

UPMC / CNRS

Graph Theory for Complex Networks Analysis



Laboratoire
d'informatique de Paris 6



Université Pierre-
et-Marie-Curie



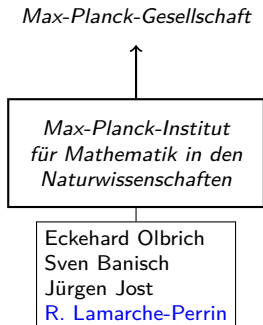
Centre national de la
recherche scientifique

Robin Lamarche-Perrin
Research associate at CNRS

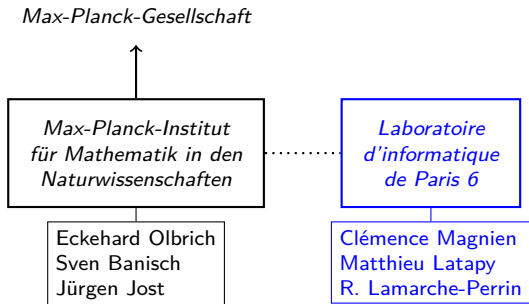
Clémence Magnien
Research director at CNRS

Matthieu Latapy
Research director at CNRS

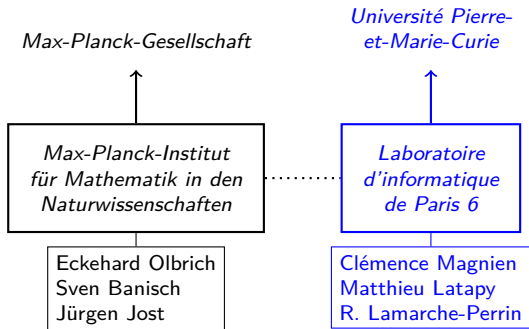
The institutional level



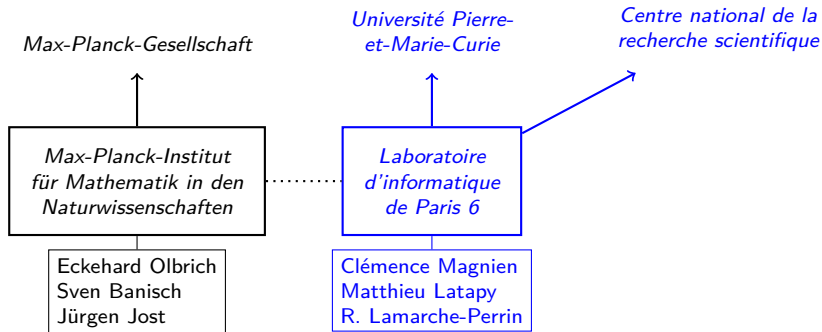
The institutional level: LIP6



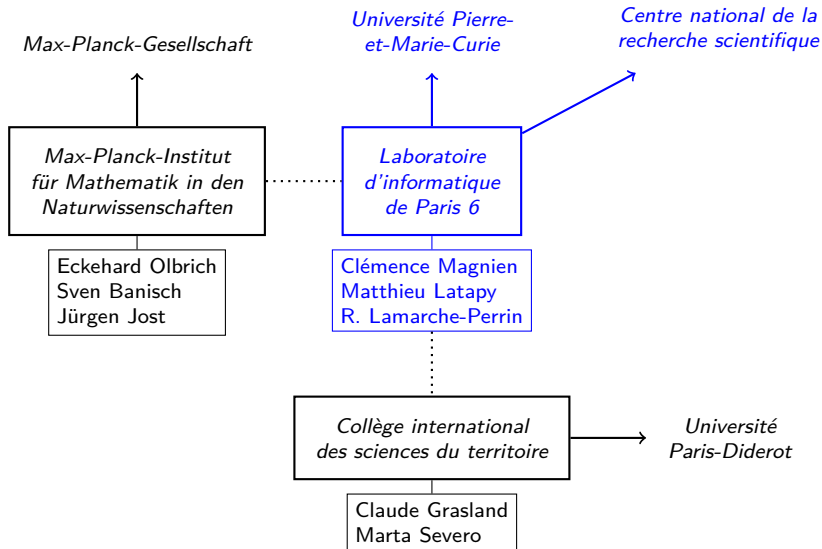
The institutional level: LIP6, UPMC



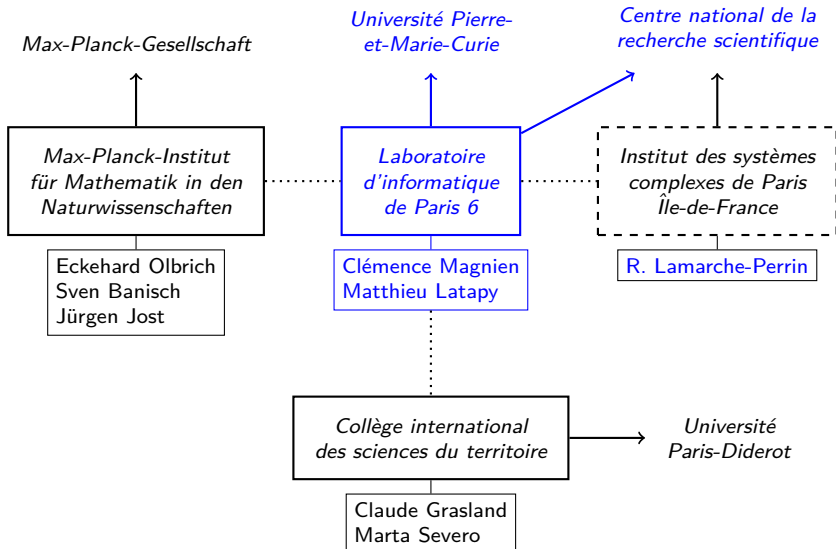
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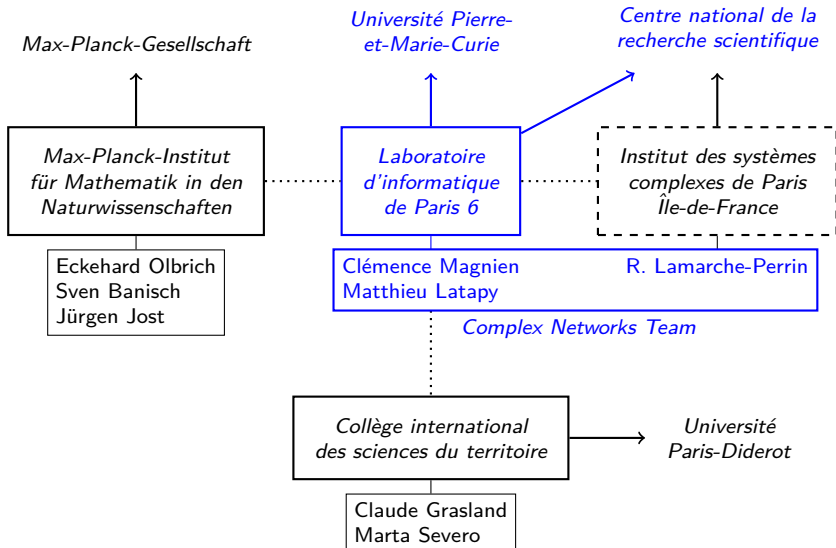
The institutional level: LIP6, UPMC, CNRS



The institutional level: LIP6, UPMC, CNRS, etc.



The institutional level: LIP6, UPMC, CNRS, etc.





complexnetworks.fr

3 permanent researchers:

- Clémence Magnien (5 PM)
- Matthieu Latapy (5 PM)
- Lionel Tabourier

2 associate researchers:

- Robin Lamarche-Perrin (12 PM)
- Fabien Tarissan

1 post-doctoral student:

- Rémy Cazabet
- + future postdoc (24 PM)

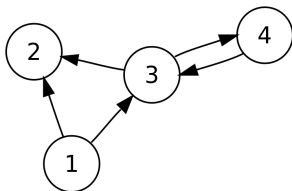
8 doctoral students:

- Audrey Wilmet
- + future PhD student (36 PM)

Several graduate students:

- Mariana Patrício (6 PM)
- Léonard Panichi (6 PM)

From graph theory ...



How to describe this object?

→ connectivity, path, distance, centrality, density, modularity, *etc.*

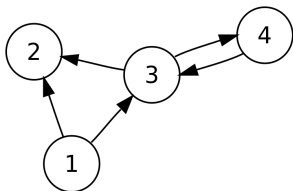
How to compute such properties?

→ algorithmic graph theory

How to reproduce these properties?

→ random graph models

From graph theory ...



How to describe this object?

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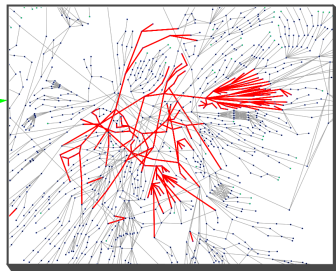
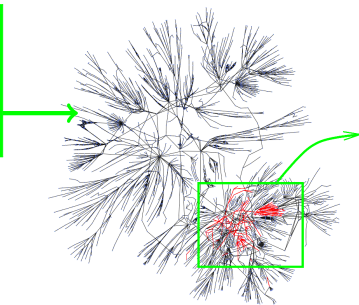
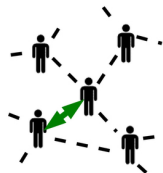
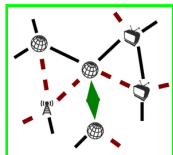
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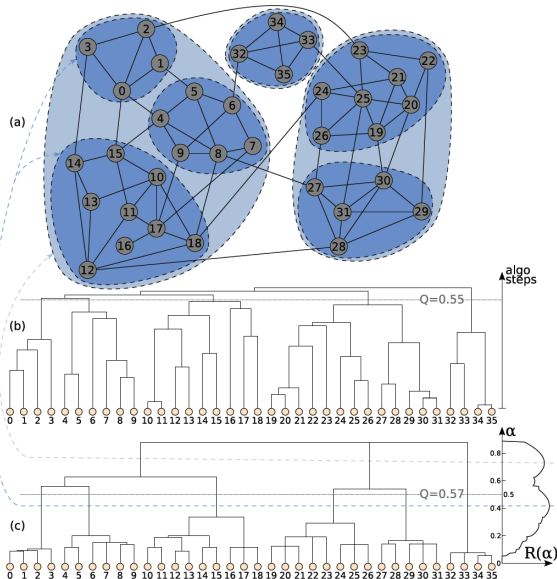
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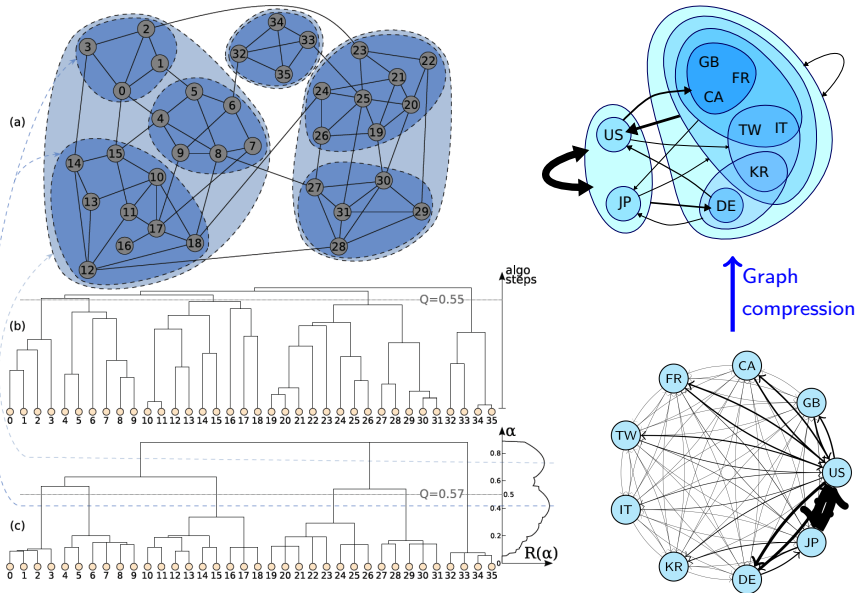
... to complex networks



Unravelling the multilevel structure of network topology

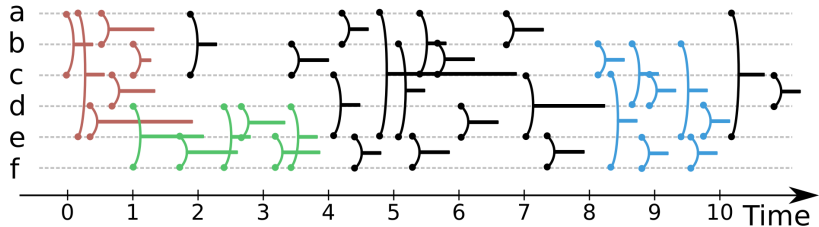


Unravelling the multilevel structure of network topology



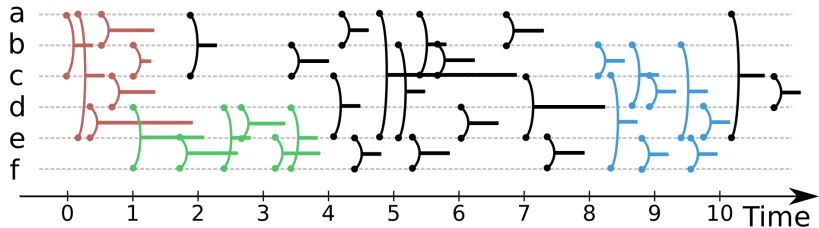
Studying the dynamics of interaction with link streams

Link Stream: a set of interactions $E \subset V \times V \times T$
between couples of vertices in V at a given time instances in T

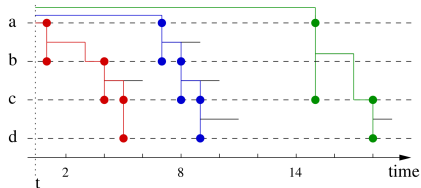


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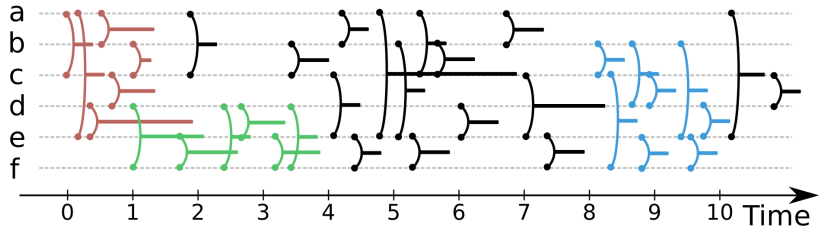


Defining **paths** and **distances**

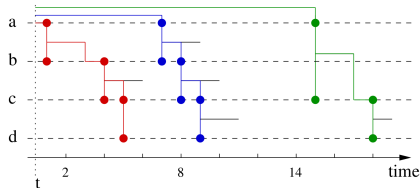


Studying the dynamics of interaction with link streams

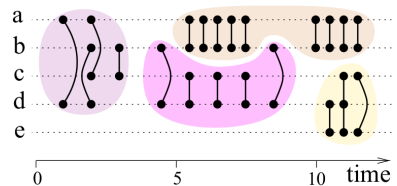
Link Stream: a set of interactions $E \subset V \times V \times T$
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Defining **paths** and **distances**



Defining **density** and **communities**



Geomeia: the multidimensional structure of media flows

International Media Flows

THE GUARDIAN

THE TIMES OF INDIA

Paper 1



"Japan"

Paper 2



"Madrid"

Paper 3



"French"

"Spain"

Data: 292 767 articles

published by **36 newspapers** (in 23 different states)

during **52 weeks** (from 28/04/2014 to 26/04/2015)

and citing **197 countries** (recognised by the UN)

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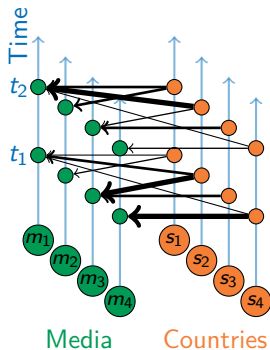


"French"

"Spain"



Weighted temporal bipartite graph



Data: 292 767 articles

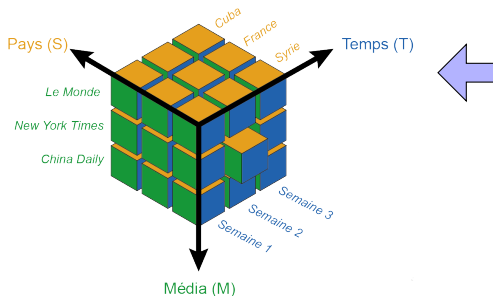
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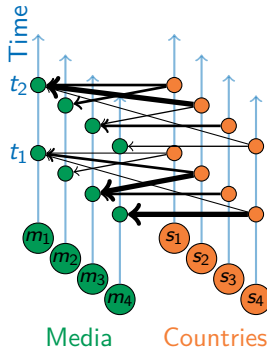
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Geomeia: the multidimensional structure of media flows

Geomeia Cube (media \times space \times time)



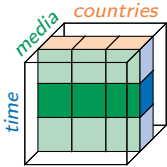
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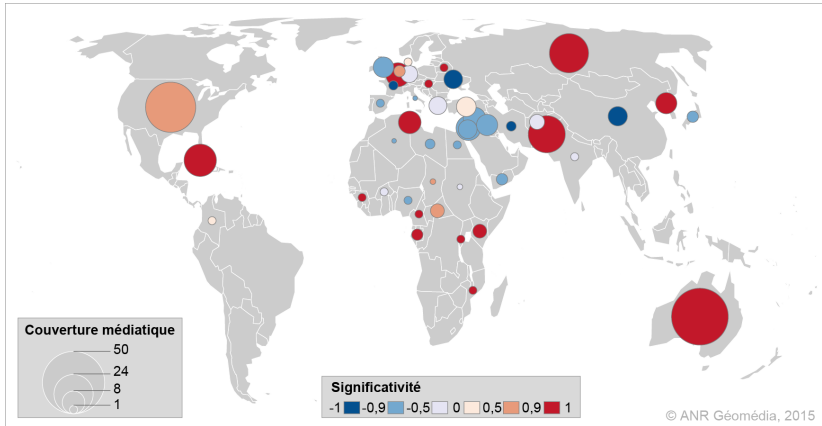
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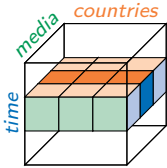
Geomedia: the multidimensional structure of media flows



ISTA Model: Internal Spatio-Temporal Agenda measures significant divergences with respect to the mean internal agenda of a particular newspaper
(*Le Monde*, week of 15th December, 2014)



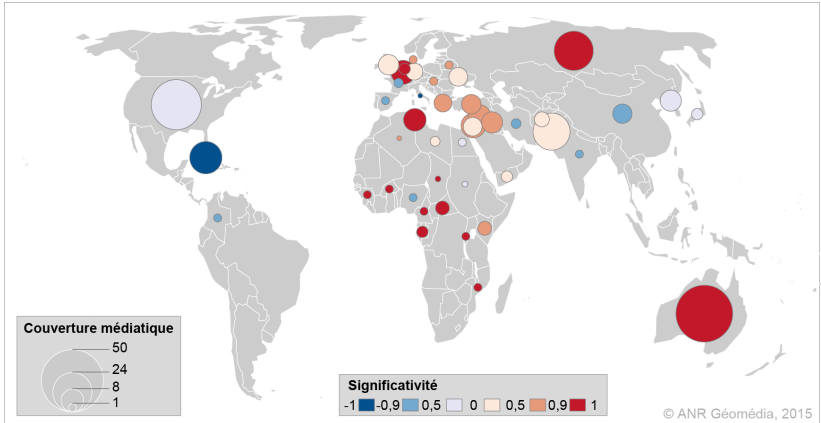
Geomedia: the multidimensional structure of media flows



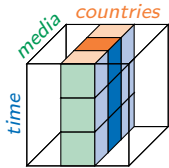
GSA Model: Global Spatial Agenda

measures significant divergences with respect to the mean spatial agenda of all media on a particular time period

(Le Monde, week of December 15th, 2014)



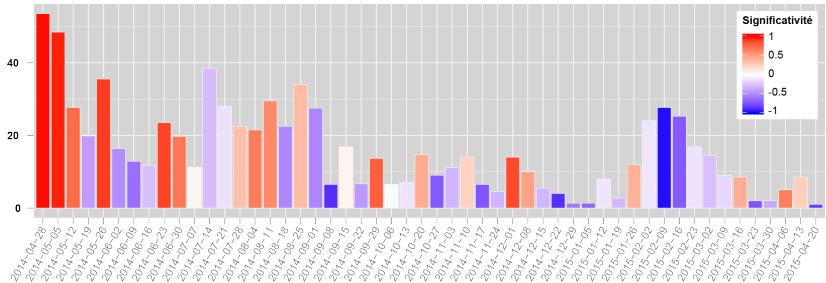
Geomedia: the multidimensional structure of media flows



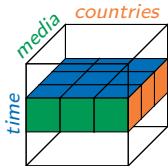
GTA Model: Global Temporal Agenda

measures significant divergences with respect to the mean temporal agenda of all media regarding a particular country

(Ukraine, Le Monde)

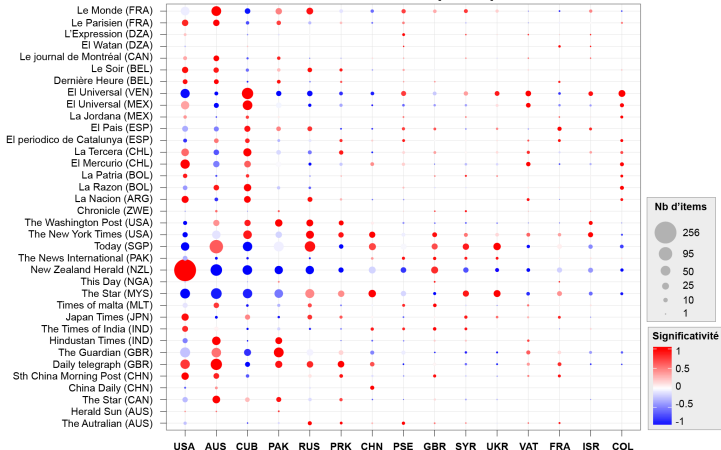


Media Aggregation

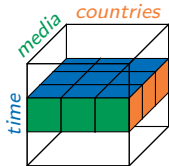


GSA Model

Week of
15/12/2014

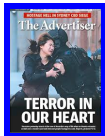
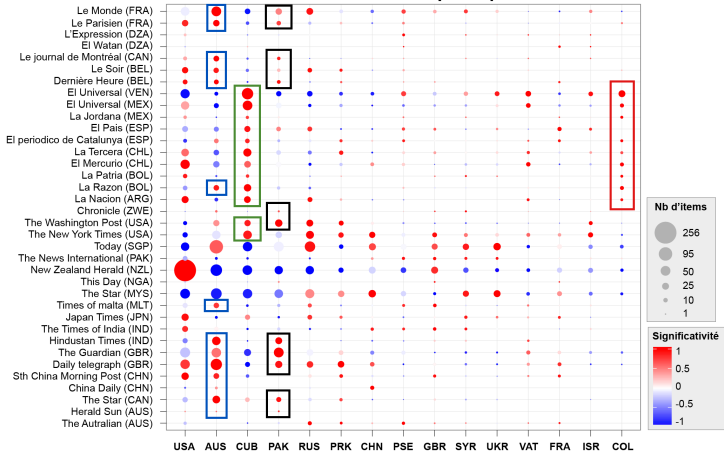


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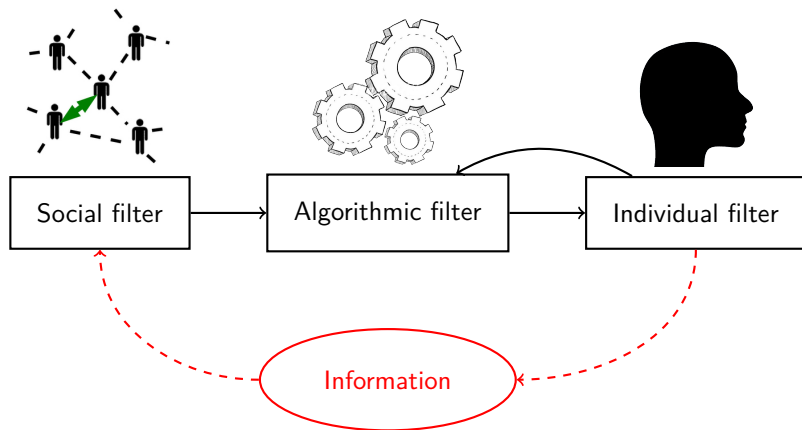


GSA Model

Week of
15/12/2014



AlgoDiv: Information diversity in online communities



Thank you for your attention



complexnetworks.fr

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Matthieu.Latapy@lip6.fr

Clemence.Magnien@lip6.fr

