Information Diffusion Analysis in Social Networks with Influence Maximizing

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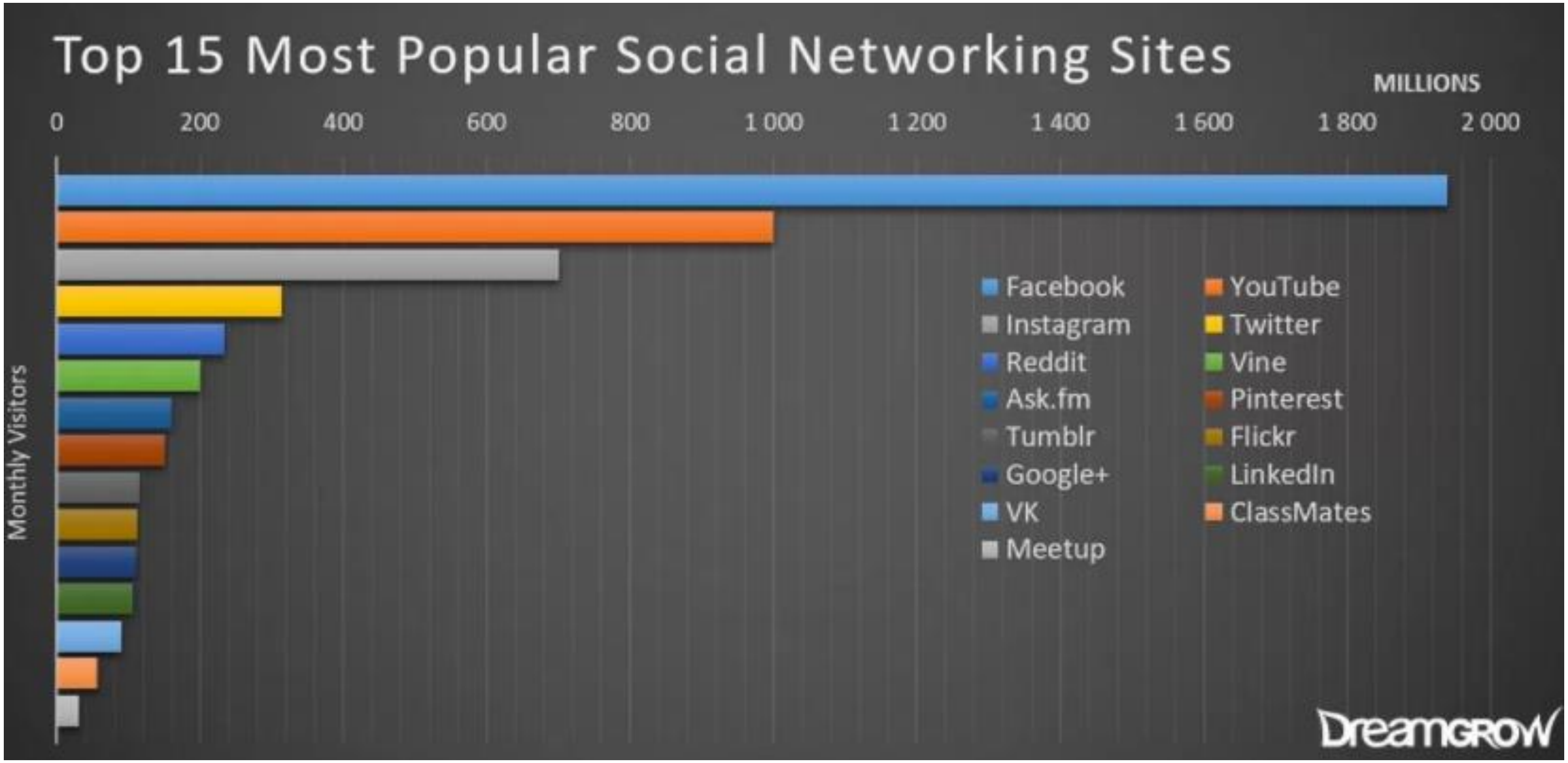
Outline

- Introduction and Motivation
- Problem Model and Modulation
- Algorithm Analysis
- Experiments
- Conclusion
- Future Work

Introduction and Motivation

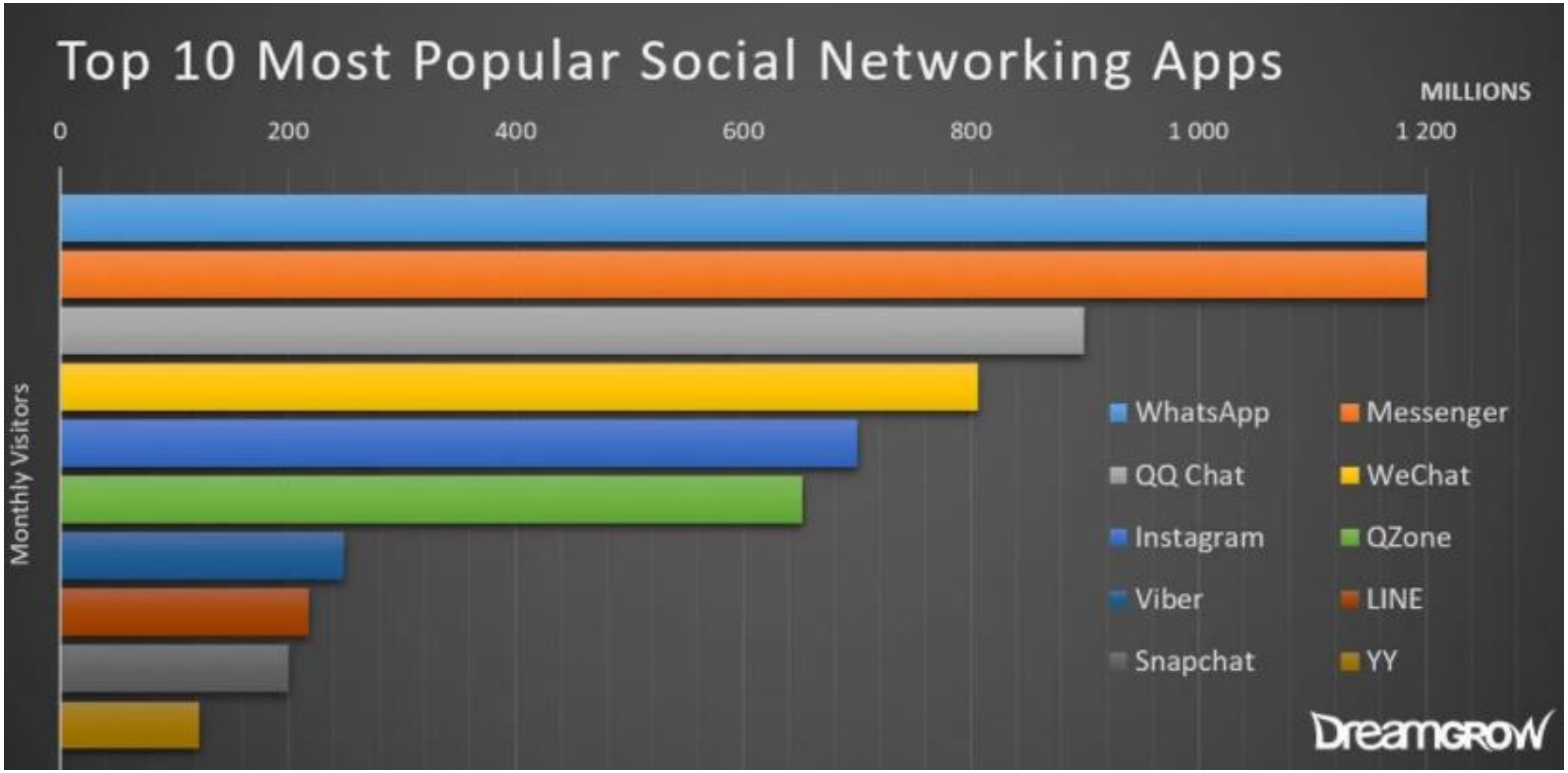
- A social network is a social structure made up of a set of social actors (such as individuals or organizations), sets of dyadic ties, and other social interactions between actors.

Introduction and Motivation



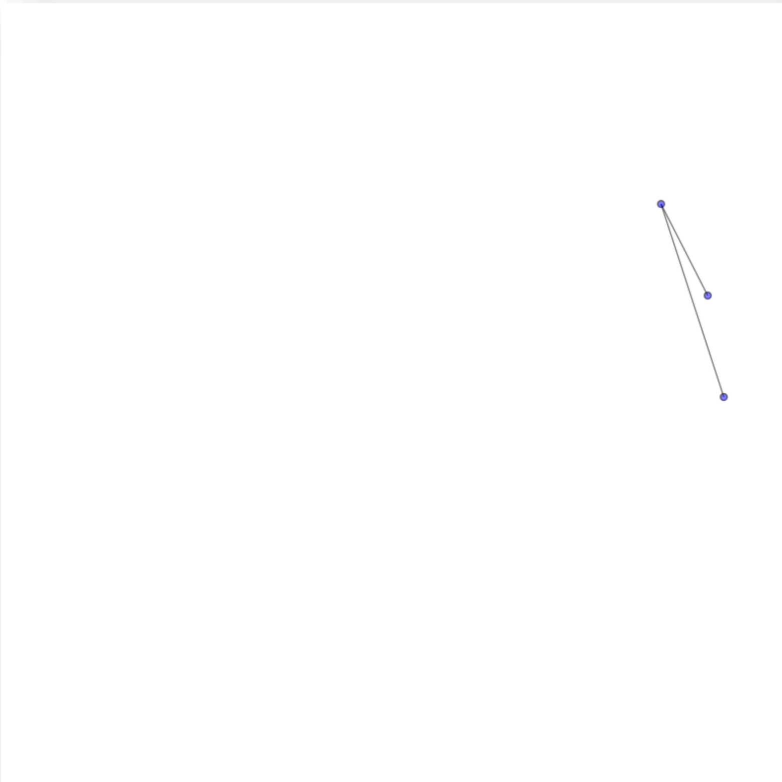
Most Popular Social Networking Sites

Introduction and Motivation



Most Popular Social Networking Apps

Introduction and Motivation



Evolution Graph of a Social Network

How to quantify the influence of information diffusion
and how to maximize it?

Problem Model and Modulation

Maximizing the Spread of Influence through a Social Network

The model is as follows:

The social network is represented by a directed graph

G = (N, E).

Each node represents an individual u, while each edge (u, v) means u may influence v.

Problem Model and Modulation

Linear Threshold Model:

A node v is influenced by each neighbor u according to a weight b_{uv} such that $\sum_{u \in S} b_{uv} \leq 1$.

Each node v chooses a threshold θ_v from [0,1] and the node will be activated when

$$\sum_{\mathrm{u} \in S} \mathrm{b}_{\mathrm{vu}} \geq \theta_v$$

Problem Model and Modulation

Independent Cascade Model:

When node u first becomes active in step t, it is given a single chance to activate currently inactive neighbor v with probability p_{uv}.

Goal: Select a subset of at most k agents to maximize the influence.

Abstraction:

Monotone submodular maximization
under cardinality constraint

Problem Model and Modulation

Submodular:

The marginal gain from adding an element to a set S is at least as high as the marginal gain form adding the same element to a superset of S.

$$f(S \cup \{v\}) - f(S) \geq f(T \cup \{v\}) - f(T)$$

Cardinality constraint:

In the cardinality constraint, we require that

$|S| \leq k$. It is still NP-hard.

Algorithm Analysis

Greedy:

The greedy algorithm provides a good approximation to the optimal solution for this problem. We start with S_0 =∅.

Then in each iteration:

$$S_i = S_{i-1} \cup \{\arg max \Delta(e|S_{i-1})\}$$

Algorithm Analysis

Approximation:

Theorem:

For nonnegative monotone submodular function f, there is

$$\sigma(A) \geq \left(1 - \frac{1}{e}\right) \max_{|B|=k} \sigma(B)$$

Experiments

To be continued

Conclusion

To be continued

Future work

To be continued

Reference

Q&A

Thank you