

Complex Networks 2016

Satellite Meeting of StatPhys26

Detecting Global Bridges in Networks

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The Scope of Centrality Measures

- Many different measures (really many)
- Betweenness Centrality
- Connection between different "regions"
- Some nodes do it
- A high BC is suggestive of that

Betweenness Centrality

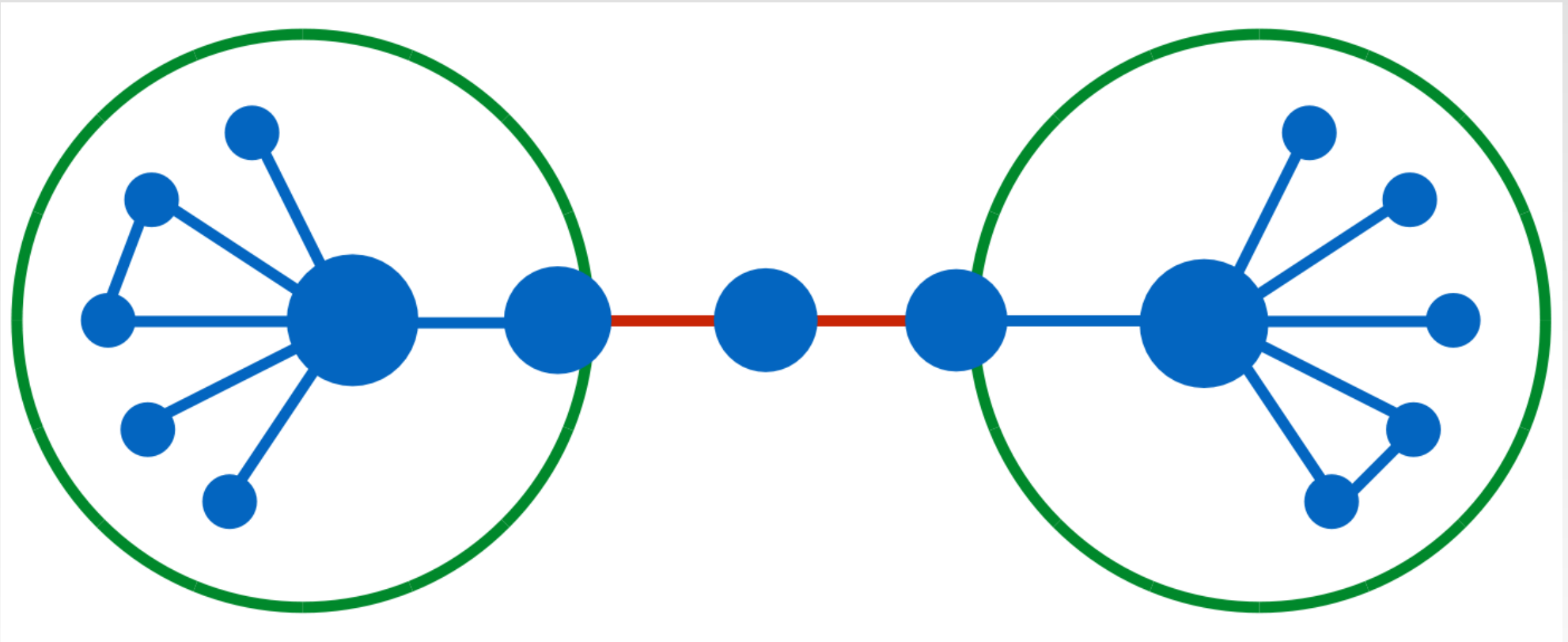
$$g(v) = \sum_{s \neq v \neq t} \frac{\sigma_{s,t}(v)}{\sigma_{s,t}}$$

$G = (V, E)$

$(s, v, t) \in V$

$\sigma_{s,t}$ shortest path between s and t

Communities, Bridges

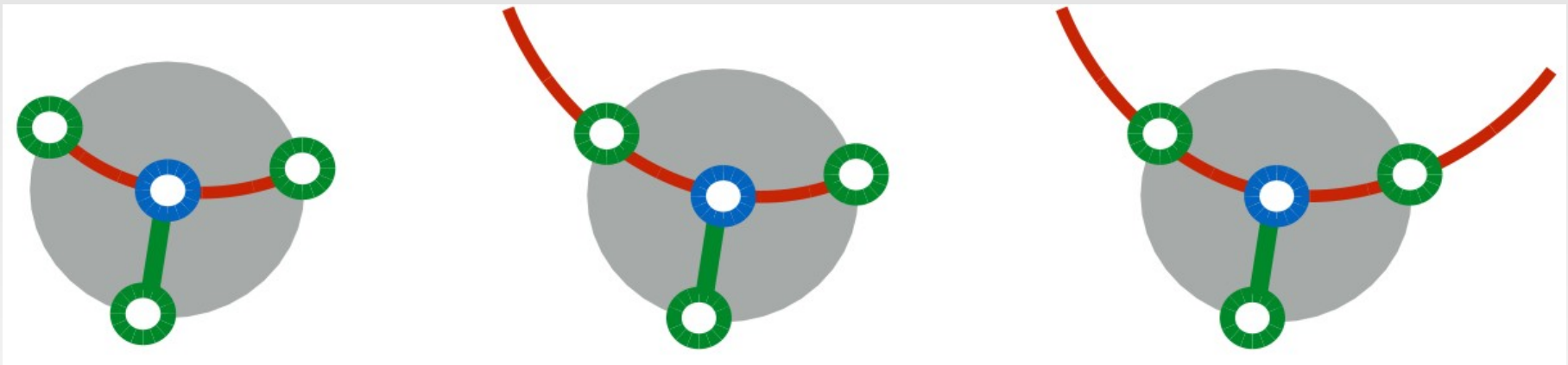


BC: Drawbacks

- Centrality is somewhat captured
- Bias towards high degree nodes
- Global/Local bridges lumped together
 - Local bridges: central to communities, connected nodes are "similar"
 - Global bridges: located between communities, connected nodes are "dissimilar"

Bridgeness Centrality

- Shortest Paths starting or ending on first neighbours node are ignored.

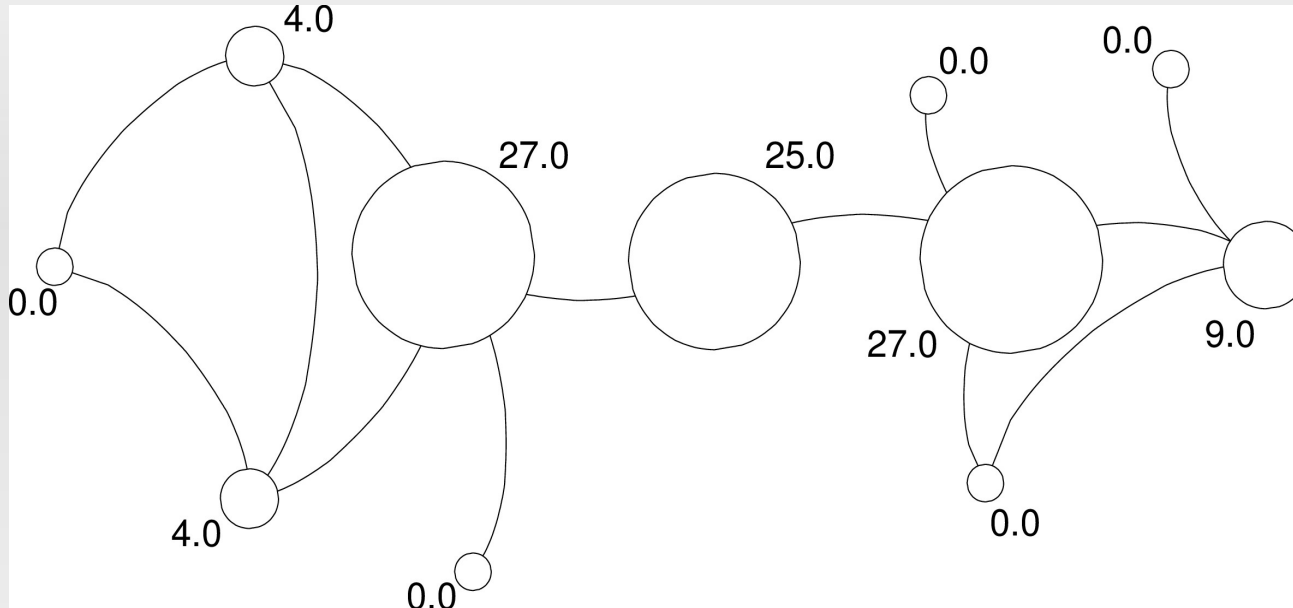


Ignored SP

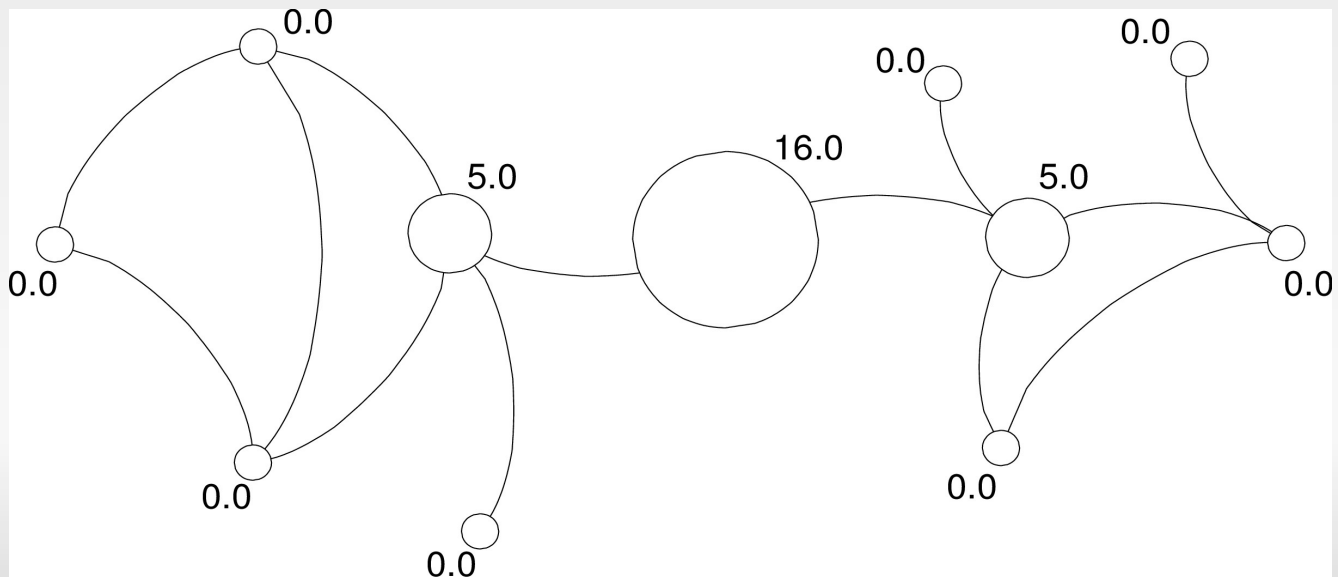
Ignored SP

Allowed SP

Bridgeness Centrality



Betweenness
Centrality



Bridgeness
Centrality

Ranking Bridges (Independently)

- Rao-Stirling
 - Prior Categorization
 - "Distance"

$$G(i) = \sum_{J \in \text{communities}} l_{IJ} \delta_{i,J}$$

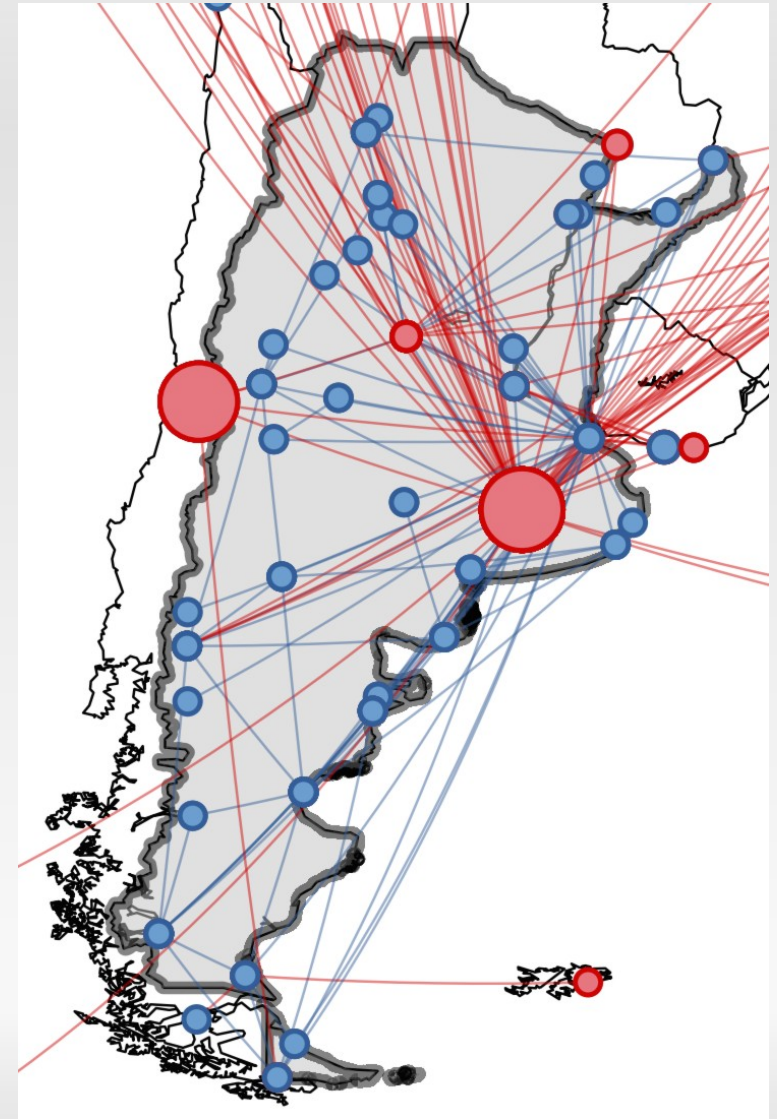
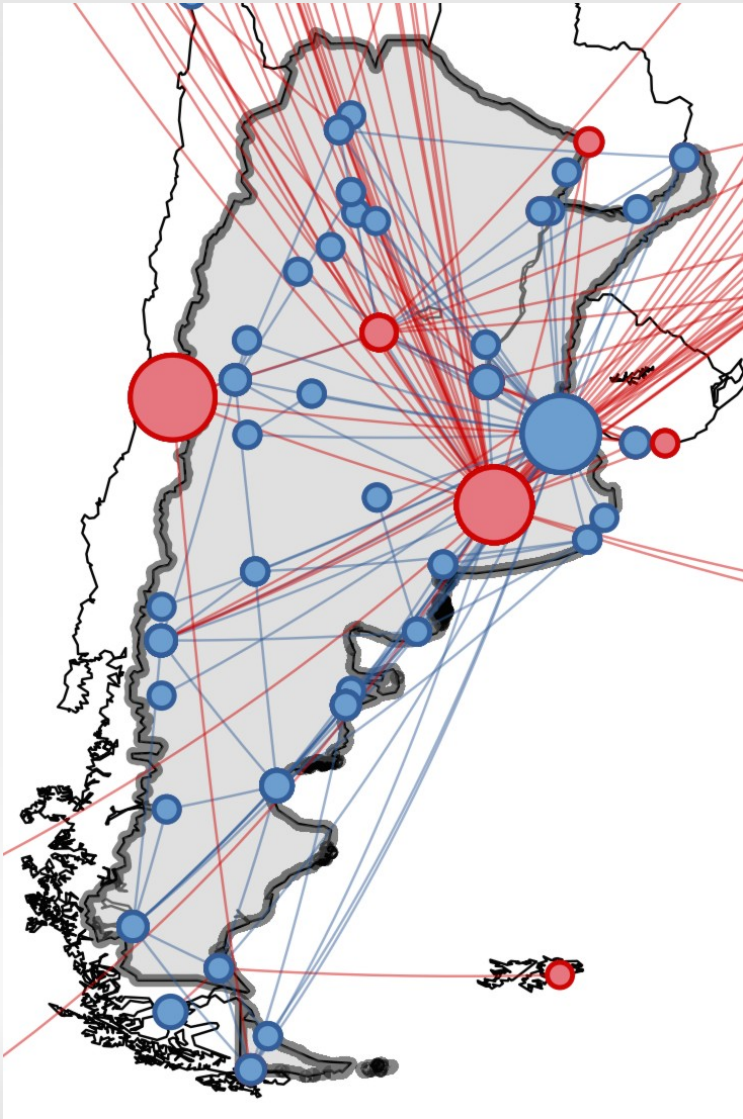
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$$G(i) = \sum_{J \in \text{communities}} l_{IJ} \delta_{i,J}$$

- **Airports**
- **mLFR**
- **Scientometric Network**

Betweenness vs. Bridgeness



BC decomposed

$$\text{BC}(j) = \sum_{i \neq j \neq k} \frac{\sigma_{ik}(j)}{\sigma_{ik}},$$

$$\text{Bri}(j) = \sum_{i \notin N_G(j) \wedge k \notin N_G(j)} \frac{\sigma_{ik}(j)}{\sigma_{ik}},$$

$$\text{local}(j) = \sum_{i \in N_G(j) \vee k \in N_G(j)} \frac{\sigma_{ik}(j)}{\sigma_{ik}}.$$

Questions

Thank you.

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