Abstract

In a graph, known as $G(V, E)$, an important problem is how to clustering the vertex *automatically*. That means that the clustering method should be *unsupervised*. The spectral clustering method is a powerful solution.

1 Laplacian matrix and graph

The weight matrix is defined as

$$W = [w_{ij}]$$

in which, $w_{ij} = w_{ji}$ is the measurement weight of the edge, refers the distance between V_i and V_j.

The degree matrix is diagonal matrix

$$d_{ii} = \sum_{j=1}^{N} w_{ij}$$

where N is the number of vertex.

The subtraction is *Laplacian* matrix L

$$L = D - W \tag{1}$$

For any N dimensional vector $f \in R^N$

$$f^T L f = \frac{1}{2} \sum_{i,j=1}^{N} w_{ij}(f_i - f_j)^2 \tag{2}$$