**Week 7-1: Paper Summaries**

***CE-510 Seminar: Social Media Mining***

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* **DeepInf: Social Influence prediction with deep learning**

**What is social influence:**

Social influence is everywhere around us, not only in our daily physical life but also on the virtual Web space. The term social influence typically refers to the phenomenon that a person’s emotions, opinions, or behaviors are affected by others.

**Problem:**

Conventional social influence prediction approaches typically design various hand-crafted rules to extract user and network specific features. However, their effectiveness heavily relies on the knowledge of domain experts. As a result, it is usually difficult to generalize them into different domains.

**DeepInf (A user-level influence prediction models):**

An end-to-end framework to learn user’s latent features representation for predicting social influence. In general, DeepInf takes a user’s local network as the input to a graph neural network for learning her latent social representation. We design strategies to incorporate both **network structures** and **user-specific features** into convolutional neural and attention networks.

**What exactly are they doing ?:**

In this paper, we focus on the prediction of user-level social influence. We aim to predict the action status of a user given the action statuses of her near neighbors and her local structural information. For example, in Figure 1, for the central user v, if some of her friends (black circles) bought a product, will she buy the same product in2 the future?

To solve such a problem, they propose a deep learning-based framework, DeepInf, to represent both influence dynamics and network structures into a latent space. To predict the action status of a user v, they first sample its local neighbors through random walks with restart. After obtaining a local network as shown in Figure 1, they leverage both graph convolution and attention techniques to learn latent the latent embeddings.

图表, 散点图

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**Methodology:**

**然后所有实验基于如下假设：**

**Closed World Assumption:** users’ social decisions and actions are influenced only by their near neighbors within the network, while external sources are assumed to be not present.

**Define the graph**

The graph itself can be represented as:

r-hop neighbors of the target nodes: (指定了我们要观察的影响范围，可以理解为:



is the geodesic distance

**r-ego** network 是G的一个子图，通过r-hop neighbor推导出来。

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然后：



是social action 的一个集合

我们的模型：social influence locality models the probability of v’s action status conditioned on her **r-ego** network:

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通过似然函数，来使得观测结果X发生的概率最大的参数, 或者可以表示为 .

**Model detail:**

图示

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对于(d): The formal input layer which concatenates together network embedding, two dummy features (one indicates whether the user is active, the other indicates whether the user is the ego), and other customized vertex features (see Table 2 for example).

Random\_walk embedding + Vertex\_feature + active\_status + ego

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比较有趣的发现：

图表

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the first attention head tend to focus on the ego-user, while the second and the third highlight active users and inactive users, respectively. However, this property does not hold for other attention mechanisms. Due to the page limit, we do not discuss them here