Centrality and community detection in a mobile social network

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Random instant-messaging networks

- A new type of online social dynamics

Motivation & goal

Methods

- Presentation of Photoswap
- Database
- Research questions

Results

Future work

Social cybernetworks

- Email networks
- Instant-messaging networks (Google Talk, Skype, MSN)
- Picture-sharing websites (Flickr, Picasa)

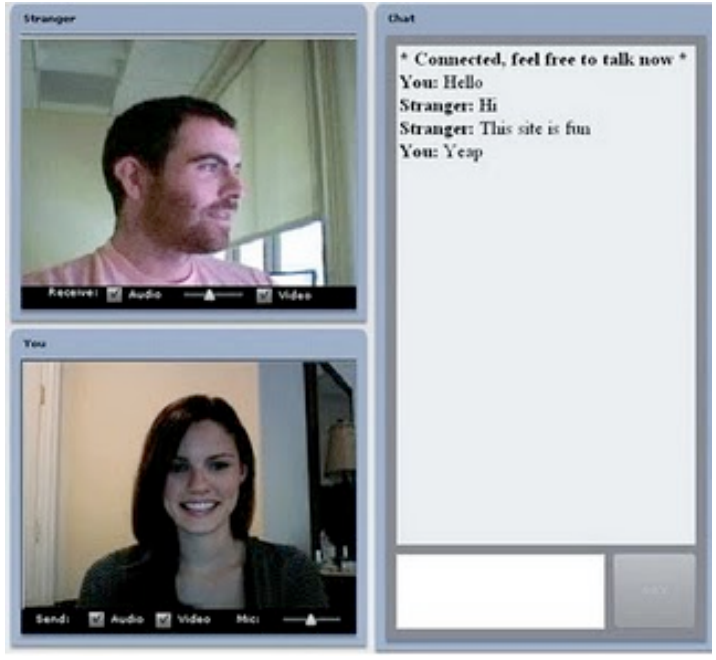
Combining these and randomness leads to random instant-messaging applications, e.g. Photoswap, Omegle or Chatroulette.

Random instant-messaging networks

- Mobile phones + camera (P)
- Personal computers + webcam (O, C)
- Free access
- Plug & play

Screenshots

Photoswap, Chatroulette



Motivation

- Nowadays very popular applications.
- Easy access for children despite age delimiters.
- Influence of anonymity on behavior ?

The context :

- Anonymity
- Privately moderated
- Meeting people
- Entertainment, excitement

Photoswap

During the 50 days under study :

- $71,785$ users.
- 127 pictures pro user.
- $180,000$ pictures exchanged everyday.
- 1377 banned users (for three days).
- 1750 times banned.

Chatroulette.com

- 89% male
- 11% female
- 20% $<$ 20 years old
- 10% $>$ 40 years old
- offensive behaviour : 13%

(Source : `techcrunch.com`)

Presentation of Photoswap

How does it work ?

- User A launches the application and takes a picture.
- The picture is randomly sent to user B who can answer the picture with another picture, and so on they exchange pictures..
- If he doesn't, there's no more way to communicate with User A.
- At the same time user A received a picture and so on.

Moderation, control

- Possibility to report offensive pictures.
- Leads to ban concerned users.

Data

- Data go from 19.02.2010 to 10.04.2010
- Longitudinal analysis is possible.
- Users are anonymous.
- Possibility to ask moderators about pictures from their ids, but not to consult them.

Defining the network

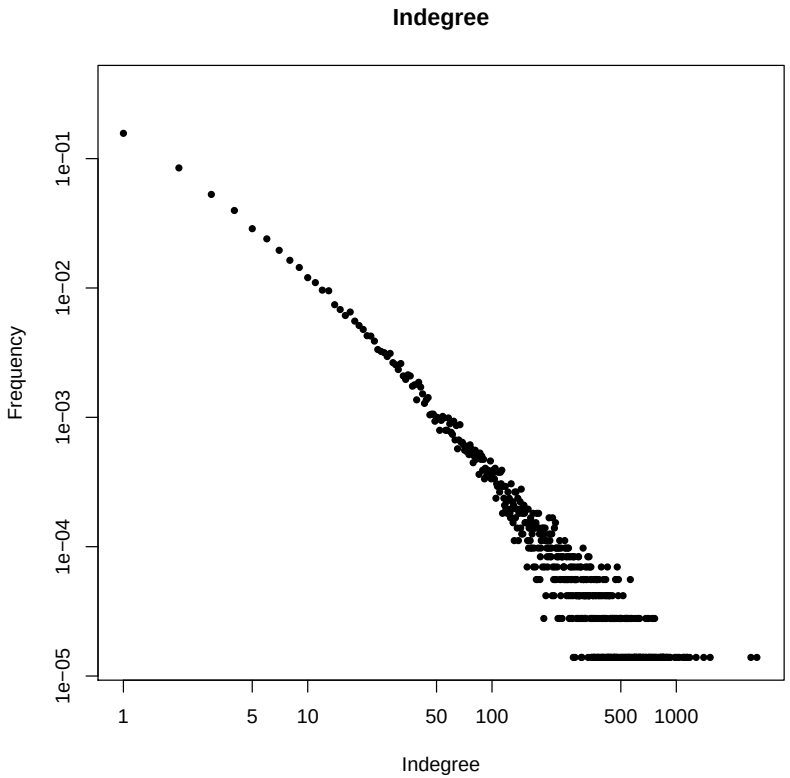
- Nodes are the users.
- Directed networks.
- There is an arc from User A to User B if User A has sent at least one picture to User B.
- Each arc is weighted. The weight is the number of pictures sent.

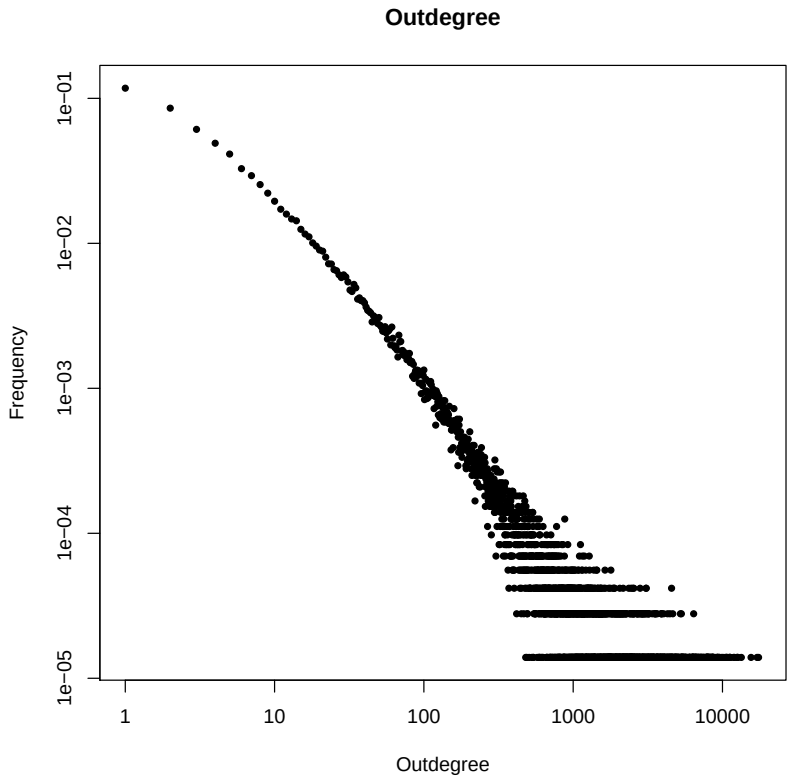
Description

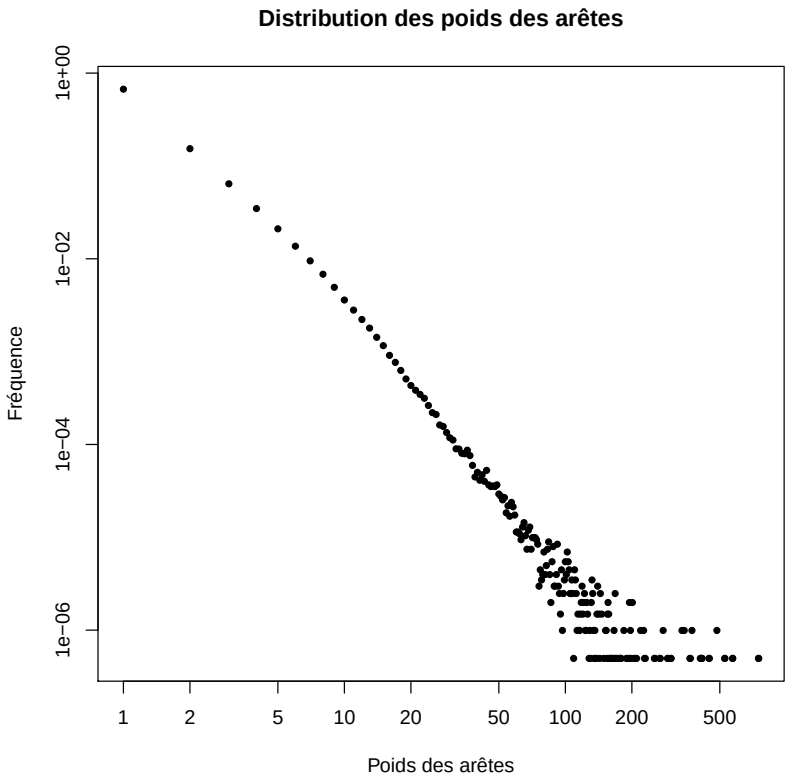
- # Nodes (order) 71,785
- # Edges (size) 9,142,714
- 1,814,915 pictures with response
- 7,327,799 pictures without response
- out-degree max : $17,440$
- in-degree max : 2736

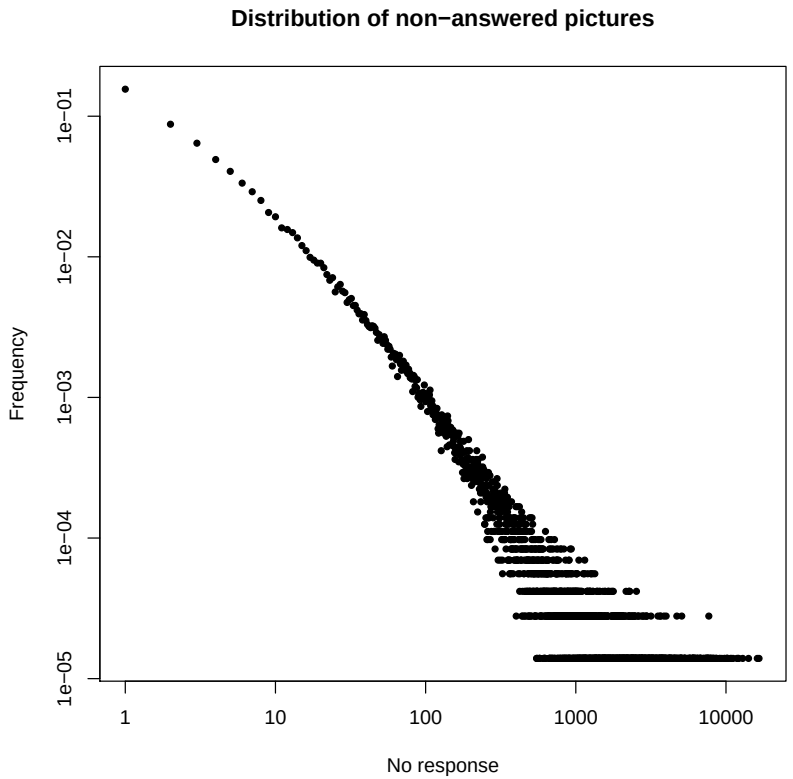
Research questions

- Degree distribution.
- Weights of arcs distribution.
- Identify the users showing offensive behavior (mostly exhibitionism). Are they different from the ones of "normal" users ?
- Make an attempt to detect them.


Indegree
Frequency
1e−01
1e−02
1e−03
1e−04
1e−05
1
5
10
50
100
500
1000
Indegree


Outdegree
Frequency
1e−01
1e−02
1e−03
1e−04
1e−05
1
10
100
1000
10000
Outdegree


Distribution des poids des arêtes
Fréquence
1e+00
1e−02
1e−04
1e−06
1
2
5
10
20
50
100
200
500
Poids des arêtes


Distribution of non−answered pictures
Frequency
1e−01
1e−02
1e−03
1e−04
1e−05
1
10
100
1000
10000
No response

Use of banishment

- Levels of # times banned : from 0 to 6.
- In order to study users' behavior according to banishment, it is necessary to define an appropriate measure.

Outdegree - Indegree

- Let's suppose 10% of users are offenders, at least 9 pictures out of 10 won't get any answer.
- The expression

$$\text{Out-degree} - \text{In-degree}$$

can measure that.

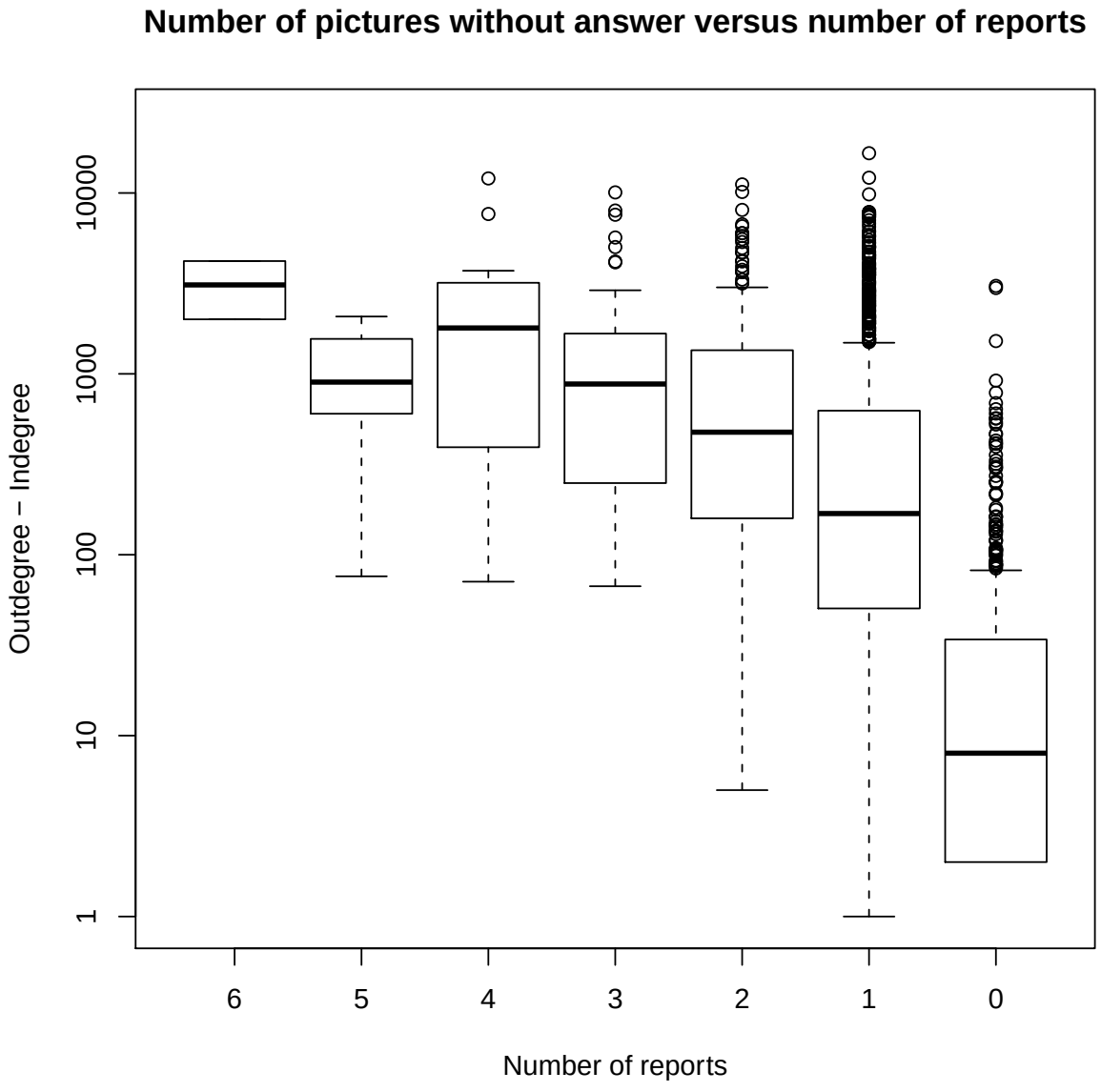
Remark

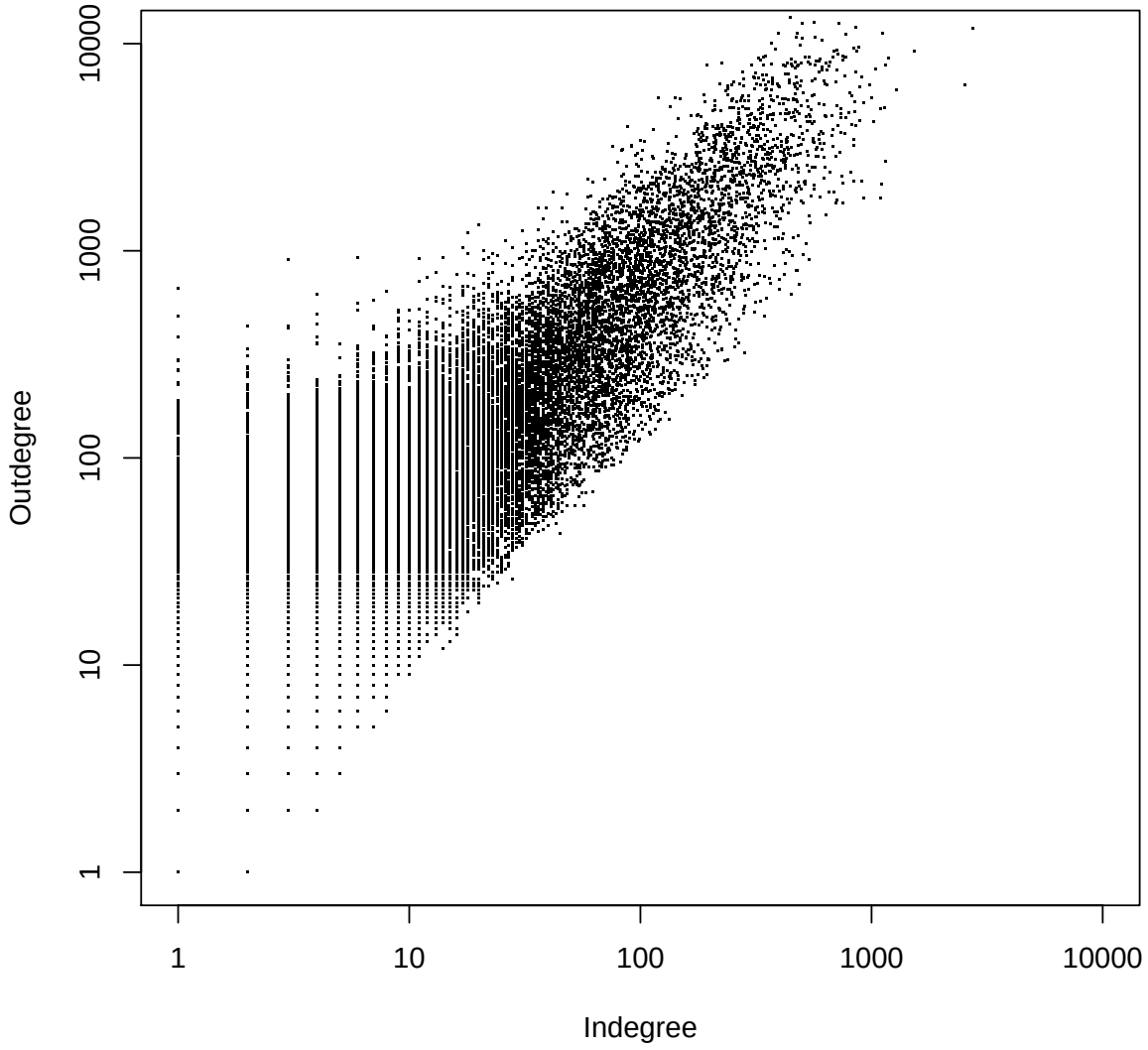
The expression

$$\frac{\text{Out-degree}}{\text{In-degree}}$$

doesn't give as satisfying results as

$$\text{Out-degree} - \text{In-degree}.$$


Number of pictures without answer versus number of reports
Outdegree – Indegree
1
10
100
1000
10000
6
5
4
3
2
1
0
Number of reports

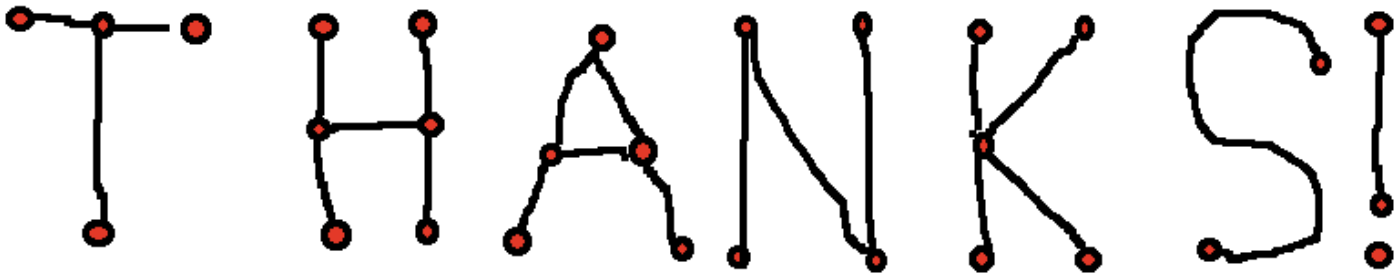

Outdegree
1
10
100
1000
10000
1
10
100
1000
10000
Indegree

Future Work

- Detect offenders according to network data ?
- Does any community detection algorithm gives satisfying results ?
- Do people with similar aesthetic tastes cluster ?

Acknowledgements

- Thanks to Gábor Csárdi and Tamas Nepusz for the package **igraph** and for promptly answering questions appearing in the mailing-list.
- `http://igraph.sourceforge.net/`
- `http://www.r-project.org/`
- Thanks to Sarah Dégallier for her help.


THANKS!