Modelling and Analysis of Complex Networks

Exercise 11

Due: 13:00 on Dec. 13, 2024

The maximum score of this assignment is: **16 points**. Please submit the assignment in any readable data format (.txt, .doc, .pdf, .md ...) and submit the assignment before the deadline. If you have additional information concerning your answers, please also upload the document to the Moodle, or include the link to the document in your answers (e.g., link to your Github repository).

This assignment aims to broaden your understanding of Graph Neural Networks (GNNs) beyond the standard GraphSAGE, GAT, and GCN models discussed in class. You will explore, implement, and analyze one of the latest GNN architectures, understanding its unique characteristics and applications. Please indicate your team number in your submission.

Assignment Parts: (16 points in total)

1. Theoretical Research
   - Task: Select and research a GNN model not covered in class.
   - Deliverable: A report covering:
     - An overview of the model's architecture. **(2.5 points)**
     - Comparison with GraphSAGE, GAT, and GCN. **(2.5 points)**
     - Potential applications and advantages. **(2.5 points)**
     - Summary of limitations of the chosen model. **(2.5 points)**
2. Practical Implementation and Analysis
   - Task: Implement the chosen GNN model (using its official implementation by the authors) and apply it to the link prediction task on Facebook-Ego dataset. The link prediction setting is the same as the last two assignments.
   - Deliverable: Code submission covering:
     - Implementation details (please pay attention to the implementation of loading data and metrics calculation). **(1.5 points)**
     - Experimentation methodology and results (prediction accuracy, AUROC, precision and ROC curve). **(1.5 points)**
     - Comparison with the results in the previous two assignments. **(1.5 points)**
     - Challenges faced during implementation and training. **(1.5 points)**

Resources: Locate a research paper published in 2022 or later that focuses on novel developments in GNNs:

1. Google Scholar: https://scholar.google.de/.
2. List of accepted papers from the following conferences:
   - ICLR2022: https://iclr.cc/virtual/2022/papers.html?filter=titles.
   - ICML2022: https://icml.cc/virtual/2022/papers.html?filter=titles.
   - NeurIPS2022: https://neurips.cc/virtual/2022/papers.html?filter=titles.
   - ICLR2023: https://iclr.cc/virtual/2023/papers.html?filter=titles.
   - ICML2023: https://icml.cc/virtual/2023/papers.html?filter=titles.
   - NeurIPS2023: https://neurips.cc/virtual/2023/papers.html?filter=titles.
3. Or others, please cite the paper clearly.