Katz Centrality

$$\mathbf{C}_{\text{Katz}} = \beta(\mathbf{I} - \alpha A^T)^{-1} \cdot \mathbf{1}$$

Harmonic Centrality

$$c_{\text{har}}(x) = \sum_{y \neq x} \frac{1}{d(y,x)}$$

Jaccard Similarity

$$\sigma_{Jaccard}(v_i, v_j) = \frac{|N(v_i) \cap N(v_j)|}{|N(v_i) \cup N(v_j)|}$$

Graph Modularity

$$\begin{aligned} Q &= \frac{1}{2m} \sum_{ij} \underbrace{\left(A_{ij} - \frac{d_i d_j}{2m} \right)}_{B_{ij}} \underbrace{\delta\left(t(v_i), t(v_j) \right)}_{(\Delta\Delta^T)_{i,j}} = \frac{1}{2m} \text{Tr}(B\Delta\Delta^T) \\ &= \frac{1}{2m} \text{Tr}(\Delta^T B \Delta) \end{aligned}$$

Closeness Centrality

$$c_{\text{clos}}(x) = \frac{1}{\sum_y d(y,x)}$$

length of the shortest path from y to x

Clustering Coefficient

$$C_i = \frac{2e_i}{k_i(k_i - 1)}$$

Pearson correlation

$$\rho(X_L, X_R) = \frac{\sigma(X_L, X_R)}{\sigma(X_L)\sigma(X_R)}.$$

$$\sigma_X^2 = \text{E}[(X - \text{E}[X])^2] = \text{E}[X^2] - [\text{E}[X]]^2$$

$$\sigma(X_L, X_R) = \text{E}[X_L X_R] - \text{E}[X_L]\text{E}[X_R]$$