# Project Report of COMP6651: Analyzing and Implementing Minimum-Cost Flow Algorithms on Randomized Source-Sink Networks

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**Abstract** 

#### 1 Introduction

- 1.1 Introduction to Community Detection
- 1.2 Machine Learning Context
- 1.3 Usage of Machine Learning in Community Detection
- 1.4 Challenges in Community Detection

#### 2 Related Work

- 2.1 Overview
- 2.2 Optimization-Based Methods
- 2.3 Modularity-Based Methods
- 2.4 Deep Learning Methods

## 3 Proposed Approach

- 3.1 GNN Architectures
- 3.1.1 GCNConv
- 3.1.2 GraphSAGEConv
- 3.2 Scalability Techniques
- 3.2.1 Full-Batch Training
- 3.2.2 Neighbor Sampling
- 3.2.3 Graph Partitioning

# 4 Results, Training, and Evaluation

- 4.1 Datasets
- 4.2 Training Approaches
- 4.3 Evaluation Metrics
- 4.4 Experimental Results
- 4.4.1 Synthetic Graphs
- 4.4.2 CORA Dataset
- 4.4.3 Reddit Dataset
- **4.4.4** Performance Summary Tables

### 5 Conclusion

### References