Neighbor-Anchoring Adversarial Graph Neural Networks
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Motivation

- What is the definition of a sample on a graph?
- How do we produce good samples?

Challenges

- Graph neural networks
- Neighborhood aggregation
- Generative adversarial networks
- Generator vs. discriminator
- Prior studies seldom explore GANs and GNNs jointly in an end-to-end manner.

Related work

- Graph neural networks
- Neighborhood aggregation
- Generative adversarial networks
- Network embedding models
- DeepWalk
- Unsupervised GAN-based models
- GraphGAN
- ARGA and ARVGA
- Semi-supervised GAN-based models
- ARGA(S), ARVGA(S), GraphGAN
- End-to-end graph neural networks
- GCN and GAT

The proposed model: NAGNN

![Diagram of the proposed model: NAGNN](image)

**Algorithm 1** Model training for NAGNN

<table>
<thead>
<tr>
<th>Input</th>
<th>Parameters</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph $G$, labeled set $L$, number of epochs $n$</td>
<td>$\theta_D$, $\theta_G$</td>
<td>$\theta_D$, $\theta_G$</td>
</tr>
</tbody>
</table>

**Loss function**

$$
L(D) = \frac{1}{|V|} \sum_{v \in V} \log D(x_v) + \alpha \frac{1}{|V|} \sum_{v \in V} \log [D(K + 1)(v) + \lambda_2] ||\theta_Z||^2_2 \tag{4}
$$

**Feature synthesizing**

$$
\hat{x}_v = \frac{1}{|V|} \sum_{v \in V} x_v
$$

Baseline models

- DeepWalk
- GraphGAN
- ARGA
- ARVGA
- GCN
- GraphGAN

Datasets

<table>
<thead>
<tr>
<th>Datasets</th>
<th># Nodes</th>
<th># Edges</th>
<th># Classes</th>
<th># Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cora</td>
<td>2,708</td>
<td>5,429</td>
<td>7</td>
<td>1,433</td>
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<tr>
<td>Citeseer</td>
<td>3,327</td>
<td>4,732</td>
<td>6</td>
<td>3,705</td>
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<td>PubMed</td>
<td>19,717</td>
<td>44,388</td>
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<td>500</td>
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<tr>
<td>DBLP</td>
<td>1,666</td>
<td>7,133</td>
<td>4</td>
<td>1,084</td>
</tr>
</tbody>
</table>

Conclusions

- **Problem**
  - Adversarial learning with graph neural networks
- **Challenges**
  - What is the definition of a sample on a graph?
  - How do we produce good samples?
- **Proposed model: NAGNN**
  - Generator
  - Neighbor-anchoring strategy: produce fake samples
  - Discriminator
  - Perform recursive neighborhood aggregation on the fake samples

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