Capacity Constrained Influence Maximization in Social Networks

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Influence Maximization

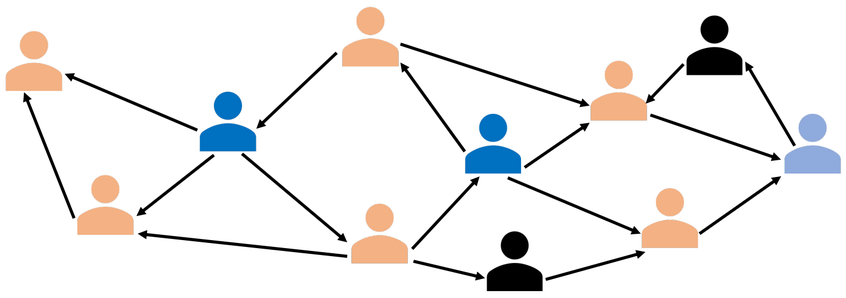
In viral marketing, merchants

- pay k influencers
- hope word-of-mouth promotes the product
- create a cascade of influenced individuals

initial adopter: paid by the merchant

subsequent adopter: influenced by friends

inactive user: not adopt the product yet



viral marketing on the social network

Influence Maximization (IM)

For a fixed k, how to pick k influencers to maximize the eventual influence spread #( ) + #( )

Limitations

Limitation #1 of conventional IM

- Conventional IM
  - ignores user's capacity for spending on the promotion
- User's capacity
  - is crucial as it determines the adoption of the product
  - is limited online (e.g., while playing e-games)

Limitation #2 of conventional IM

- Conventional IM
  - assumes influencers unconditionally be initial adopters
- Observation from real-world scenarios
  - influencers tend to be friends of the initial adopters

source: https://zootopia.fandom.com/wiki

New Problem: Capacity Constraint Influence Maximization

Input: d initial adopters and a capacity constant k

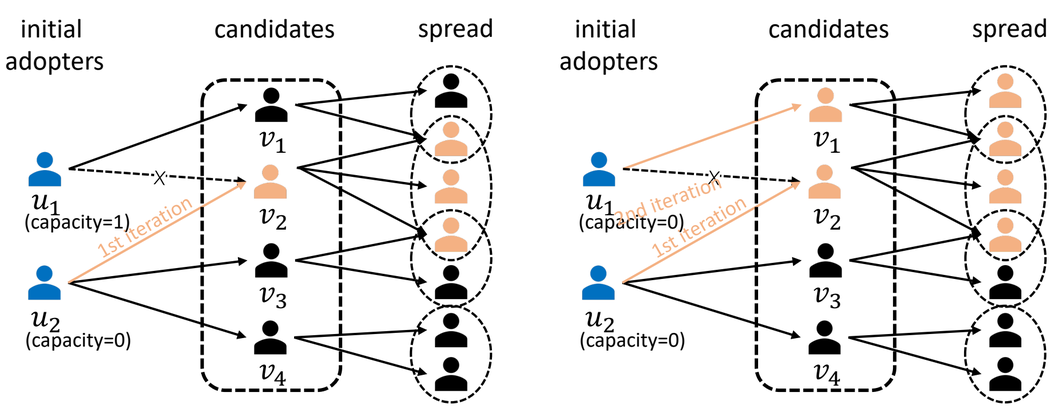
Output: k influential friends (seeds) for each of d initial adopters

Objective: maximize the spread of the set of all selected seeds

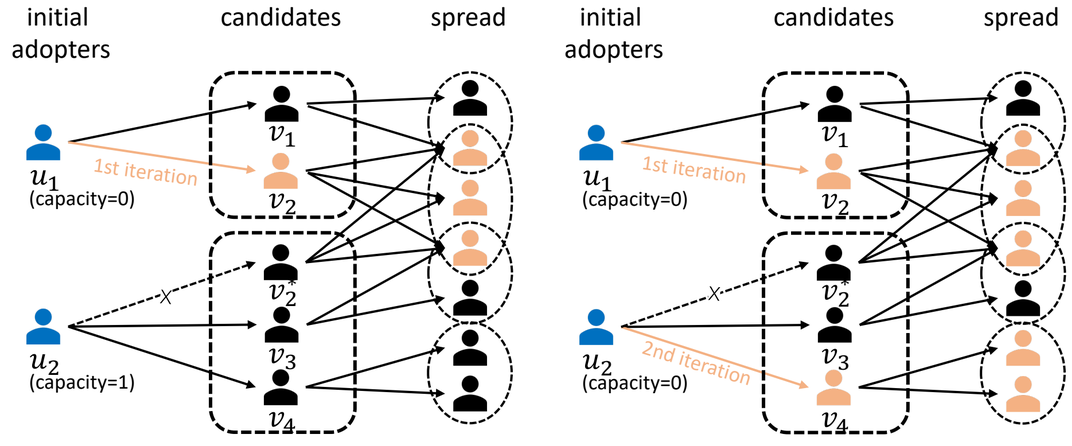
CIM is NP-hard

Greedy Algorithms and Scalable Implementations

MG-Greedy



RR-Greedy



Scalable implementations: follow the framework of OPIM-C and redesign the constants with rigorous analysis

Instances: first-cut versions (MG-OPIM, RR-OPIM) and final version (**RR-OPIM+**)

Experiments

CIM solutions

Local competitors:

- Degree, PageRank, IMM, OPIM-C

Greedy solutions:

- MG-Greedy, RR-Greedy

Scalable implementations:

- MG-OPIM, RR-OPIM, RR-OPIM+

RR-OPIM+ outperforms all other solutions in terms of actual spread of Tencent e-games

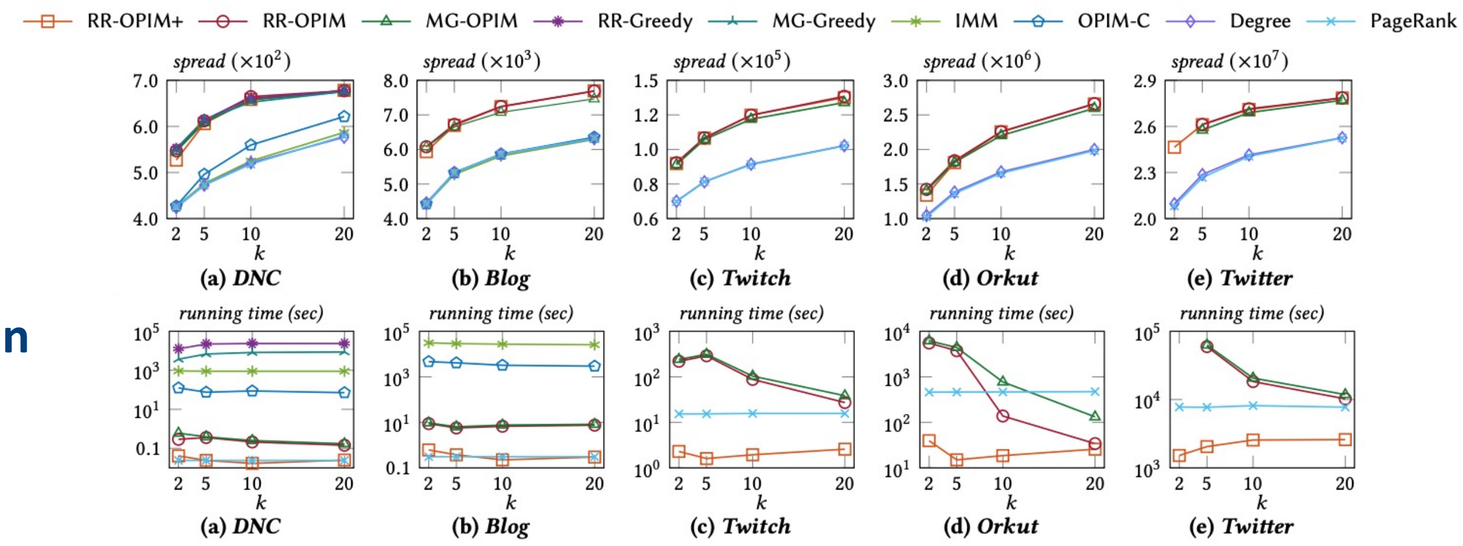
Offline evaluation

Solution	RR-OPIM+	MG-OPIM	RR-OPIM	Degree	PageRank
Spread	**1,632**	1,625	1,609	1,488	1,471

Online deployment

Solution	Treatment	Control
Spread	**60.69K**	58.28K

RR-OPIM+ outperforms all other solutions on 5 public datasets in terms of spread and running time.



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