Motivating Examples

Coupled Factor Graph Model

Implicit Target Network Construction
- Solve Incompleteness
- Coupled Factor Graph Model
- Solve Asymmetry
- Solve Heterogeneity

Coupled Networks
Given a source network $G^s = (V^s, E^s)$ and a target network $G^t = (V^t, E^t)$, they compose coupled networks if there exists a cross link $e_{ij}$ with one node $v_i \in V^s$ and the other node $v_j \in V^t$. The cross network $G^{x} = (V^x, E^x)$ is a bipartite network containing all the cross links in the coupled networks.

Coupled Link Prediction
Given the source network $G^s$ and the cross network $G^{x}$ in coupled networks $G = (G^s, G^{x}, G^t)$, the task is to find a predictive function: $f : (G^s, G^{x}) \rightarrow V^t$.

where $V^t$ is the set of labels for the potential links in the target network $G^t$, with $y_{ij} = 1$ indicating a link exists between $v_i$ and $v_j$, and $y_{ij} = 0$ indicating no link exists between them.

Challenges
Incompleteness. We do not have structure information between two users in target network—there is a visibility of links that go from source network to target network but not beyond that.

Heterogeneity. The source and target networks with multi-object types are twisted and coupled with one another. This makes it difficult to directly use a supervised learning approach.

Asymmetry. Following the heterogeneity, the two coupled networks usually present different network properties—such as the average degree or clustering coefficient.

Related Work

Problem Definition

Coupled Network Data
- Disease–Gene Networks (D, G)
- Asian Mobile Networks (A)
- European Mobile Networks (E)

AUPR

attributes | D | G | D->G | G->D | As | Gs | Es | Fs
---|---|---|---|---|---|---|---|---
Studes | 703 | 1,132 | 1835 | 348,440 | 63,687 | 235,715 | 9,511,87 | 0.019
Vedges | 74,523 | 2,450 | 10848 | 613,614 | 96,325 | 306,212 | 7,355,197 | 3.012
average degree | 212.01 | 43.3 | 11.43 | 3.52 | 3.22 | 2.59 | 2.65 | 1.023
Clustering coefficient | 0.5639 | 0.0777 | 0.0 | 0.0237 | 0.0487 | 0.0 | 0.0 | 0.0
adjacent coefficient | -0.0256 | 0.1761 | -0.2556 | 0.2011 | 0.0465 | 0.0 | 0.0423 | 0.0

AUROC

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Experiments

CoupledLP Framework

CoupledLP: Link Prediction in Coupled Networks

Problem

Coupled Networks
- Disease–Gene Networks (D, G)
- Asian Mobile Networks (A)
- European Mobile Networks (E)

CoupledLP: Link Prediction in Coupled Networks

Reference

4. Y. Sun, J. Han, C. C. Aggarwal, and Y. C. Chawla. Will We Miss This Happen? Relationship Prediction in Heterogeneous Information Networks. In WSDM’12.

Data & Code:
https://aminer.org/coupledlp

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