Absorbing random-walk centrality
Theory & Algorithms

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New node centrality measure:

- Defined on sets of nodes (teams)
- Generalization of random walk centrality
- Important team = central + diverse
- Query nodes
- Code available on GitHub (absorbing-centrality)
## Centrality measures

<table>
<thead>
<tr>
<th>Single node</th>
<th>Team</th>
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<tbody>
<tr>
<td>Degree</td>
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<tr>
<td>Closeness</td>
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<tr>
<td>Betweenness</td>
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<tr>
<td>Random walk</td>
<td>Flow betweenness</td>
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<td></td>
<td>Information centrality</td>
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<td>PageRank</td>
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Centrality measures

**Single node**
- Degree
- Closeness
- Betweenness
- Random walk
- RW betweenness
- Flow betweenness
- Information centrality
- PageRank

**Team**
- Degree
- Closeness
- Betweenness
- Flow betweenness

Our work
Random walk centrality

For a **single node** $\nu$,

with respect to the **whole graph** $G = (V, E)$,

measuring the **expected time** to reach node $\nu$. 
Absorbing rw. centrality

For a set of nodes \( \{v_i\} \),

with respect to a subset of nodes \( Q \subseteq V \),

measuring the expected time to reach any node in \( \{v_i\} \)
Finding the best team

Properties

- NP-hard
- Monotone
- Supermodular

Greedy algorithm

- complexity $O(kn^3)$,
  $n :$ graph nodes
  $k :$ team size
- approximation guarantee $(1 - \frac{1}{e})$
Quality of solution

Dataset: *les misérables* (70 nodes)

Top-$k$ ranked with:
- Degree centrality
- Closeness centrality
- Personalized PageRank

Greedy outperforms the heuristics.

Personalized PageRank is a good and fast alternative.
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