Dynamic of Local Community in Social Networks

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Plan

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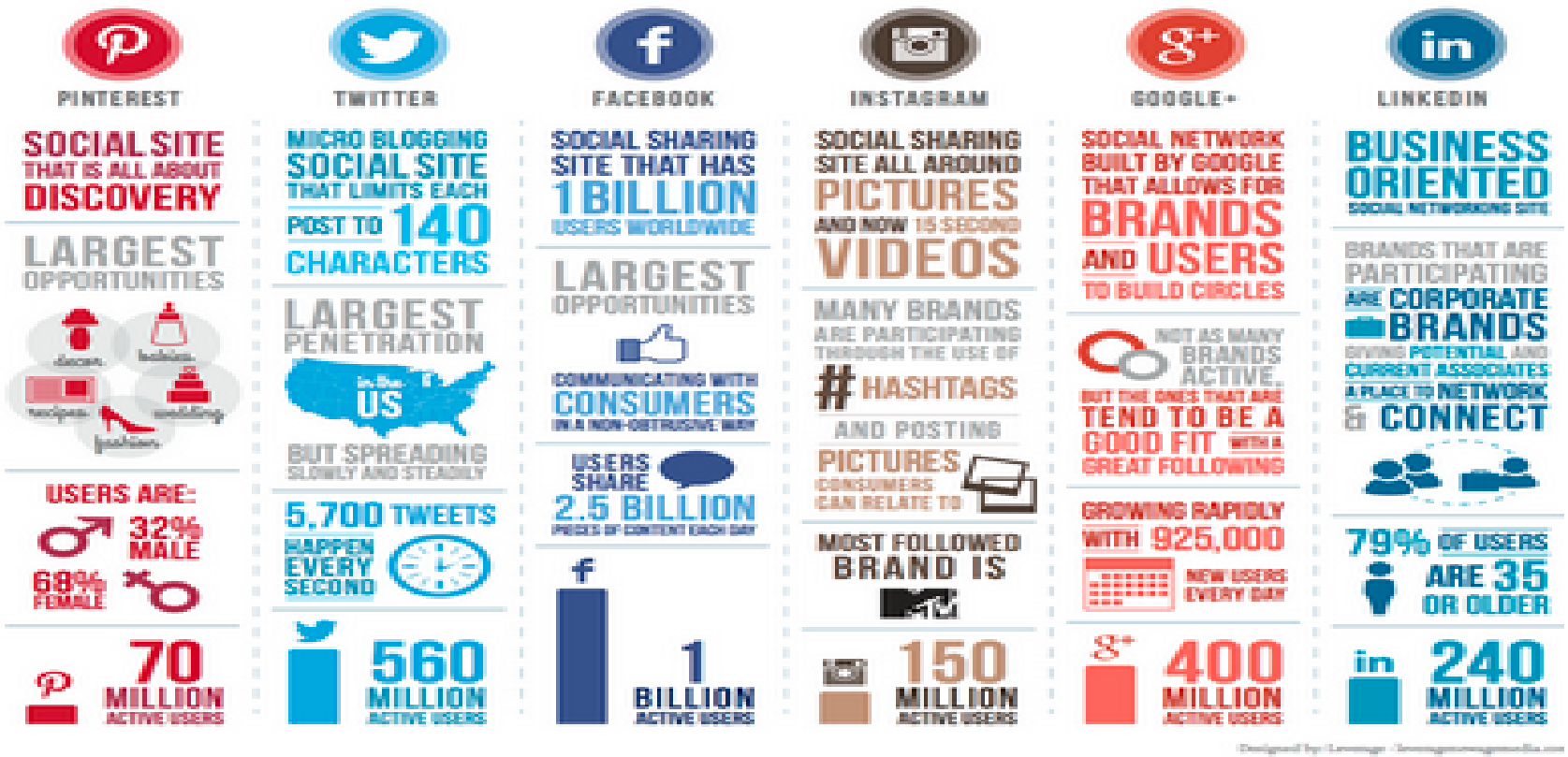
Context

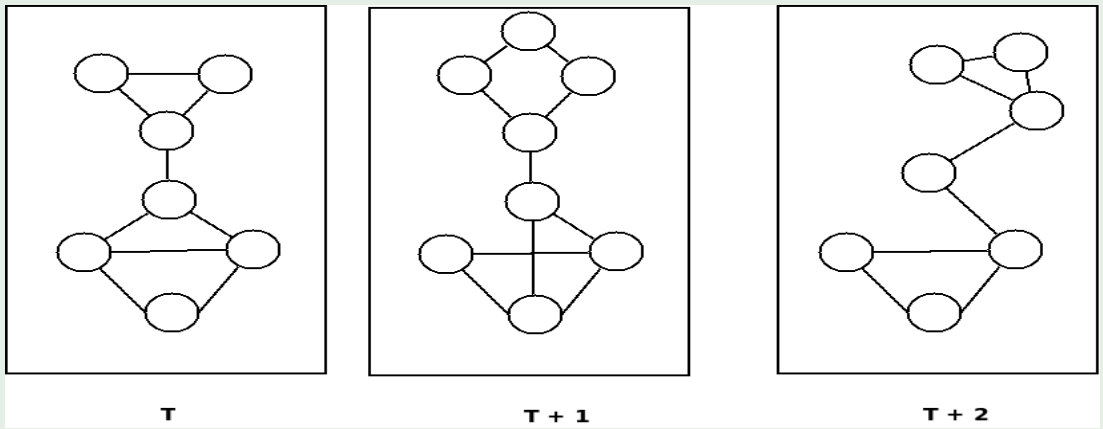


* Twitter's active users number is off – Twitter has more than half a billion registrations, but after half that many active users.

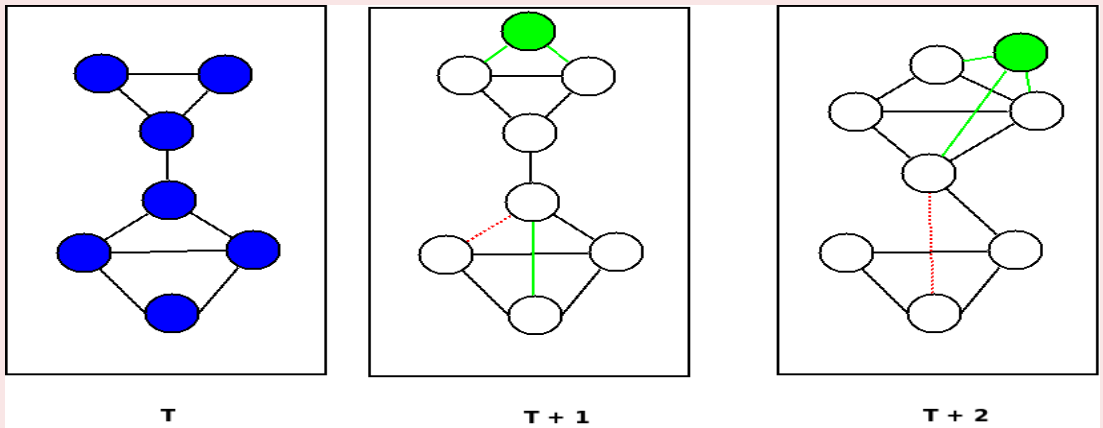
What is a dynamic network

Two kinds of dynamic

Interaction networks



Evolving network



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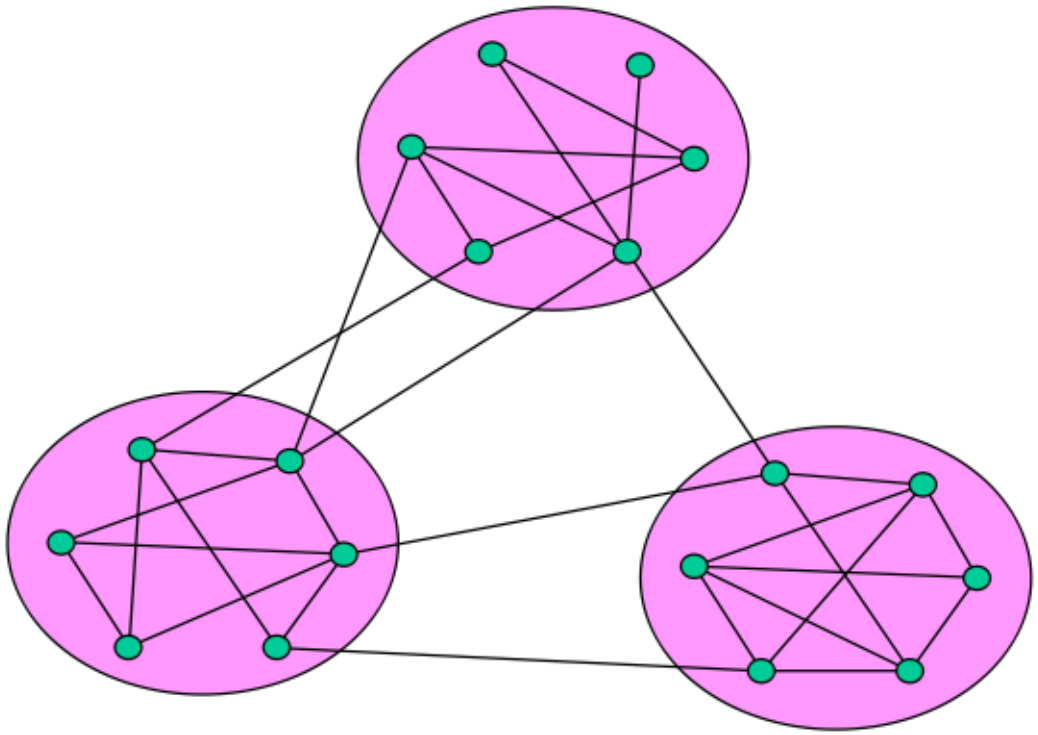
Communities in networks

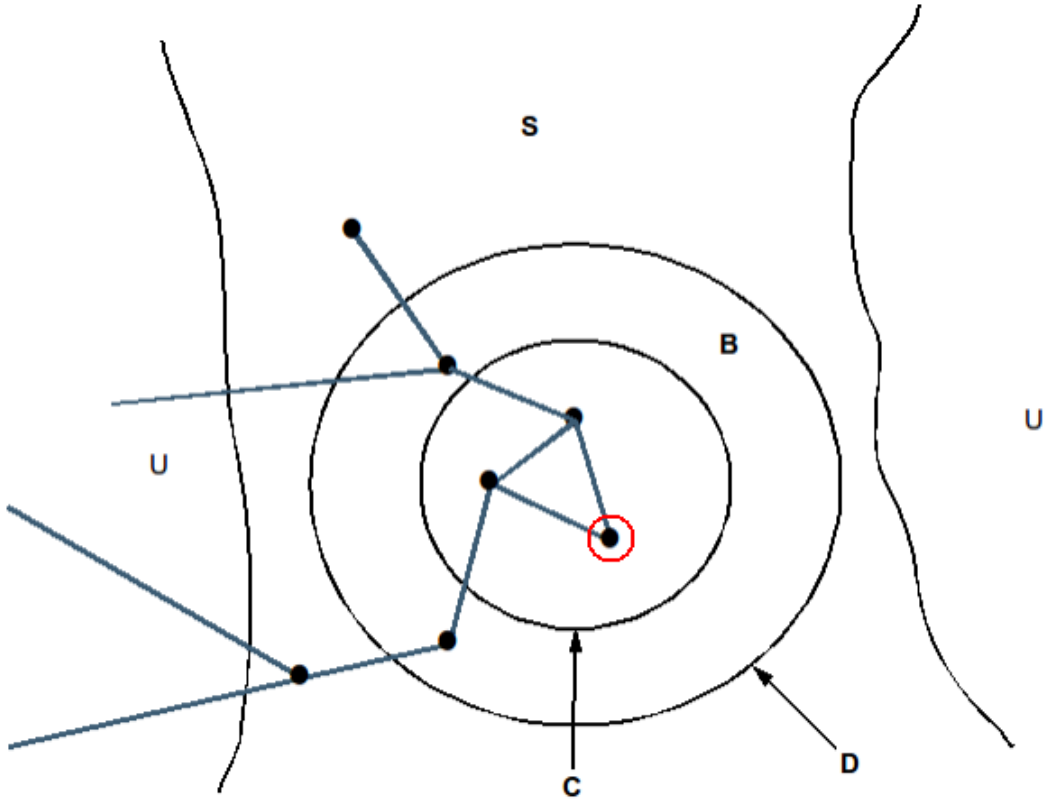
A definition based on the network topology :

- Group of densely connected nodes.
- Few links between groups.

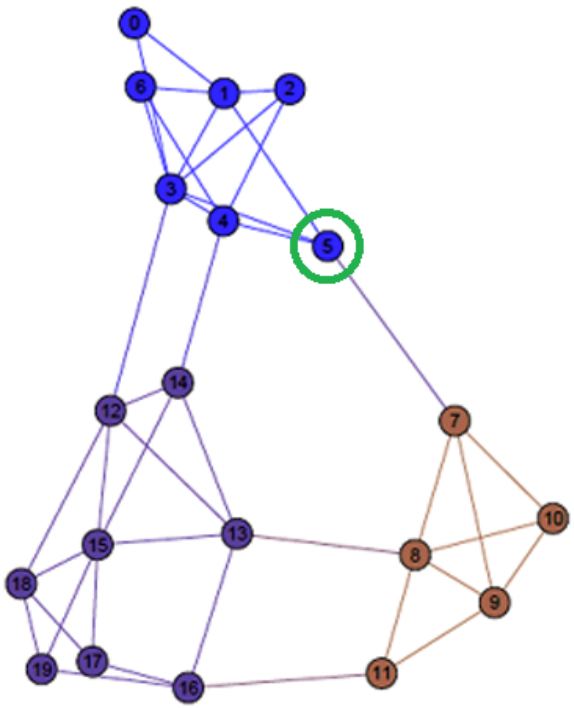


Local community detection

- Local community: identified with local information only
- We start from a node
- At each step we have a local view of the network (see the fig.)
- The nodes outside the community (but connected to it) are evaluated one by one.



Local Community detection in action



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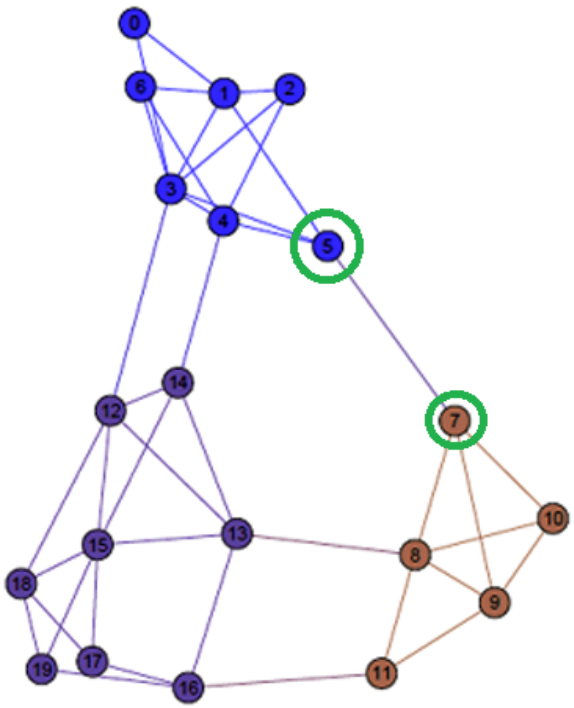

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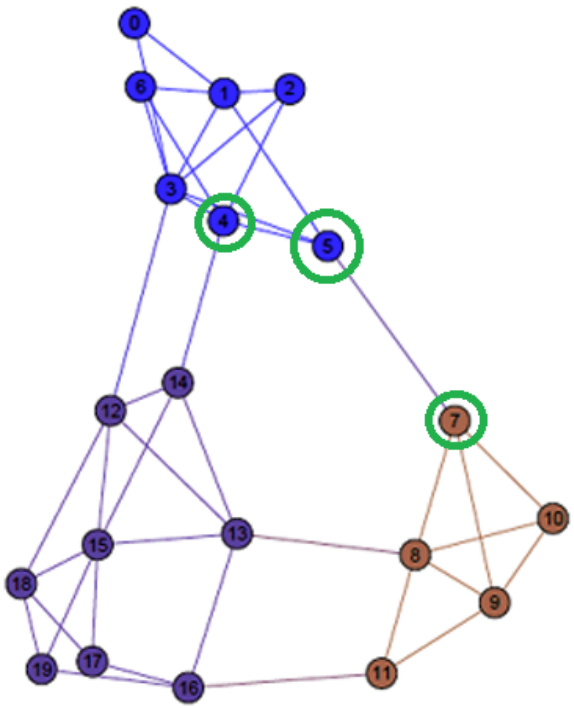

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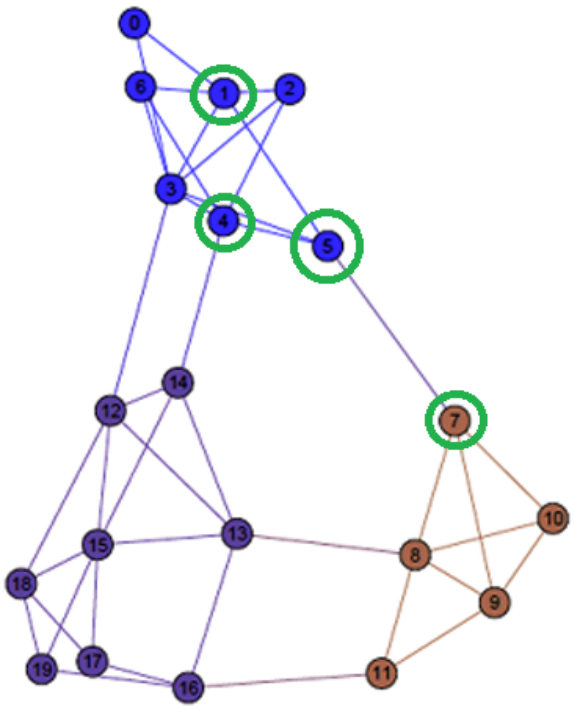
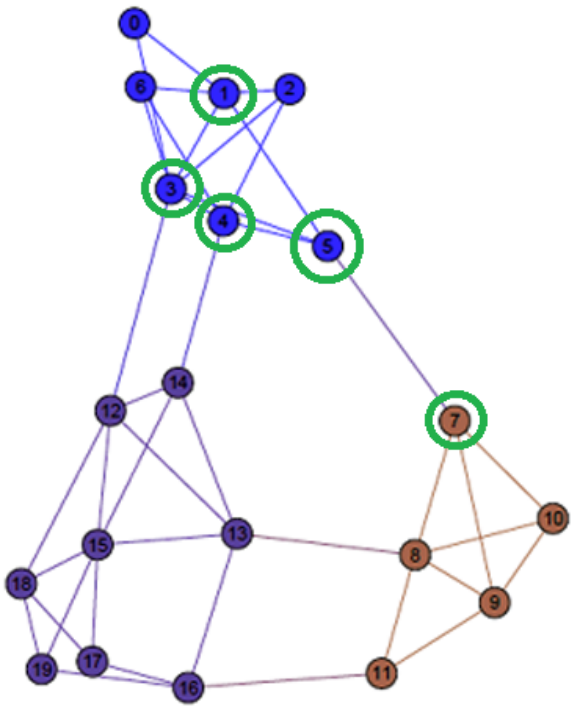
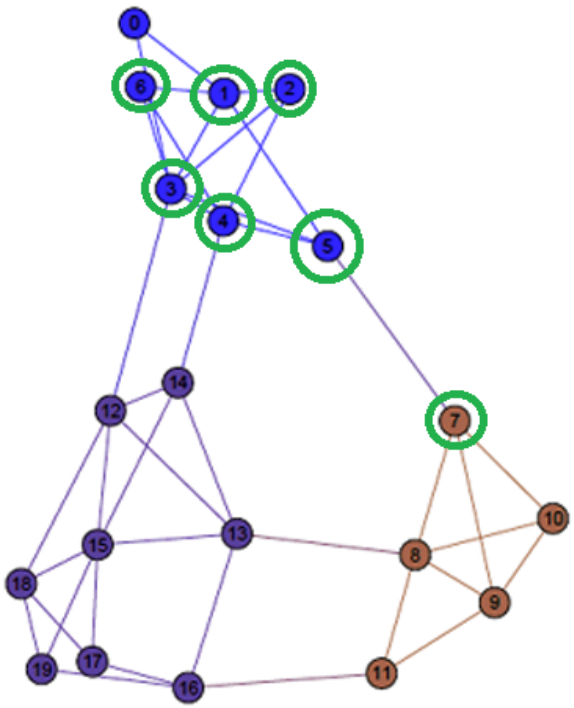


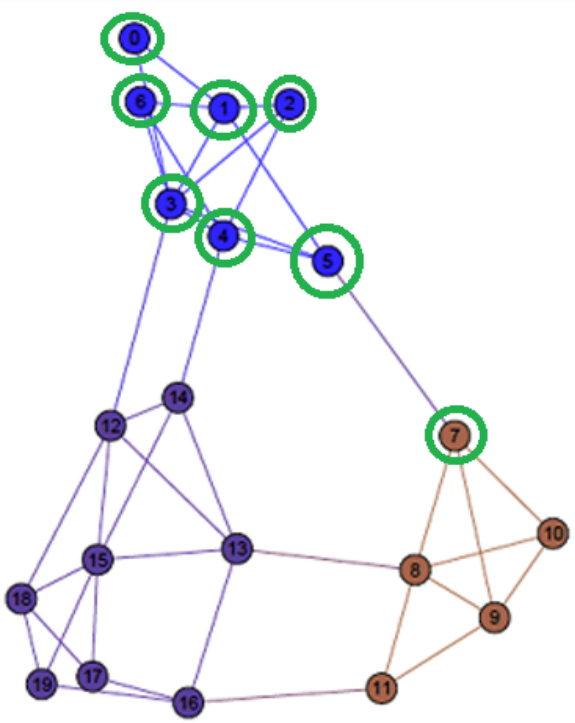
Local Community detection in action



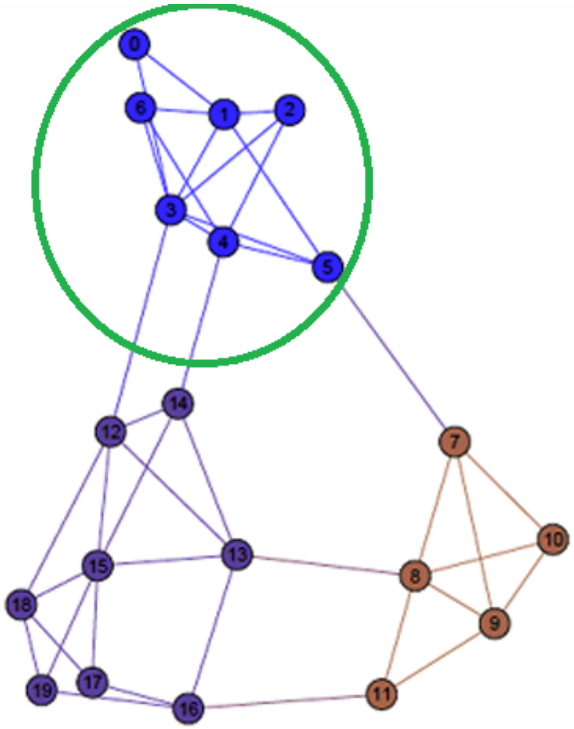
Local Community detection in action



Local Community detection in action



Local Community detection in action



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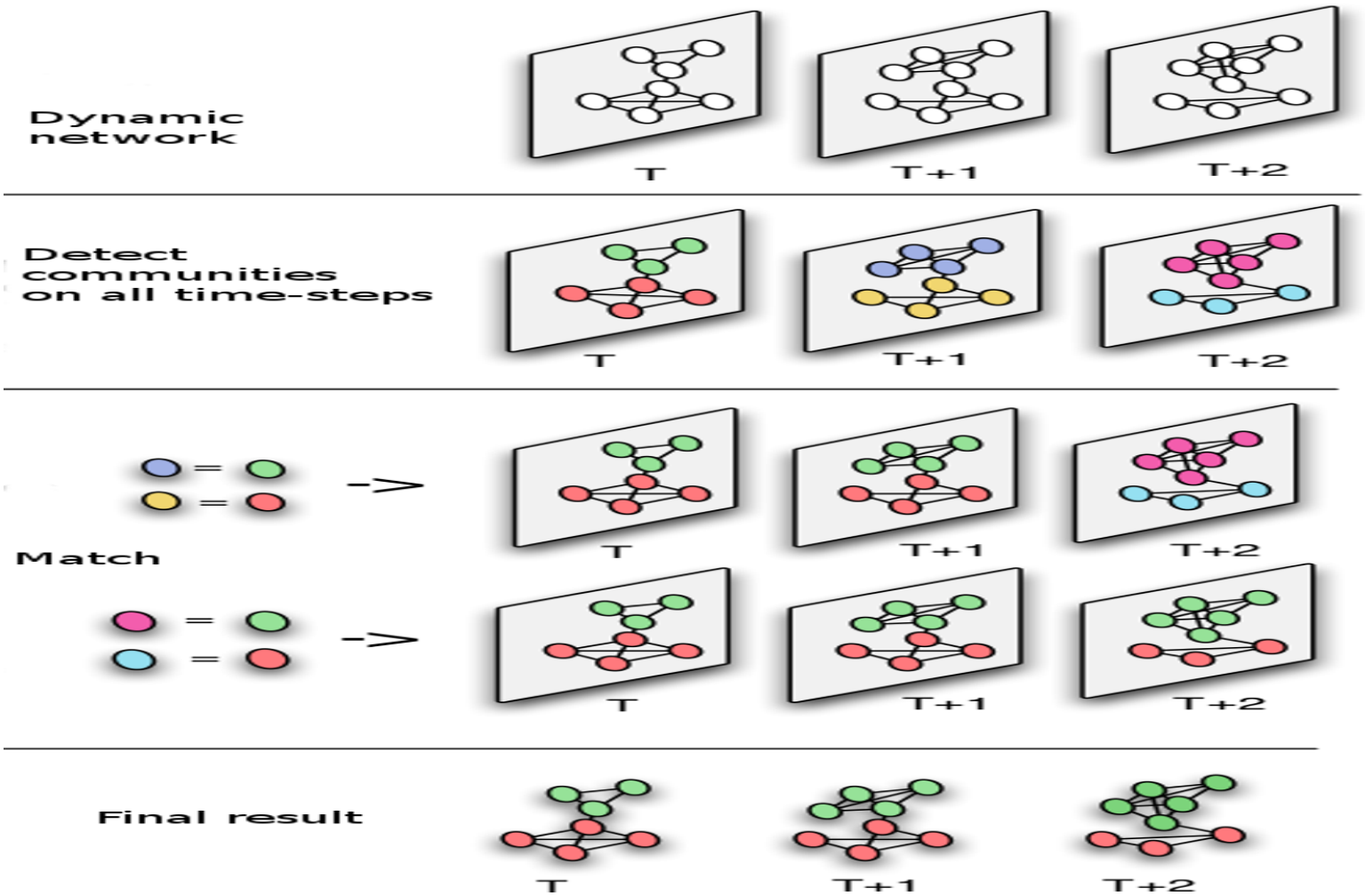
Communities in dynamic networks

No formal definition, but some trends

- Communities tracking
- Communities updating
- long term communities detection

Communities tracking

General Framework (Image from Cazabet et al.)



Communities tracking cont'd

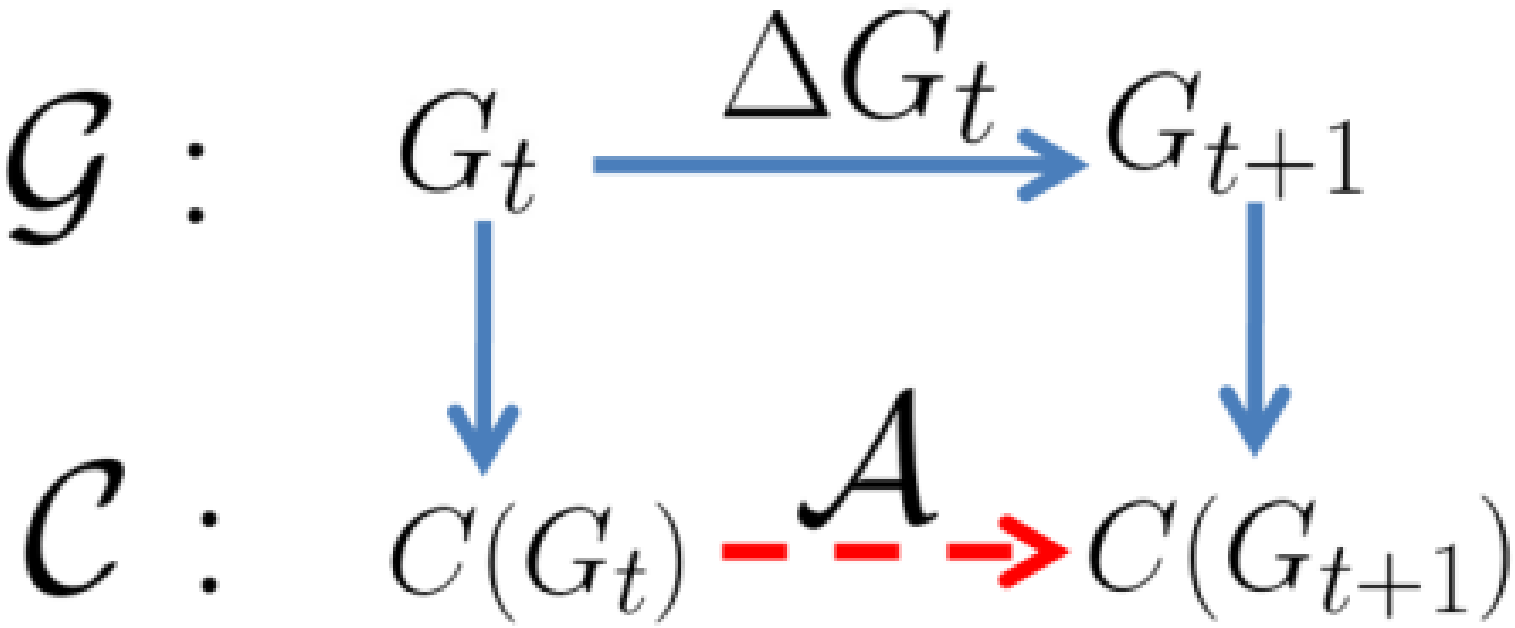
Examples

- Palla et al., 2007.
- Greene et al., 2010.
- Tantipathananandh et al., 2007.

Remarks

- Instability of detection methods
- This can be reduced by community cores analysis

Communities updating



Communities updating cont'd

Examples

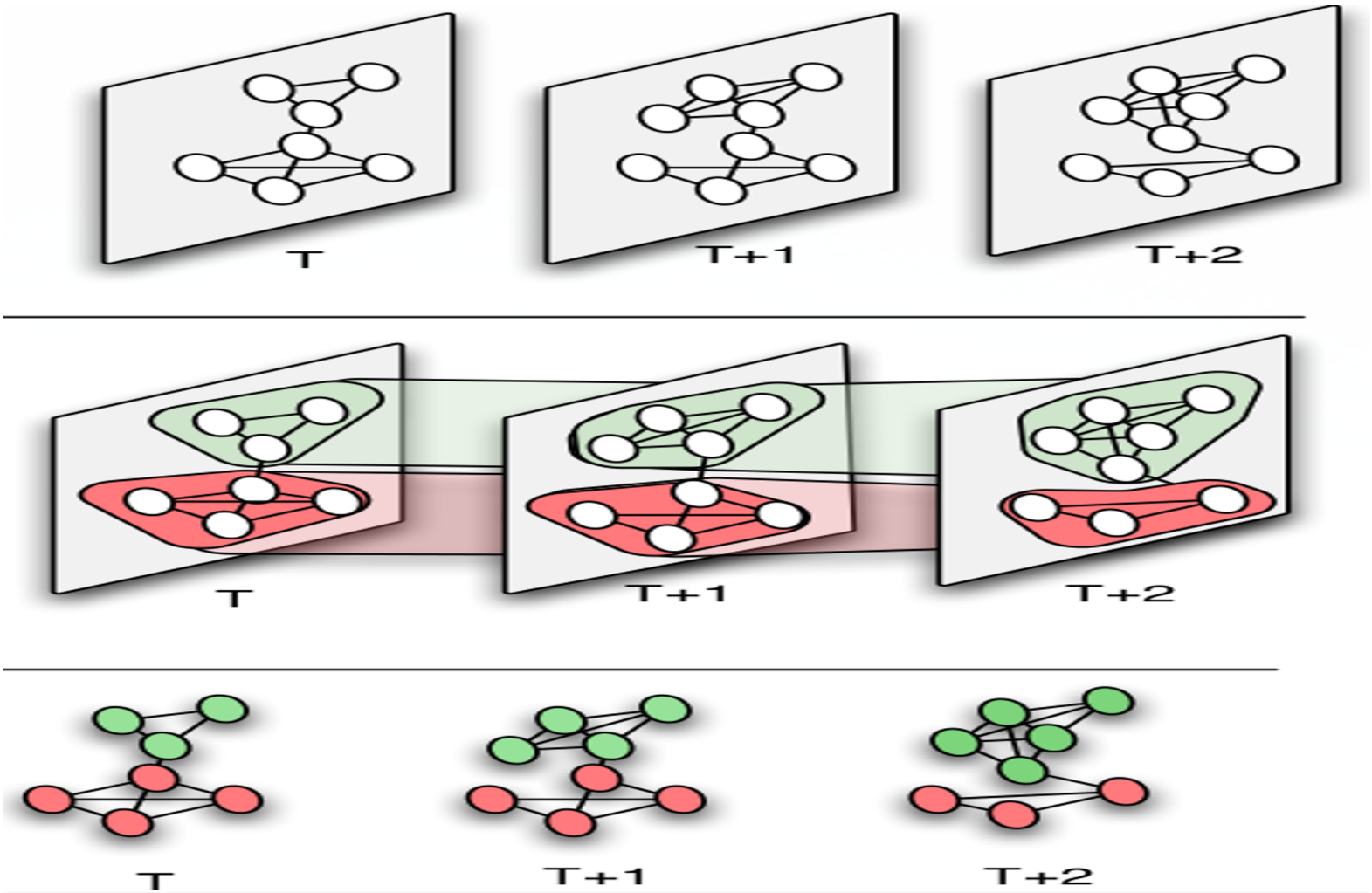
- Nguyen et al., 2011.
- Cazabet et al., 2010.

Remarks

- Dependence with previous partitioning
- Can start with an empty network

Long-term communities detection

(Image from Cazabet et al.)



Long-term communities detection cont'd

Examples

- Aynaud et al., 2010.
- Mitra et al., 2011.

Remarks

- No formal evaluation method.
- Some evaluations by applications

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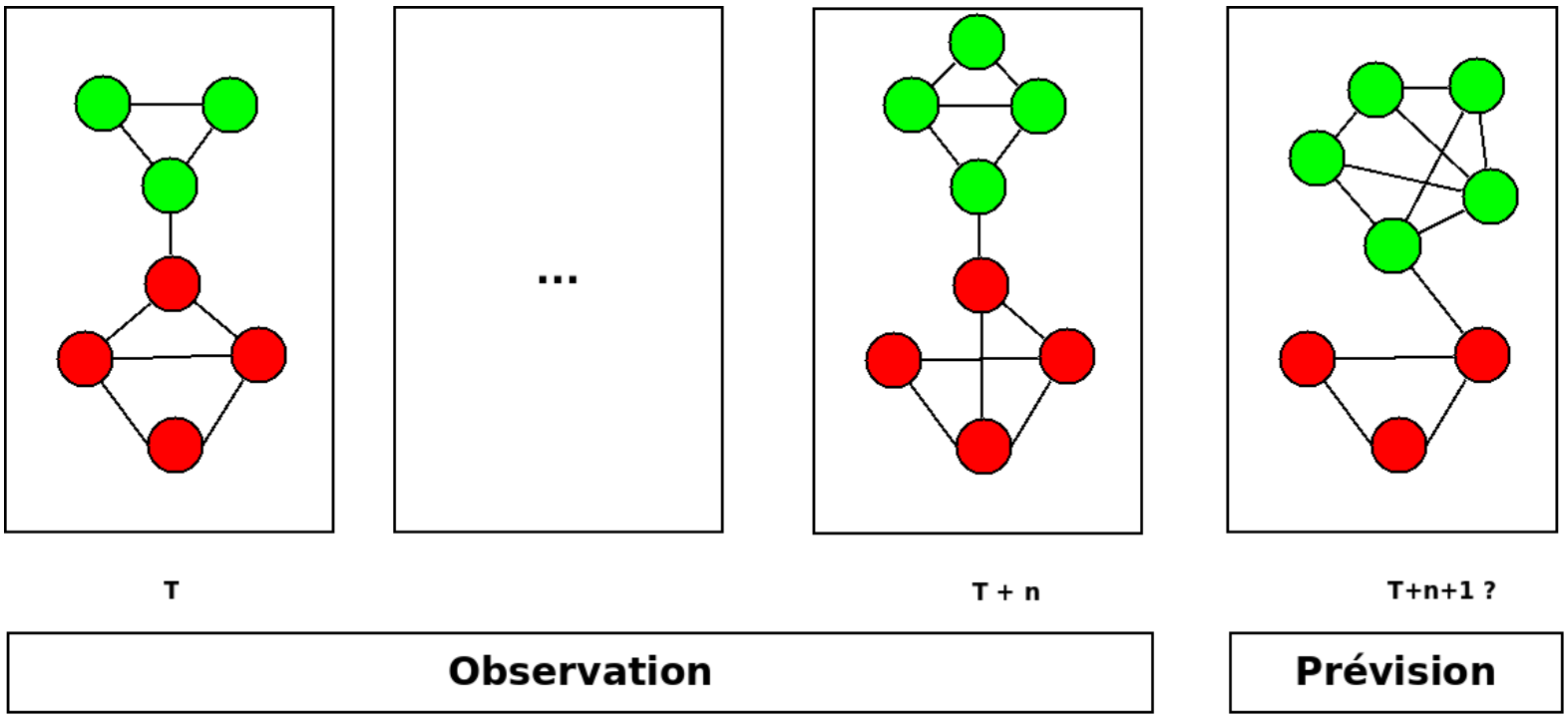
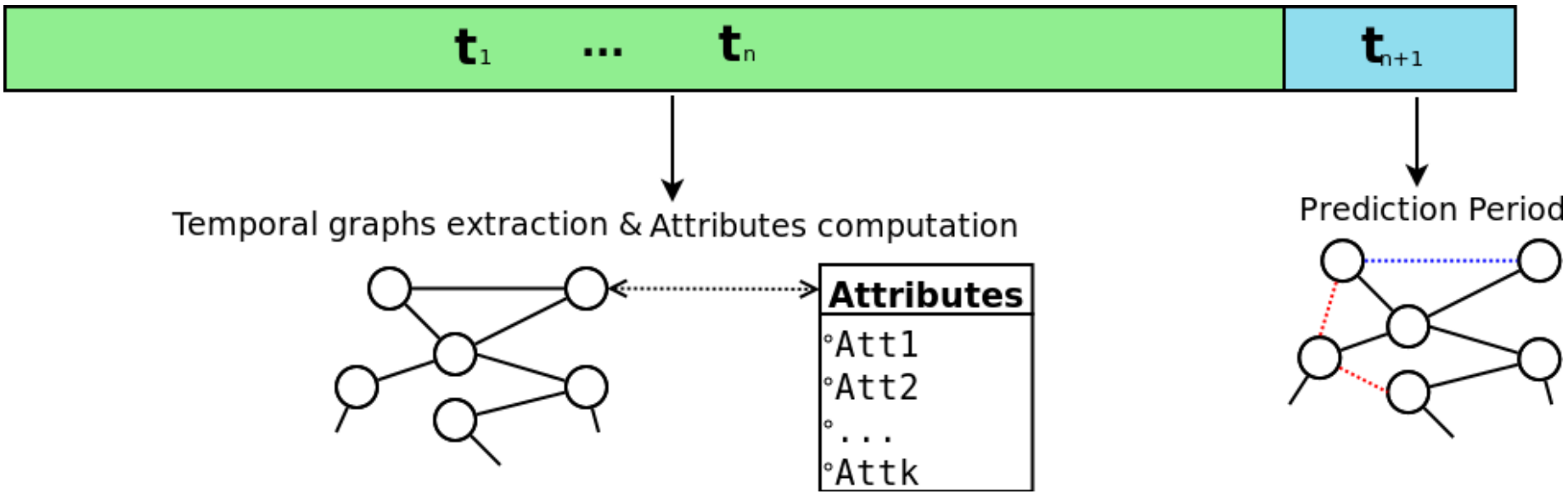
Community prediction in interactions networks



The proposed approach

- Predict the interactions
- Compute the communities on the predicted network

Interaction prediction is more general than link prediction



Supervised learning approach

Attributes

For each time step extract the following attributes:

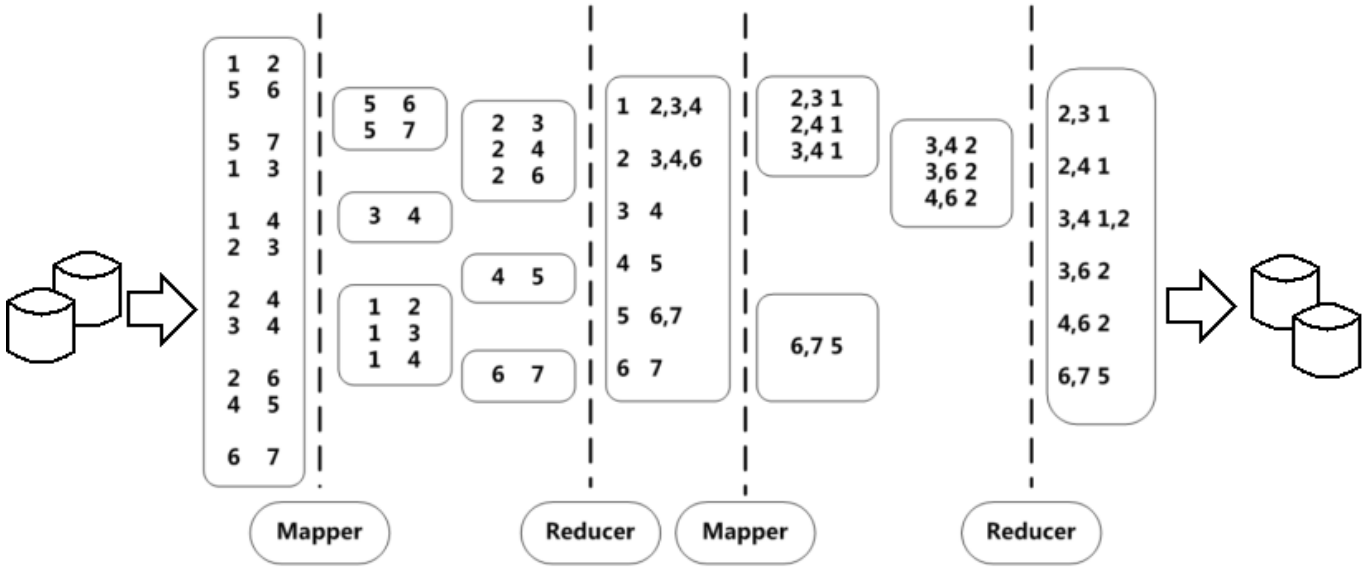
- the number of common neighbors
- the number of common community members
- number of interaction between the two nodes
- the attribute similarity between the two nodes(if available)

Target variable: An interaction is present or not in target time-step?

Model Construction

- Support Vector Machines
- RBF Kernel
- Normalization of the attributes
- Parameters estimated with grid search

Disgression: Common neighbors computation



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Datasets description

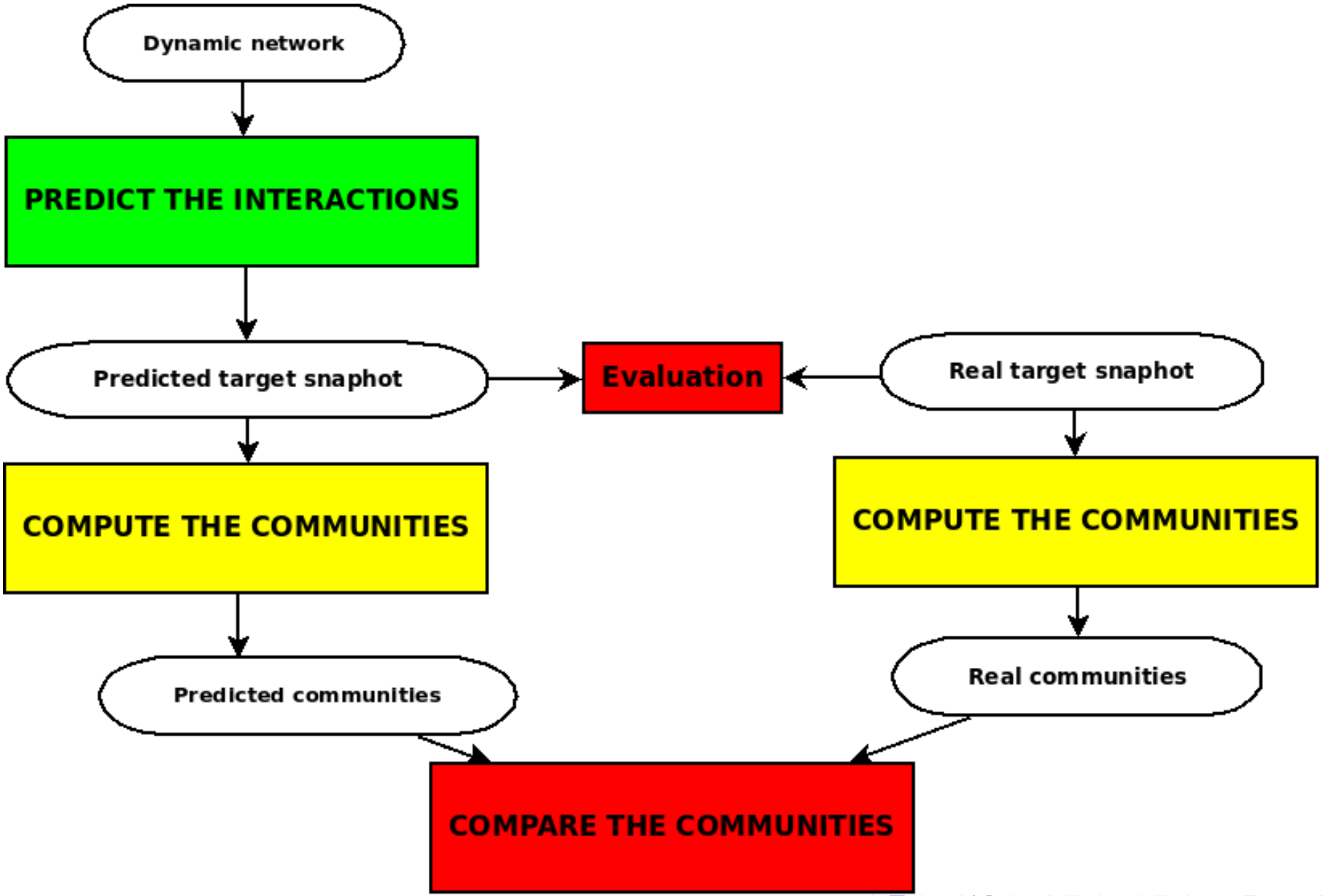
DBLP

- Co-authorship dataset
- Nodes authors
- interactions: common publications
- 11 time-steps (years from 2000 to 2011)

Facebook Walls

- A subset of Facebook New Orleans users
- Nodes Facebook users
- interactions: wall posts (undirected)
- 5 time-steps (years from 2004 to 2008)

Evaluation protocol



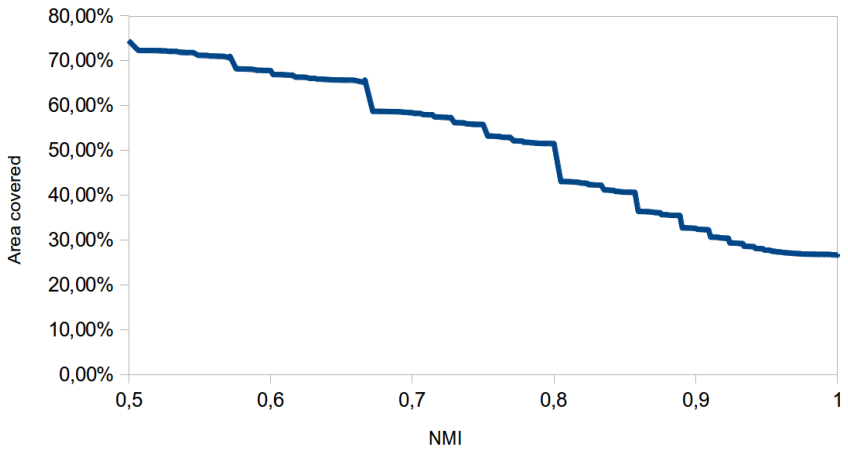
Interaction prediction evaluation

Evaluation with Area Under the Curve(AUC)

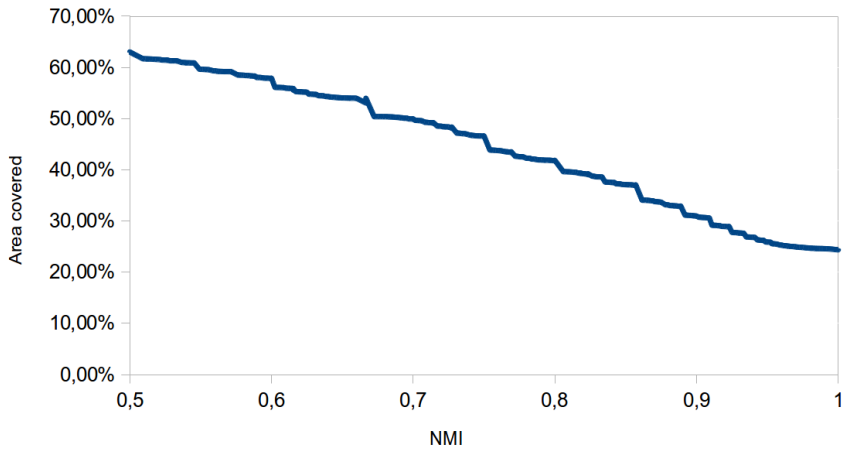
	DBLP	Facebook wall
Random model	0.50	0.50
Similarity based model	0.69	0.84
Supervised model	**0.87**	**0.92**

Communities prediction evaluation

Evaluation with Normalized Mutual Information (NMI)
Communities detected by local method from Ngonmang et al. 2012.



DBLP



Facebook Wall

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Conclusions and perspectives

Some conclusions

- We have introduced the Community prediction problem
- We have proposed an approach using interaction prediction
- We have Tested on real networks

Some perspectives

- Deal with new nodes
- Test on other real networks

Merci

- Thanks you for your attention
- Questions?