues that both states voted on (neither abstained) and agreed in their voting.

$$A_{ij} = \frac{\text{number of votes in agreement}}{\text{number of votes neither state abstained}}$$

This is a matrix of symmetric data that we can then do multidimensional scaling on. To do multidimensional scaling you need to minimize the stress function.

$$S(\mathbf{v}_1, \dots, \mathbf{v}_{13}) = \sum_{1 \leq i < j \leq 13} (A_{ij} - \|\mathbf{v}_i - \mathbf{v}_j\|)^2$$

Here  $\|\cdot\|$  is the standard Euclidean distance function.

Using a method of your own design, minimize the stress function for the Constitutional Convention data for 1, 2, and 3 dimensions. Make graphic output of the data with each state represented by its postal code abbreviation as it is in the raw data set.