Subgraph Isomorphism Counting

DiffPool

Node-centric scheme falls short of exploiting edge-centric message passing.

SOTA (1, 2, 3) models leverage a fixed graph representation to match with all possible queries.

Challenges:

C1: How to capture fine-grained structural information?

C2: How to adapt the input graph to each query individually?

The proposed model: Count-GNN

Overall-framework

Edge-centric aggregation

Query graph representation

Counter module

Overall objective

Experimental setup

<table>
<thead>
<tr>
<th>Method</th>
<th>SMALL</th>
<th>LARGE</th>
<th>MUTAG</th>
<th>OGB-PS</th>
<th># Queries</th>
<th># Graphs</th>
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Isomorphisms counting

- Count-GNN achieves 65x ~ 324x speedups over the classical VF2, 8x ~ 26x speedups over Peregrine.
- Count-GNN is more efficient than other GNN-based isomorphism counting models.
- Count-GNN is more accurate than Conventional GNN models by at least 30% improvements in most cases.

Ablation study

- Ablation study
  - First challenge: Modulate the whole graph representation conditioned on the query to adapt each edge.
  - Second challenge: Modulate the input graph representation conditioned on the query to adapt each edge.

Parameter sensitivity

- Parameter sensitivity
  - As \( K \) increases, the performance in terms of MAE and Q-error generally becomes better, only with one exception on Q-error when \( K = 4 \times 10^{-1} \) may result in an inferior performance.

Conclusions

Experiments

- Extensive experiments demonstrate that Count-GNN significantly outperforms state-of-the-art models.

Reference