High Quality, Scalable and Parallel Community Detection for Large Real Graphs

Arnau Prat-Pérez, David Dominguez-Sal, Josep-Lluis Larriba-Pey

To be published in WWW 2014

GraphTA 2014

DAMA-UPC. DATA MANAGEMENT
UNIVERSITAT POLITÈCNICA DE CATALUNYA

A brief introduction

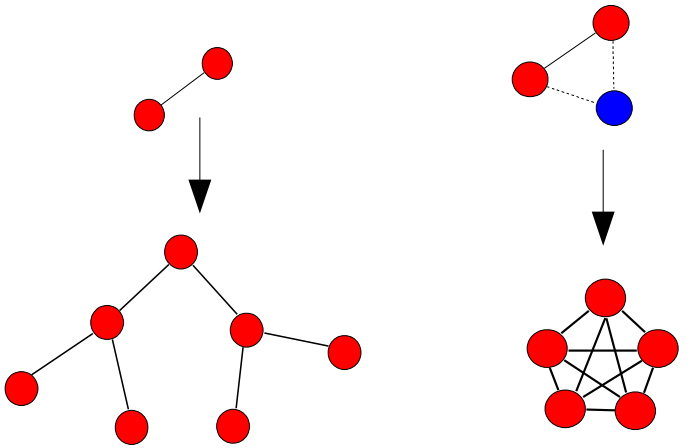
- **Real networks** are structured into modules called **communities**.
- Informally, communities are groups of nodes more **highly connected** between them than with the rest of the graph.
- Several applications:
  - **Recommend** users, products, sites, etc...
  - Find **similar proteins**.
  - **Visualization** of large data.
- However:
  - **Non consensuated definition**.
  - **Computationally expensive**.

Goal

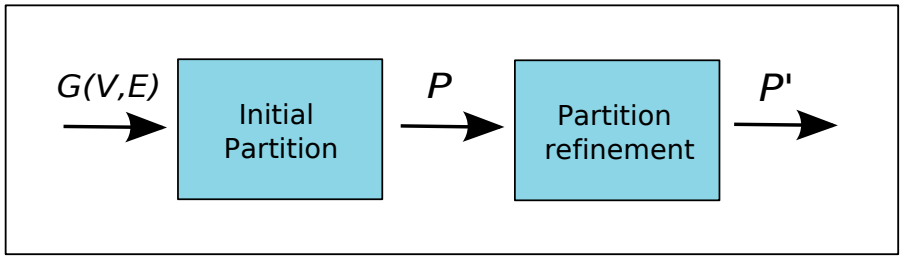
- Find algorithms with a strong focus on:
  - **Quality**
  - **Scalability**
  - **Parallelism**
- **Scalable Comunity Detection (SCD)** is our first proposal for scalable **disjoint community** detection algorithm for **SMP machines**.

Weighted Community Clustering (CIKM12)

- The **Weighted Community Clustering** (WCC) ranks the quality of a graph partition into **disjoint communities**
- Strongly based on **triangles**.
- **Good structural indicators**:
  - large internal edge density
  - small diameter
  - small conductance



Scalable Community Detection (SCD)



- **WCC** as heuristic.
- Transfers can be computed in **parallel**.
- We **approximate** the WCC using a **proposed estimator**.
- Algorithm's complexity: **O(m · log n)**

Some results

- 4-Core Xeon with 32GB of RAM.
- Quality: **better** than state of the art, using **real graphs** with **ground truth communities**.
- Scalability: **faster** than the fastest. Graphs with **1.8 Billions edges** processed in **just 4.3 hours**.
- Parallelism: almost **linear speed-up** for large graphs.
- Verified **quasi-linear complexity**.

Summary

- Triangles allow us to find communities **fast and reliably**.
- We exploit the characteristics of current **multicore microprocessors**.
- Paper and code **available** at **www.dama.upc.edu**.