COMP 9102 Assignment 3

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1 Implementation

1.1 Building the matrix

Since we treat retweet data as an undirected graph, the matrix should be symmetric.

```
for row in data:
    matrix[row[0] - 1, row[1] - 1] = 1
    matrix[row[1] - 1, row[0] - 1] = 1
```

1.2 Personal page-rank

PPR-based proximity vector for node u is defined as follows: $p_u = (1-\alpha)Ap_u + \alpha e_u$. By setting $p_u^{(0)} = \mathbf{0}$, p_u is computed iteratively.

1.3 Evaluation of clustering

We evaluated the quality of clustering using the label file by following criteria:

entropy For each cluster, the class distribution of the data is calculated first, i.e., for cluster j we compute p_{ij}, the 'probability' that a member of cluster j belongs to class i as follows: $p_{ij} = m_{ij}/m_j$, where m_j is the number of values in cluster j and m_{ij} is the number of values of class i in cluster j. Then using this class distribution, the **entropy of each cluster** j is calculated using the standard formula $e_j = \sum_{i=1}^{L} p_{ij} \log_2 p_{ij}$, where L is the number of classes. The **total entropy for a set of clusters** is calculated as the sum of the entropies of each cluster weighted by the size of each cluster, i.e., $e = \sum_{i=1}^{K} \frac{m_i}{m} e_j$, where m_j is the size of cluster j, K is the number of clusters, and m is the total number of data points.

purity Using the terminology derived for entropy, the purity of cluster j, is given by $purity_j = \max p_{ij}$ and the overall purity of a clustering by $purity = \sum_{i=1}^{K} \frac{m_i}{m}$

NMI Normalized Mutual Information $NMI(Y,C) = \frac{I(Y;C)}{[H(Y)+H(C)]/2}$ is calculated by the following steps:

1. Calculate entropy of class labels

2. Calculate entropy of cluster labels

3. Calculate mutual information by $I(Y, C) = H(Y) - H(Y|C)$, where H(Y—C)is the conditional entropy of class labels for clustering

4. Calculate NMI

2 Experiment

To run the code: `python assignment3.py -k 5`. Here, `-k` is the number of clusters to form.

	Purity	Entropy	Normalized mutual information (NMI)
k = 5	11	11	11
k = 10	11	11	11
k = 15	11	11	11