

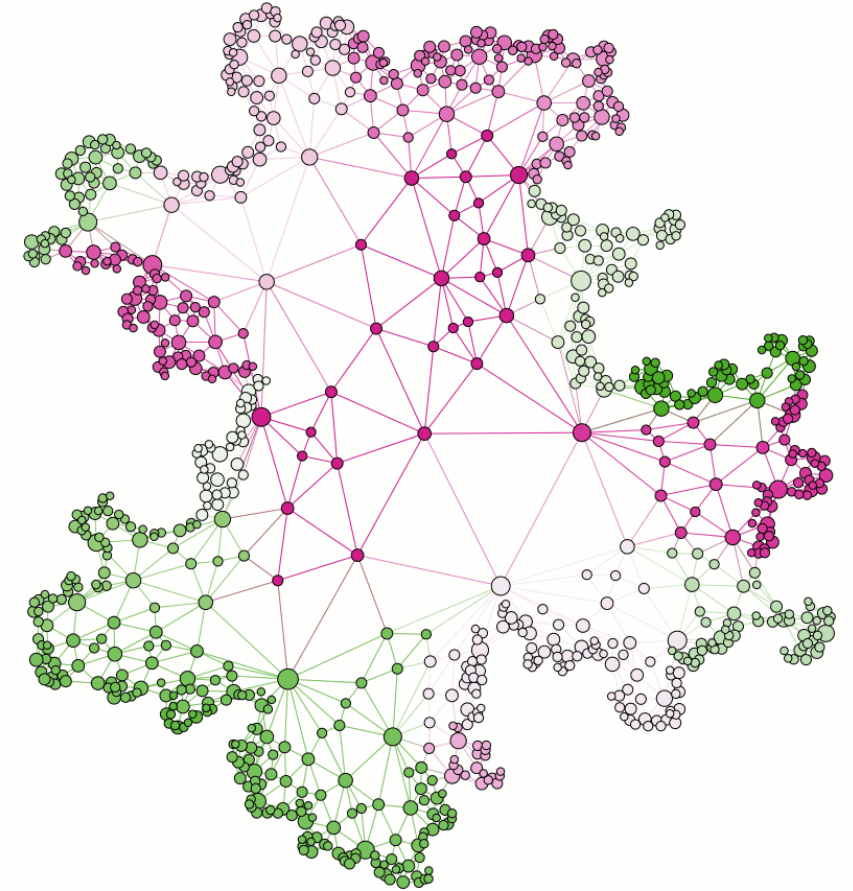


Community detection in large graphs

Patrick De Causmaecker & Pieter Leyman

Introduction

- Community structure or clustering
 - Many edges between vertices in cluster
 - Few edges between clusters
 - Importance in biology, sociology, computer science
 - What about (very) large networks?



Source: <http://ginestra-bianconi-6flt.squarespace.com/>

Introduction

- Algorithms for community detection in graphs
 - A lot of research by many disciplines
 - Focus on exact algorithms and heuristics
 - See Fortunato (2010) for an overview
- Shortcomings
 - What about metaheuristics?
 - Application to large graphs?
 - Chen et al. (2016) is a move in the right direction

Assignment

- In teams of 2 students
- Research
 - Field of community detection in graph theory
 - (Meta)heuristics
- Write own research proposal
 - Topic (community detection)
 - Overview of existing work & algorithms
 - Gaps in literature?
 - Own approach (metaheuristics)
- Finish these parts by 14 December: oral presentation
- Already start on algorithms as well!

Assignment

- Implement existing approach for selected problem
 - Motivate choice!
 - Design choices
 - How do you perform in comparison with reported results?
- Design own metaheuristic approach(es?)
 - Own algorithm(s)
 - Experiment with different operators & variants
 - Motivate decisions (with results)
- Generate own (relevant!) data
 - Data parameters
- Finish these parts by end of February?

Assignment

- Compare performance
 - Algorithm parameter tuning
 - Local search comparison
 - Your metaheuristic has to perform better!
- Impact of data parameters on results
 - What makes (classes of) instances difficult to solve?
 - How good do algorithms perform (large graphs)?
 - Composite approach?
- Write report: 22 March
 - Problem, algorithm, data, results
 - Hand in electronically
- Give presentation: 29 March

Material

- Chen, D., Zou, F., Lu, R., Yu, L., Li, Z. & Wang, J. (2016). Multi-objective optimization of community detection using discrete teaching-learning-based optimization with decomposition. *Information Sciences*, 369: 402-418.
- Fortunato, S. (2010). Community detection in graphs. *Physics Reports*, 486: 75-174.
- Fortunato, S. & Hric, D. (2016). Community detection in networks: A user guide. *Physics Reports*, To appear (Available online).
- He, D., Wang, H., Jin, D. & Liu, B. (2016). A model framework for the enhancement of community detection in complex networks. *Physica A*, 461: 602-612.
- Lancichinetti, A. & Fortunato, S. (2009). Community detection algorithms: A comparative analysis. *Physical Review E* 80, 056117: 1-11.
- Leskovec, J., Lang, K. & Mahoney, M. (2010). Empirical comparison of algorithms for network community detection. *Proceedings of the 19th International Conference on World Wide Web*: 631-640.
- You, T., Cheng, H.-M., Ning, Y.-Z. & Shia, B.-C. (2016). Community detection in complex networks using density-based clustering algorithm and manifold learning. *Physica A*, 464: 221-230.