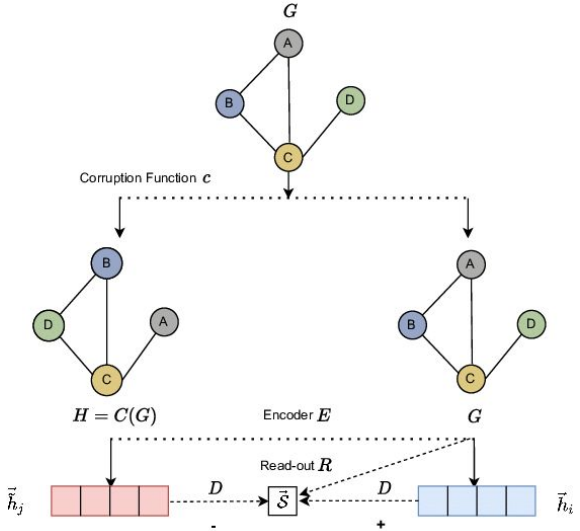
Deep Graph Infomax

What is Deep Graph Infomax?

Unsupervised framework for node embedding learning

Maximizes mutual information between local and global representations

Uses Graph Neural Networks (GNNs) for encoding



Core Idea: Mutual Information Maximization

Local Embeddings: Node representations from GNN

Global Summary: Graph-level representation from aggregation

Contrast **real pairs vs corrupted pairs** to maximize mutual information

How Does DGI Work? Step-by-Step

Step 1: Use GNN to get node embeddings

Step 2: Aggregate node embeddings to get a graph summary

Step 3: Create corrupted node features by shuffling

Step 4: Train a discriminator to distinguish real vs corrupted pairs

Step 5: Maximize discriminator accuracy to learn embeddings

Corrupted vs Real Samples

Real Sample: True node embeddings + true graph summary

Corrupted Sample: Shuffled node features + same graph summary

Discriminator learns to recognize real samples

Advantages of DGI

Fully unsupervised: no need for labels

Does **not rely** on random walks like some other methods

Applicable to transductive and inductive settings

Competitive or better than some supervised methods

Applications of DGI

Node classification

Link prediction

Graph clustering

Any downstream graph analytics task

Summary

DGI learns node embeddings by maximizing mutual information

Contrastive approach with **corrupted negative samples**

Unsupervised, scalable, and effective for diverse graphs

Opens doors for better graph analytics without labels

Quiz 1

What is the primary goal of Deep Graph Infomax?

A) To generate labeled graph data

B) To maximize mutual information between local and global node representations

C) To perform supervised node classification

D) To minimize node feature dimensions

Quiz 2

Deep Graph Infomax uses which type of neural network to encode node features?

A) Recurrent Neural Network (RNN)

B) Convolutional Neural Network (CNN)

C) Graph Neural Network (GNN)

D) Fully Connected Neural Network

Quiz 3

How does DGI create negative samples for contrastive learning?

A) By generating random graphs

B) By corrupting node features via random shuffling

C) By removing edges from the graph

D) By duplicating node features

Quiz 4

What is the role of the discriminator in Deep Graph Infomax?

A) To assign node labels

B) To differentiate between real (node, global summary) pairs and corrupted pairs

C) To cluster nodes into communities

D) To generate new node embeddings

Quiz 5

Which of the following is NOT an advantage of Deep Graph Infomax?

A) Works without requiring labeled data

B) Directly maximizes mutual information

C) Works only on small graphs due to computational limits

D) Learns useful graph representations for various downstream tasks