DYCCEUS

First consortium meeting
at Chalmers University, Göteborg
on the 12th of September, 2017

Progress Report from UPMC

Theoretical foundations for complex networks analysis

Robin Lamarche-Perrin Clémence Magnien Matthieu Latapy
and all the Complex Networks team at LIP6

LIP6 UPMC SORBONNE UNIVERSITÉS cnrs dépasser les frontières

With the participation of...

People directly working on the project:

Robin Lamarche-Perrin (tenured researcher)

Matthieu Latapy (tenured researcher)

Clémence Magnien (tenured researcher)

People indirectly working on the project:

Audrey Wilmet (doctoral student)

Lionel Tabourier (tenured lecturer)

Fabien Tarissan (tenured lecturer)

Rémy Cazabet (post-doctoral student)

People founded by the project:

Mariana Patrício
→ master student from 02/2017 to 07/2017
→ has left the team

Léonard Panichi
→ master student from 03/2017 to 09/2017
→ research engineer from 10/2017 to 09/2018

Hong-Lan Botterman
→ has not arrived yet
→ doctoral student from 11/2017 to 09/2020

Review Article about "Mining Political Opinion on Twitter"

Marta Severo (UPD)
R. Lamarche-Perrin (UPMC)

I. Concepts: What is Political Opinion?

1. Opinion as a Preference
2. Opinion as a Sentiment
3. Opinion as an Interaction
4. Opinion as an Agenda

II. Methods: The challenges of digital traces

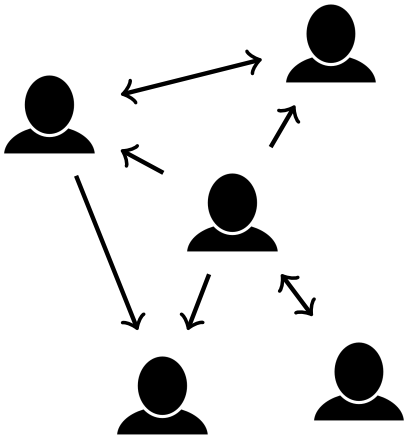
1. About Multi-scale Approaches
2. About Explanatory vs. Predictive Approaches
3. About Supervised vs. Unsupervised Approaches

Publication planned for September 2017 in *Revue française de sociologie*

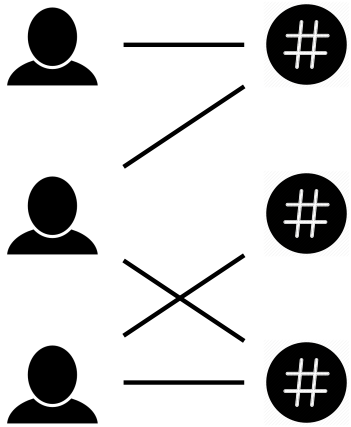
Contributes to **Deliverable 1.3**: "Conceptual grounds for the analysis of opinions about international conflicts in the media"

Work in Graph Theory

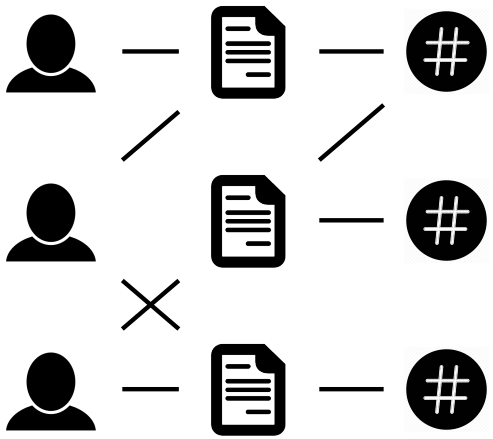
(user × user)



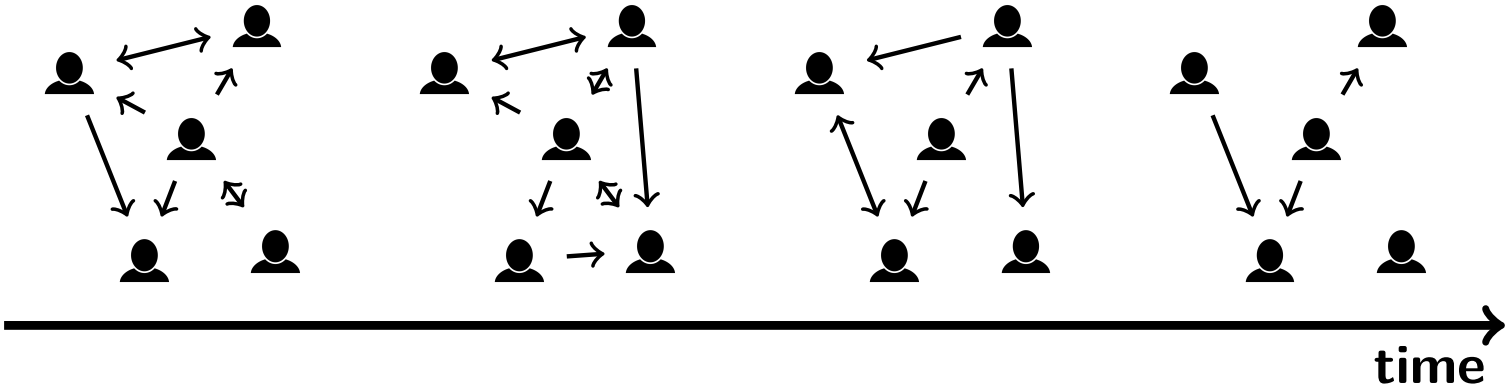
(user × topic)



(user × info × topic)



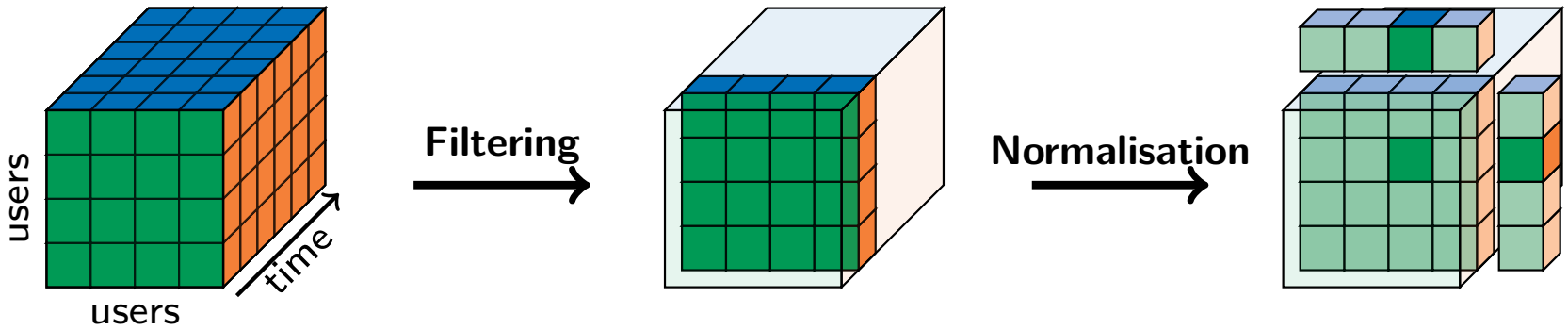
(user × user × time)



Multidimensional analysis of dynamical interaction graphs

(user × user × time)

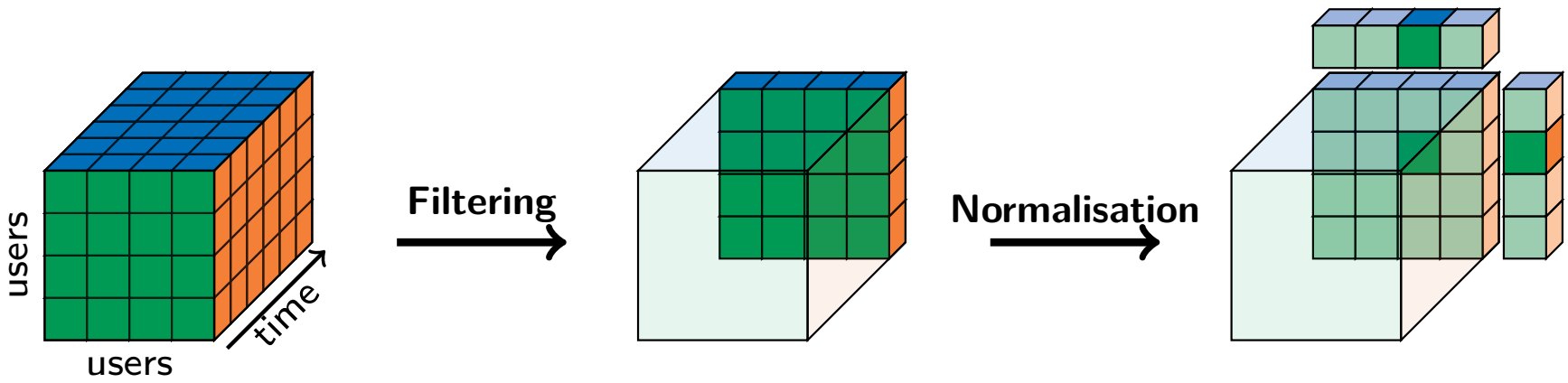
Audrey Wilmet
R. Lamarche-Perrin
Matthieu Latapy



Multidimensional analysis of dynamical interaction graphs

(user × user × time)

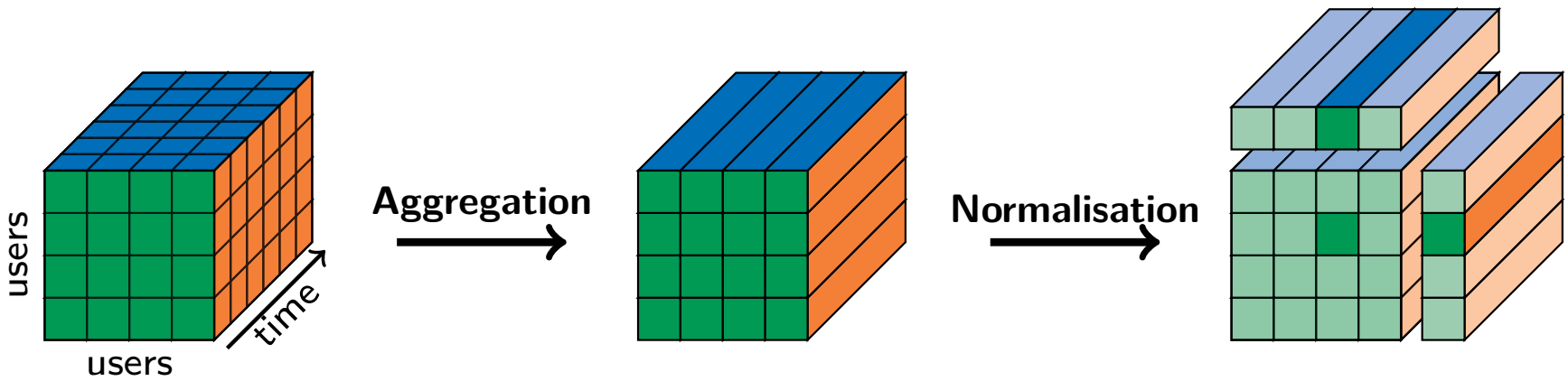
Audrey Wilmet
R. Lamarche-Perrin
Matthieu Latapy



Multidimensional analysis of dynamical interaction graphs

(user × user × time)

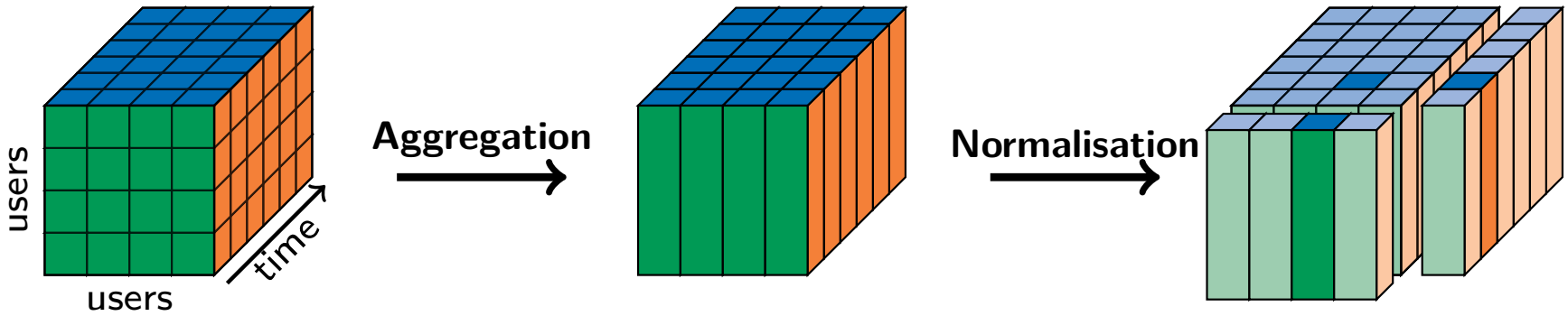
Audrey Wilmet
R. Lamarche-Perrin
Matthieu Latapy



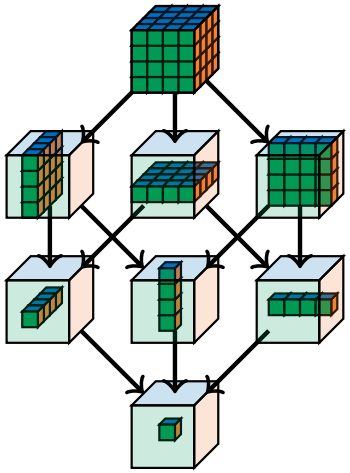
Multidimensional analysis of dynamical interaction graphs

(user × user × time)

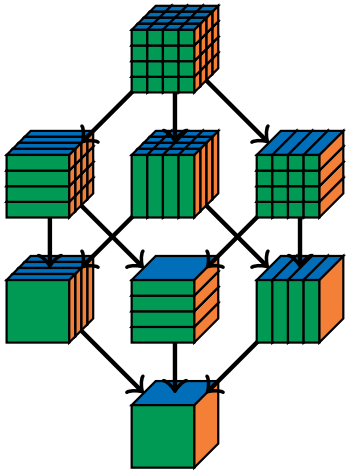
Audrey Wilmet
R. Lamarche-Perrin
Matthieu Latapy



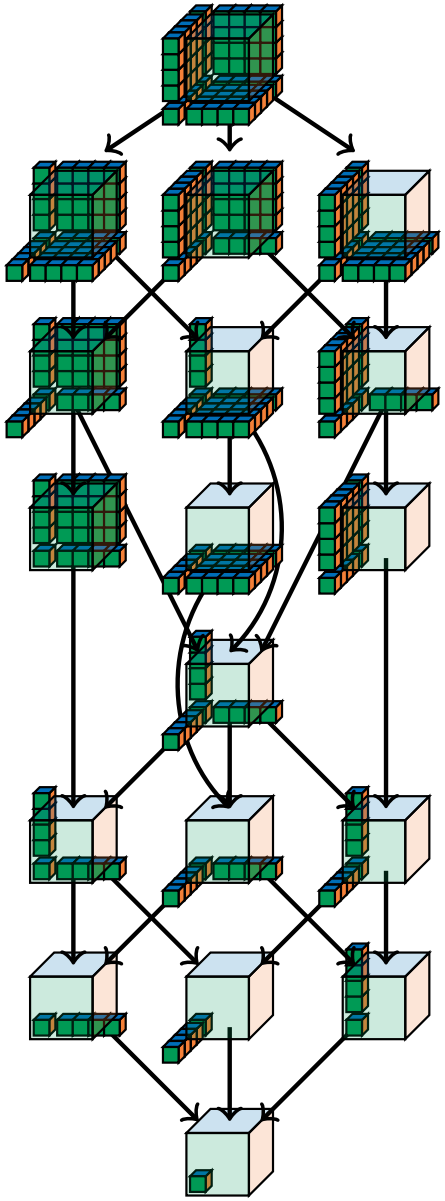
Filtering



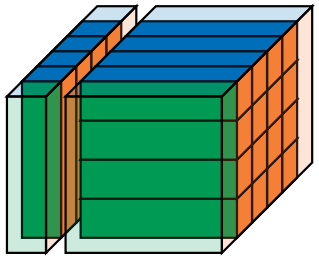
Aggregation

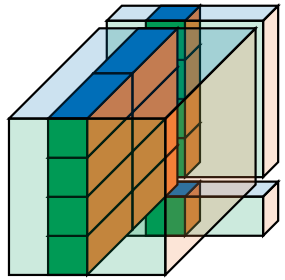


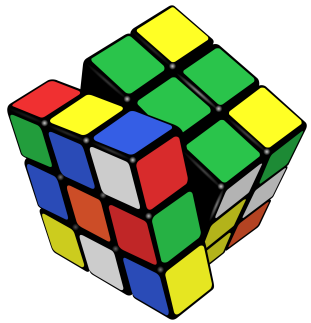
Normalisation

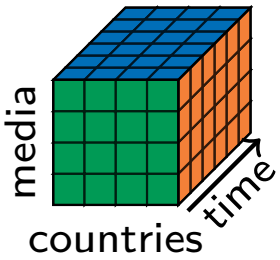


Many combinations



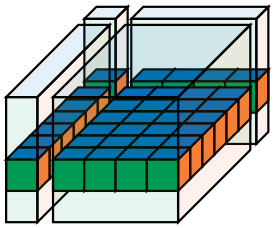




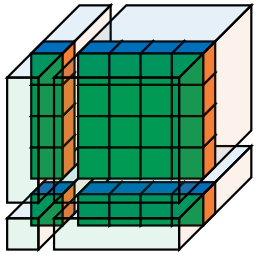


The GEOMEDIA Project

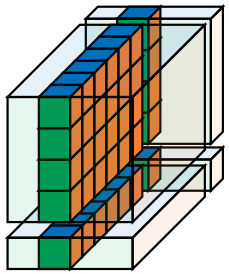
Grasland, Lamarche-Perrin, Loveluck, Pecout, "International agenda-setting, the media and geography", In *L'Espace géographique*, 45:1, p. 25-43, 2016.



Internal spatio-temporal agenda
of a given newspaper

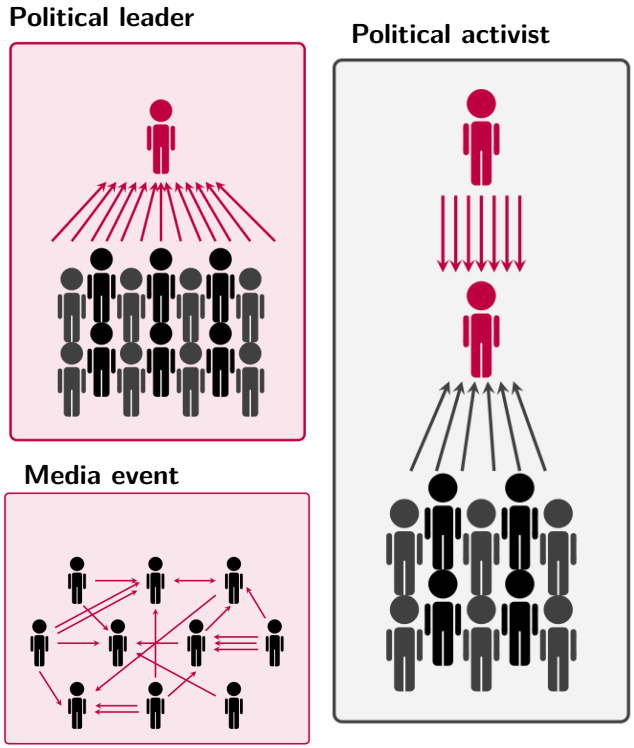


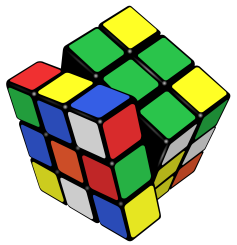
Global spatial agenda
of a given time period



Global temporal agenda
of a given country

The ODYCCEUS Project





?

Multidimensional analysis of dynamical interaction graphs

(user $\times$ user $\times$ time)

Audrey Wilmet
R. Lamarche-Perrin
Matthieu Latapy

Contributes to **Deliverable 3.4**:
"Multidimensional and multilevel analysis of interactions in social systems"

Module for **Penelope:** Implementation of basic operations on multidimensional interaction data (and description of their semantics for the analysis)

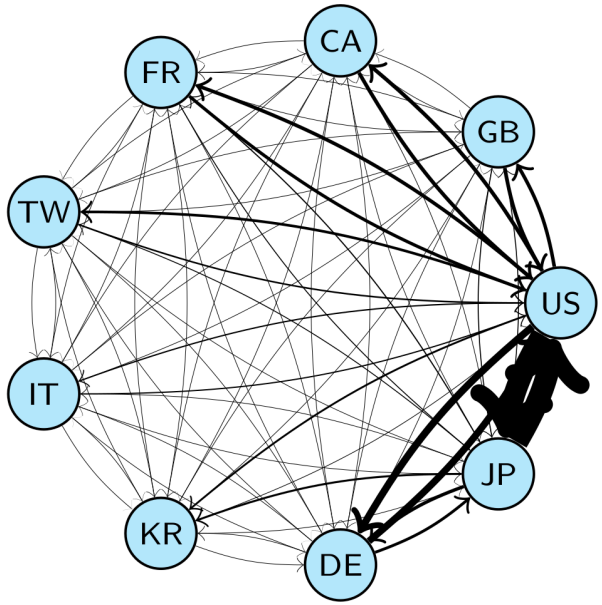
Communication on the 28th of September at the *Third European Conference on Social Networks* (EUSN'17)

Optimisation algorithms for lossy graph compression

(user × user)

Léonard Panichi
R. Lamarche-Perrin
Clémence Magnien

	GB	CA	FR	TW	IT	KR	DE	JP	US
GB		3	5	1	2	0	11	23	82
CA	3		3	2	1	0	6	15	89
FR	5	3		1	3	1	14	28	83
TW	2	3	2		1	3	4	22	62
IT	2	1	3	1		0	7	12	31
KR	2	1	2	2	1		3	47	44
DE	11	6	12	2	6	1		78	167
JP	24	14	23	9	9	14	66		504
US	86	87	75	37	29	16	161	519	

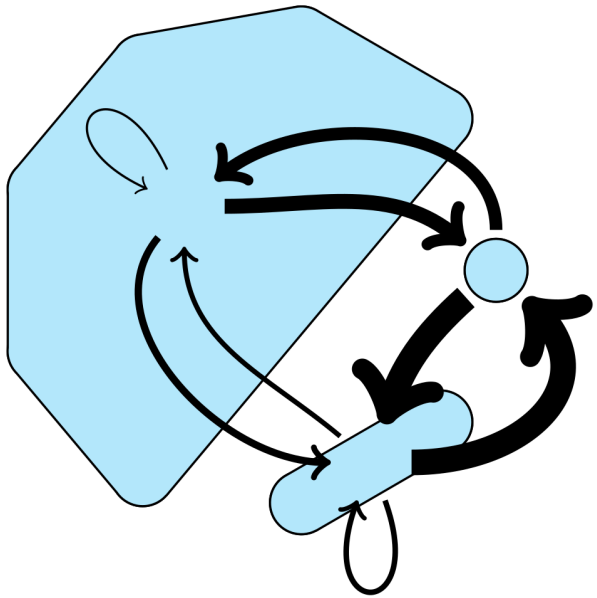


Optimisation algorithms for lossy graph compression

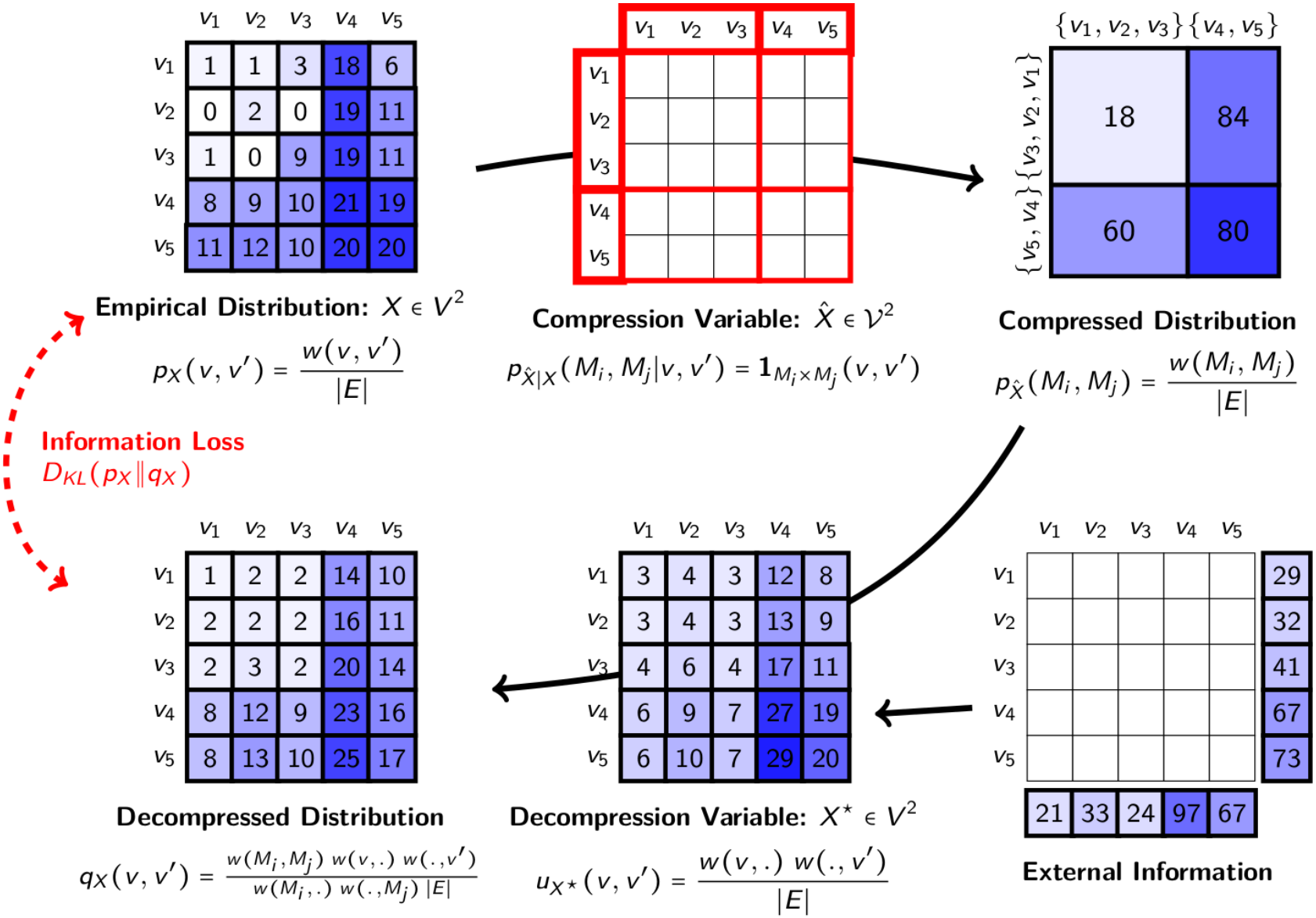
(user $\times$ user)

Léonard Panichi
R. Lamarche-Perrin
Clémence Magnien

	GB CA FR TW IT KR	DE JP	US
GB CA FR TW IT KR	59	192	391
DE JP	131	144	671
US	330	680	



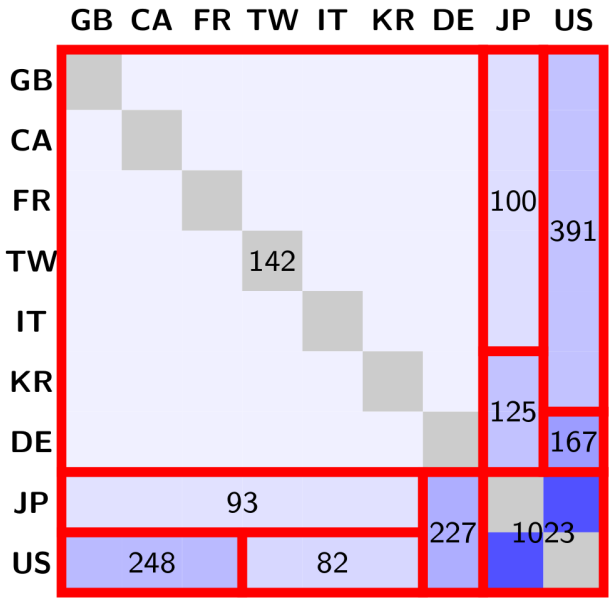
Classical block model $\rightarrow$ **Aggregation of vertices**

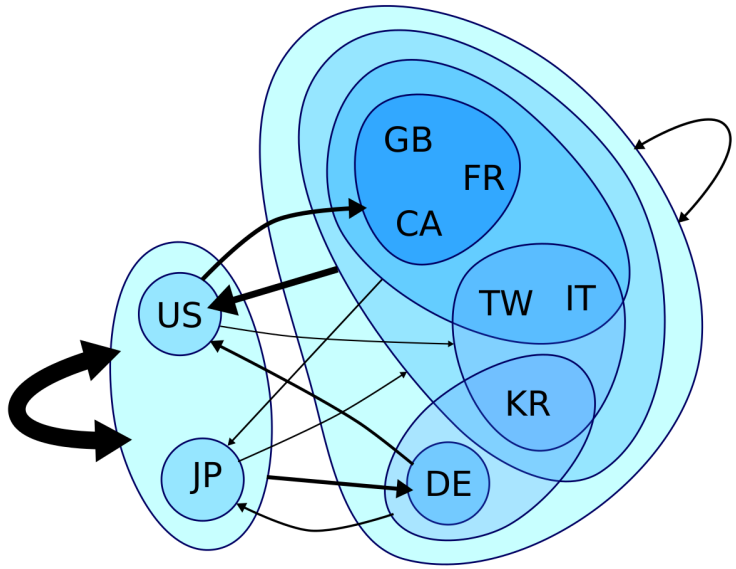

v1 v2 v3 v4 v5
v1 1 1 3 18 6
v2 0 2 0 19 11
v3 1 0 9 19 11
v4 8 9 10 21 19
v5 11 12 10 20 20
Empirical Distribution: $X \in V^2$
$p_X(v, v') = \frac{w(v, v')}{|E|}$
Compression Variable: $\hat{X} \in \mathcal{V}^2$
$p_{\hat{X}|X}(M_i, M_j|v, v') = \mathbf{1}_{M_i \times M_j}(v, v')$
$\{v_1, v_2, v_3\}$ $\{v_4, v_5\}$
$\{v_5, v_4\}$ $\{v_3, v_2, v_1\}$
18 84
60 80
Compressed Distribution
$p_{\hat{X}}(M_i, M_j) = \frac{w(M_i, M_j)}{|E|}$
Information Loss
$D_{KL}(p_X \| q_X)$
v1 v2 v3 v4 v5
v1 1 2 2 14 10
v2 2 2 2 16 11
v3 2 3 2 20 14
v4 8 12 9 23 16
v5 8 13 10 25 17
Decompressed Distribution
$q_X(v, v') = \frac{w(M_i, M_j)\, w(v, .)\, w(., v')}{w(M_i, .)\, w(., M_j)\, |E|}$
v1 v2 v3 v4 v5
v1 3 4 3 12 8
v2 3 4 3 13 9
v3 4 6 4 17 11
v4 6 9 7 27 19
v5 6 10 7 29 20
Decompression Variable: $X^\star \in V^2$
$u_{X^\star}(v, v') = \frac{w(v, .)\, w(., v')}{|E|}$
v1 v2 v3 v4 v5
v1 29
v2 32
v3 41
v4 67
v5 73
21 33 24 97 67
External Information

Optimisation algorithms for lossy graph compression

(user $\times$ user)

Léonard Panichi
R. Lamarche-Perrin
Clémence Magnien



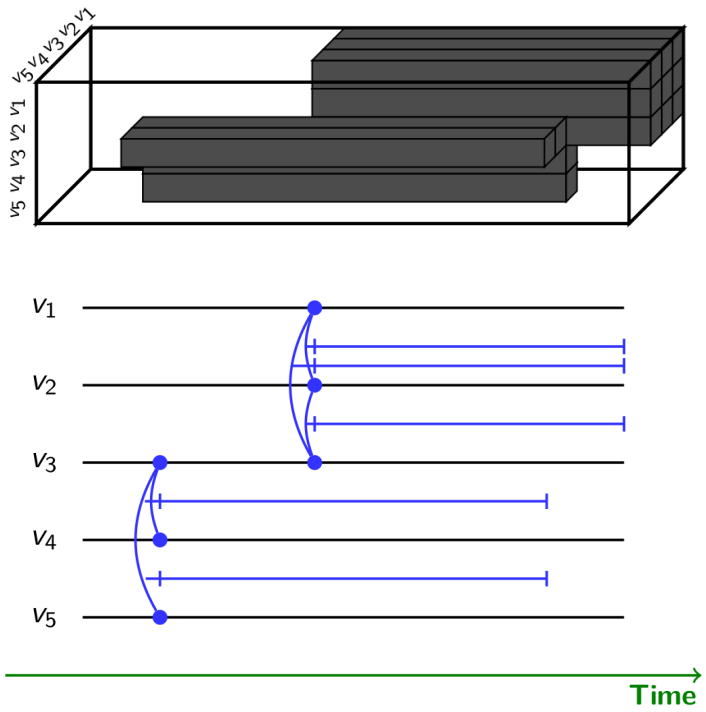


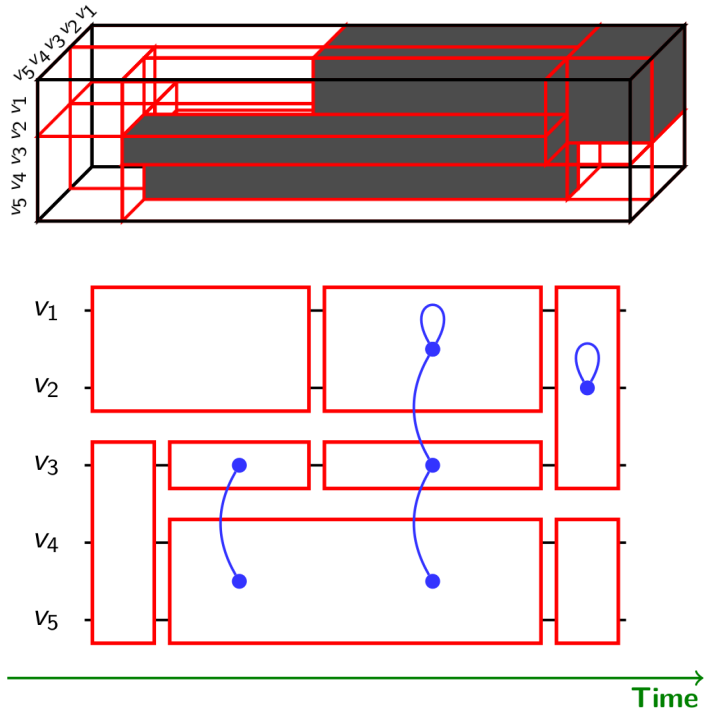
Power graph decomposition $\rightarrow$ **Aggregation of edges**

Optimisation algorithms for lossy graph compression

(user × user)

Léonard Panichi
R. Lamarche-Perrin
Clémence Magnien





Optimisation algorithms for lossy graph compression

(user $\times$ user)

Léonard Panichi
R. Lamarche-Perrin
Clémence Magnien

Contributes to **Deliverable 3.4**:
"Multidimensional and multilevel analysis of interactions in social systems"

Module for **Penelope:** Implementation of efficient algorithms for the multiscale compression of interaction data (with parametrised information loss)

Master thesis by Léonard Panichi:
"Algèbre et algorithmes pour la compression de graphes"

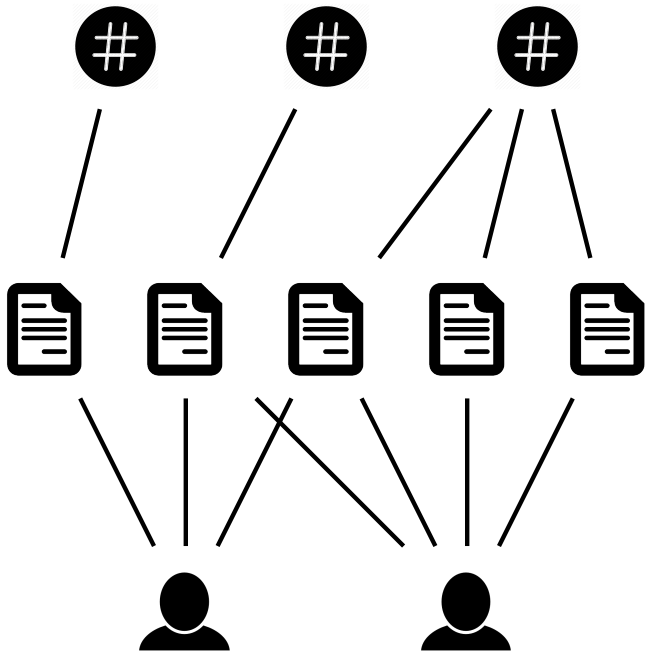
Article planned for October 2017 in *Theoretical Computer Science*:
"A General Framework for Lossy Graph Compression"

Article planned for Spring 2018:
"Heuristics for the Lossy Graph Compression Problem"

Measuring informational diversity in digital media

(user $\times$ item $\times$ topic)

R. Lamarche-Perrin
Lionel Tabourier
Fabien Tarissan
Rémy Cazabet

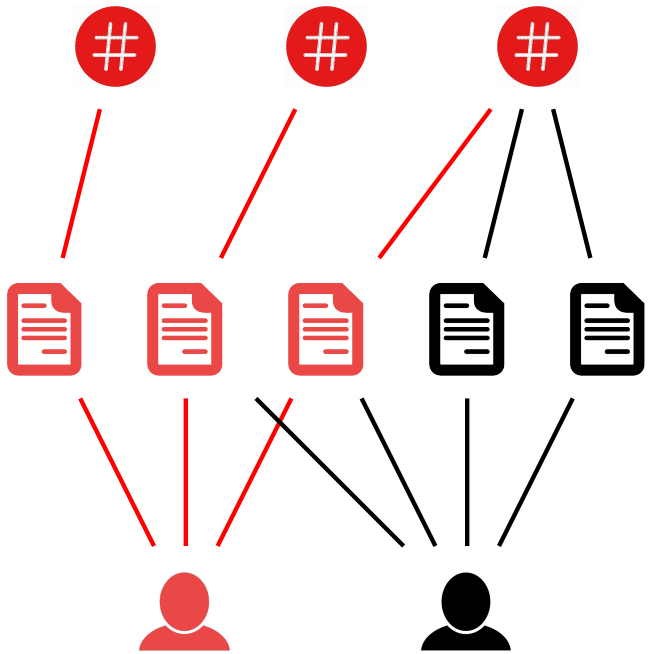


In collaboration with the French **ANR AlgoDiv Project**:
"Algorithmic recommandation and diversity of information on the web"

Measuring informational diversity in digital media

(user $\times$ item $\times$ topic)

R. Lamarche-Perrin
Lionel Tabourier
Fabien Tarissan
Rémy Cazabet

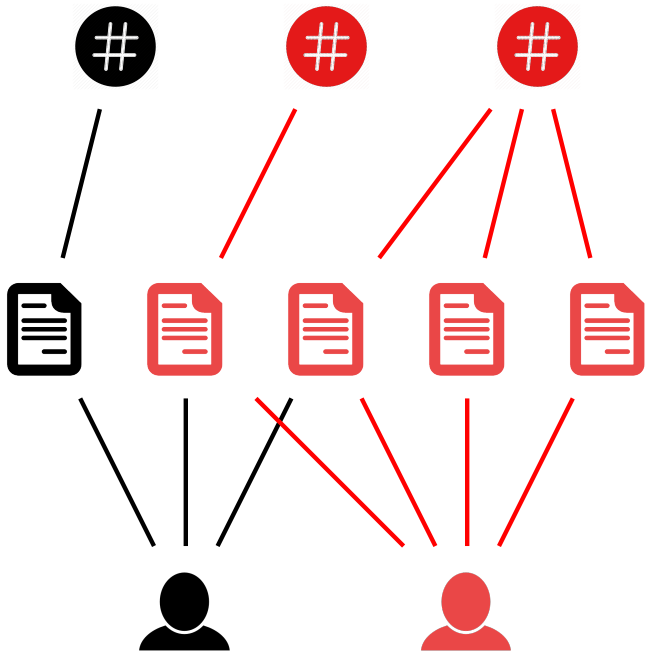


In collaboration with the French **ANR AlgoDiv Project**:
"Algorithmic recommandation and diversity of information on the web"

Measuring informational diversity in digital media

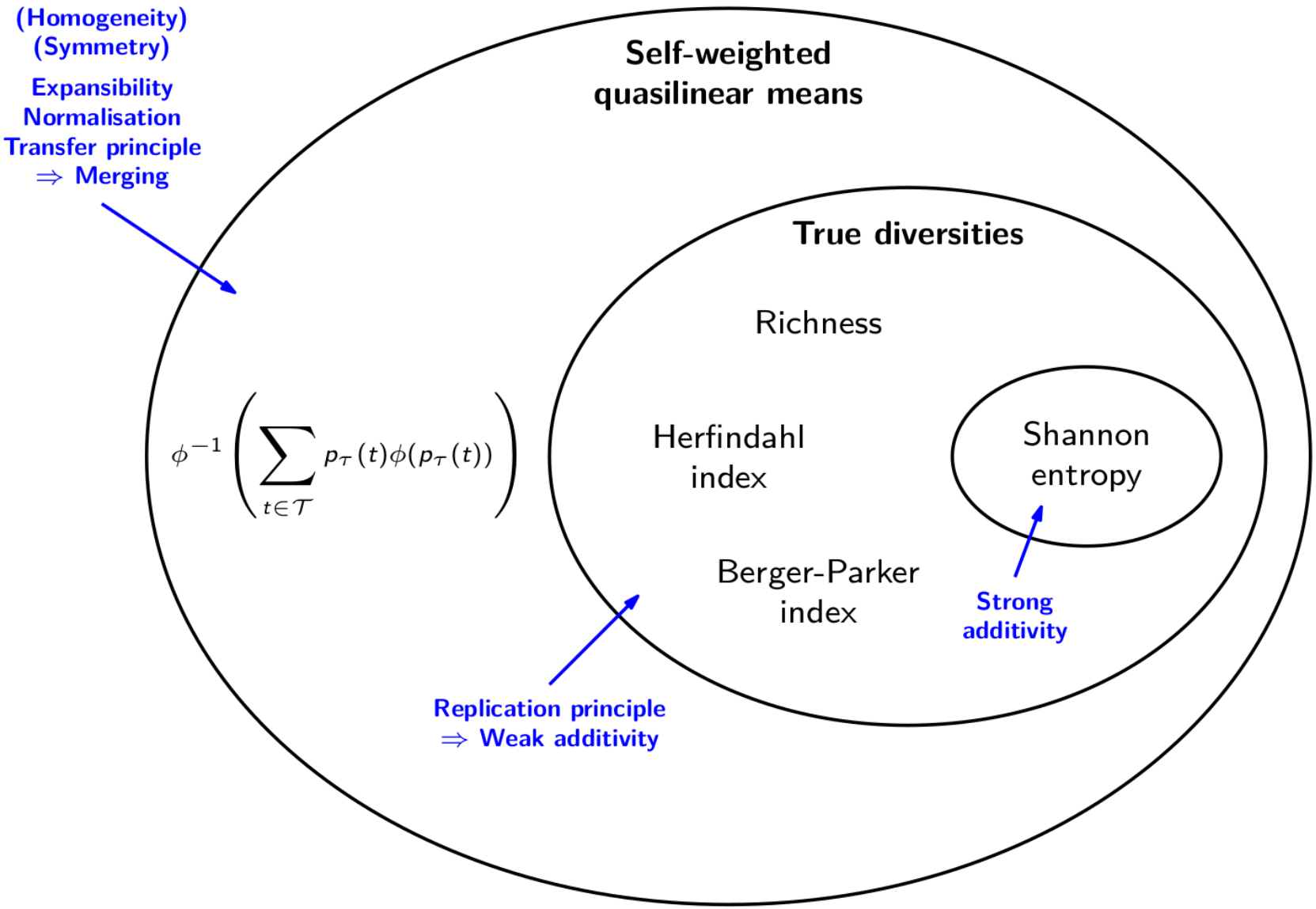
(user × item × topic)

R. Lamarche-Perrin
Lionel Tabourier
Fabien Tarissan
Rémy Cazabet

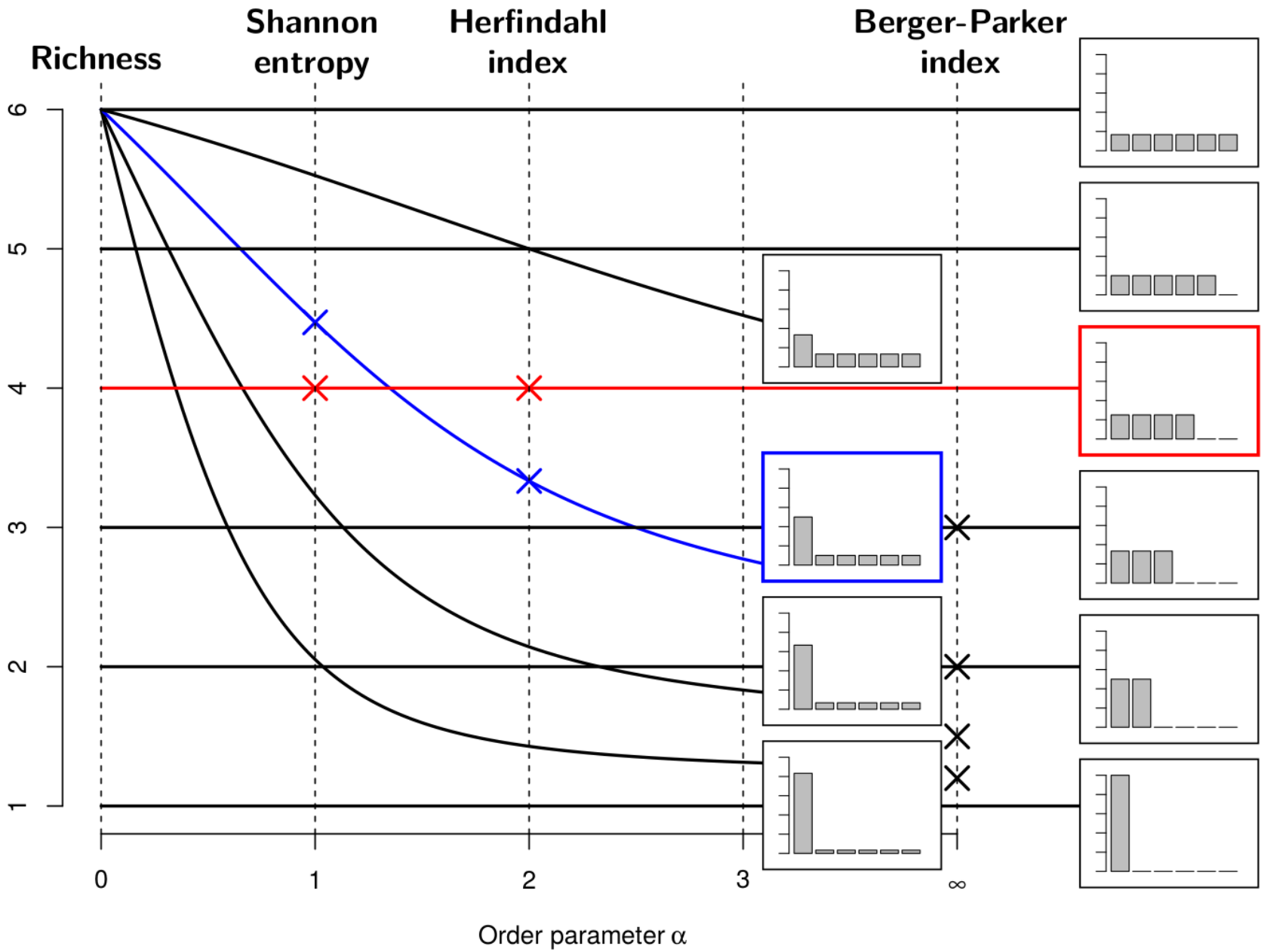


In collaboration with the French **ANR AlgoDiv Project**:
"Algorithmic recommandation and diversity of information on the web"

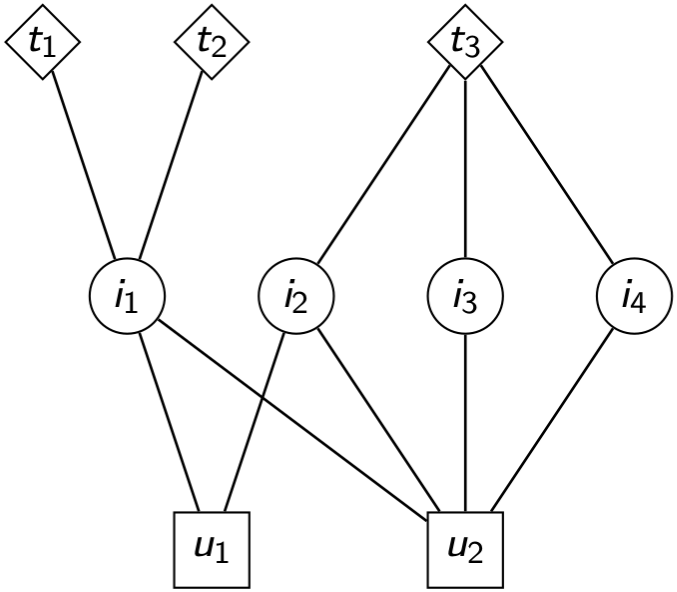
Axiomatic characterisation of diversity measures

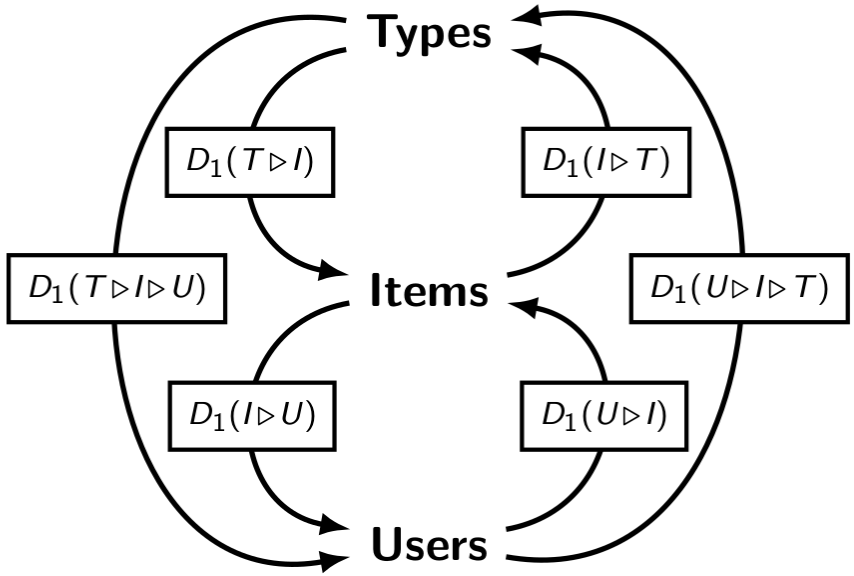


The parametrised class of "true diversity" measures

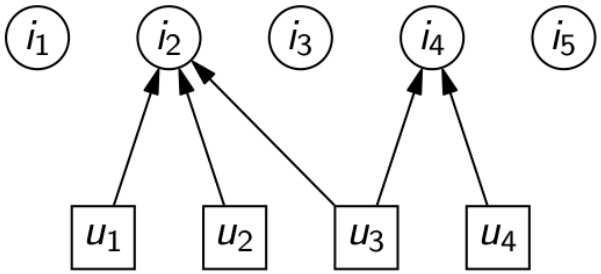


Applying diversity measures to tripartite networks

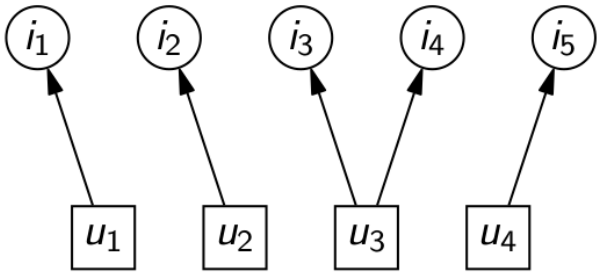




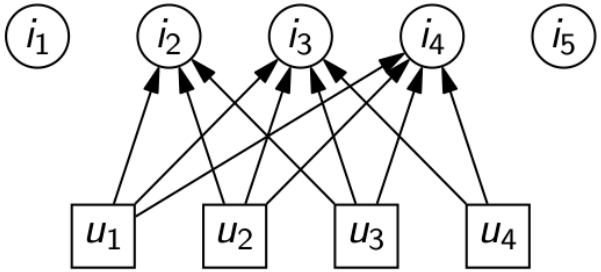
Applying diversity measures to tripartite networks



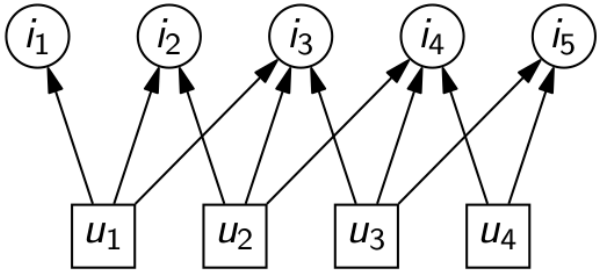
Weak individual diversity
Weak system diversity



Weak individual diversity
Strong system diversity

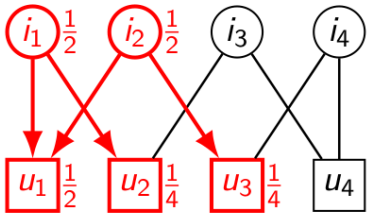


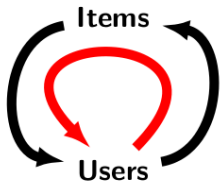
Strong individual diversity
Weak system diversity

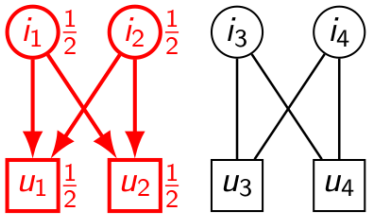


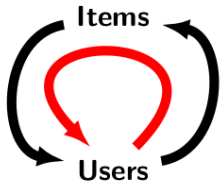
Strong individual diversity
Strong system diversity

Applying diversity measures to tripartite networks









Same system diversity
Same individual diversity

Different "retroactive" individual diversity!

Measuring informational diversity in digital media

(user $\times$ item $\times$ topic)

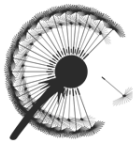
R. Lamarche-Perrin
Lionel Tabourier
Fabien Tarissan
Rémy Cazabet

Contributes to **Deliverable 3.4**:
"Multidimensional and multilevel analysis of interactions in social systems"

Module for **Penelope:** Implementation of such measures to quantify and analyse information diversity in digital media

Article planned for Spring 2018 in *Theoretical Computer Science*

Thank you for your attention



complexnetworks.fr

Robin.Lamarche-Perrin@lip6.fr

Matthieu.Latapy@lip6.fr

Clemence.Magnien@lip6.fr