

# Graphs in Machine Learning

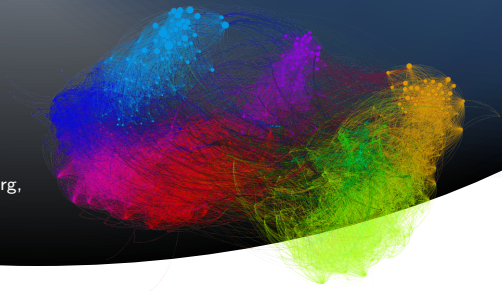
## Laplacian and Random Walks

Stationary Distribution

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Partially based on material by: Ulrike von Luxburg,  
Miller, Doyle & Schnell, Daniel Spielman



## Normalized Laplacians

$\mathbf{L}_{sym}$  and  $\mathbf{L}_{rw}$  are PSD with non-negative real eigenvalues

$$0 = \lambda_1 \leq \lambda_2 \leq \lambda_3 \leq \dots \leq \lambda_N.$$

$(\lambda, \mathbf{u})$  is an eigenpair for  $\mathbf{L}_{rw}$  iff  $(\lambda, \mathbf{u})$  solve the generalized eigenproblem  $\mathbf{L}\mathbf{u} = \lambda\mathbf{D}\mathbf{u}$ .

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<https://misovalko.github.io/mva-ml-graphs.html>