

INFORMATIVE VALUE OF NEGATIVE LINKS FOR GRAPH PARTITIONING

With an application to European Parliament Votes

Modèles et analyse des réseaux : approches mathématiques et informatiques (MARAMI)
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Israel Mendonça, Rosa Figueiredo,
Vincent Labatut & Philippe Michelon

LIA EA 4128 - Université d'Avignon



SIGNED NETWORKS

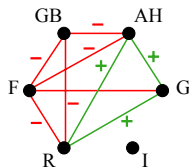
- $G = (V, E, s)$, with $s : E \rightarrow \{+, -\}$

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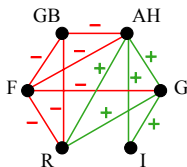
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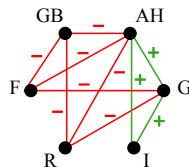
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- Modeling of systems containing antithetical relationships
- Ex.: evolution of pre-WWI alliances between countries [AKR06]



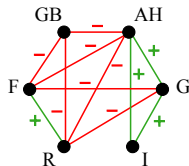
3 Emperor's league 1872-81



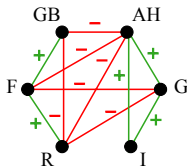
Triple Alliance 1882



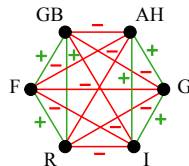
German-Russian Lapse 1890



French-Russian Alliance 1891-94



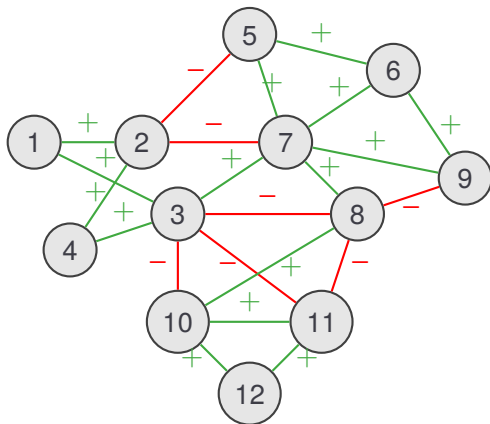
Entente Cordiale 1904



British-Russian Alliance 1907

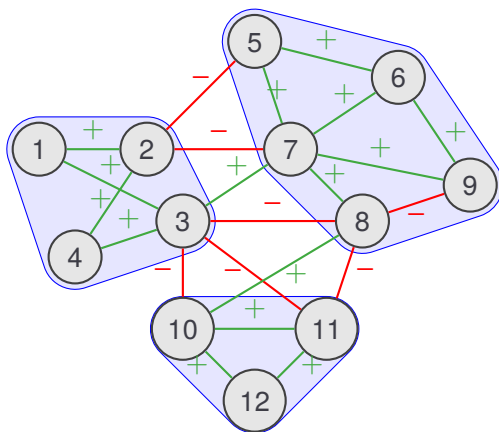
GRAPH PARTITIONING

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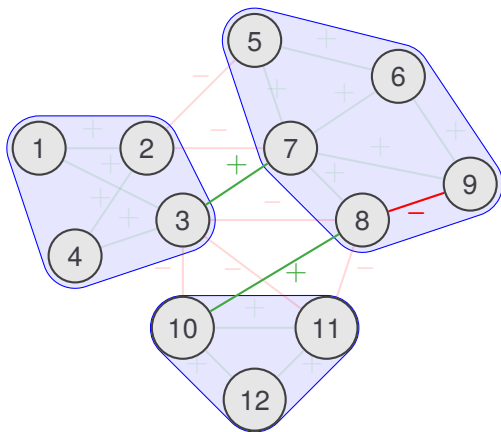
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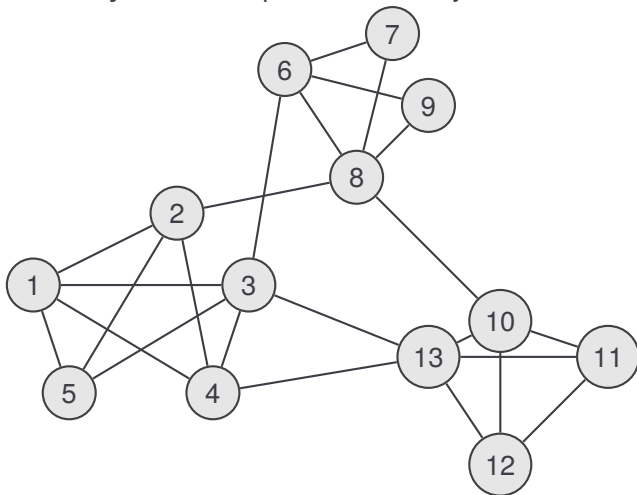
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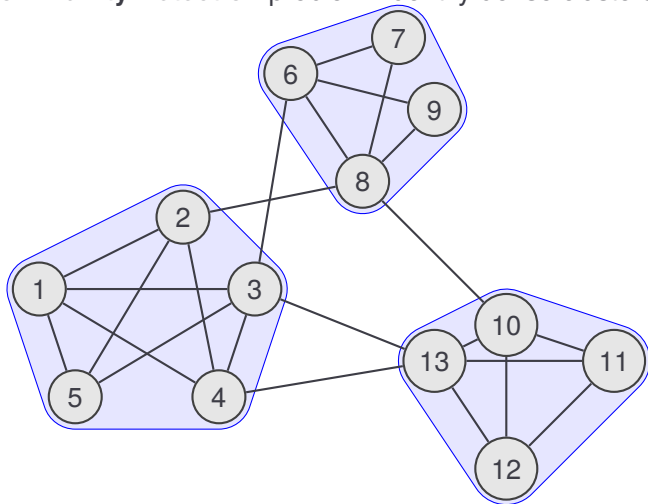
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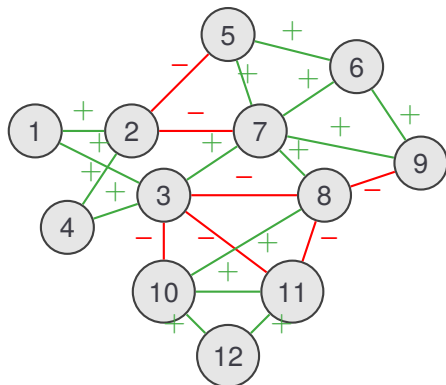
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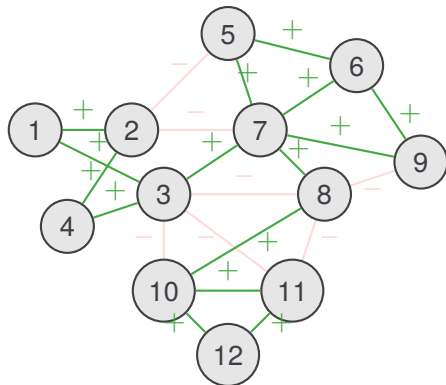
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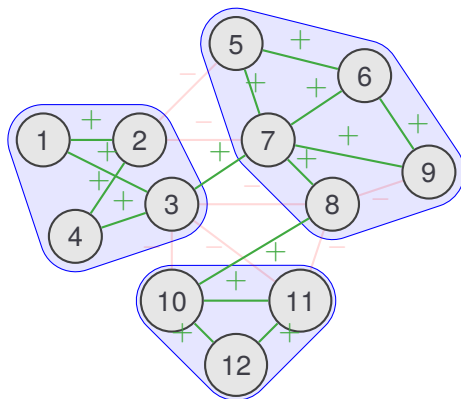
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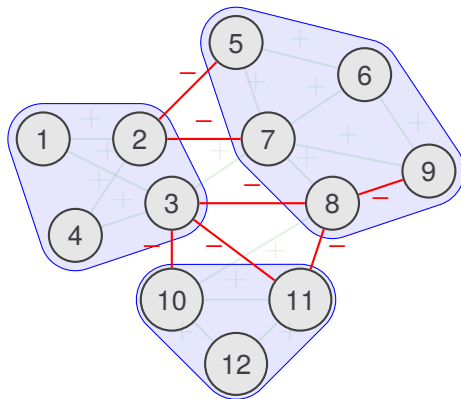
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- Proposed method:
 - Consider a different dataset, modeling a different type of relationships
 - Compare community detection and correlation clustering algorithms

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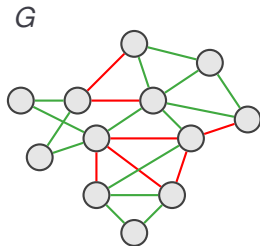
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- Networks:
 - Nodes: Members of the European Parliament (MEPs)
 - Weighted: voting agreement index values
 - Modes: 264 (time \times topics)

PARTITIONING ALGORITHMS

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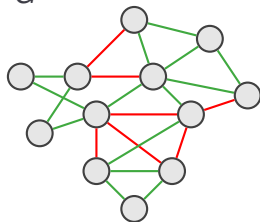
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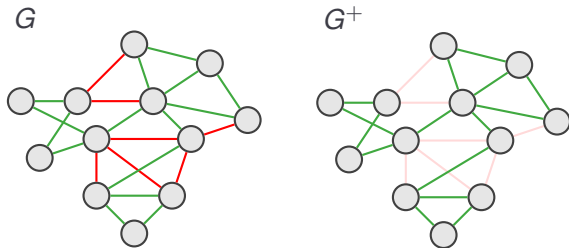
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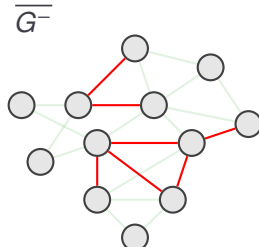
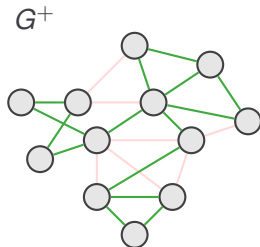
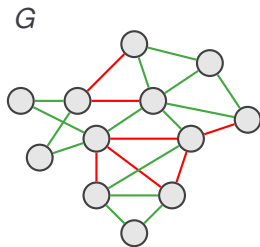
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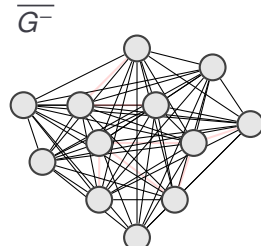
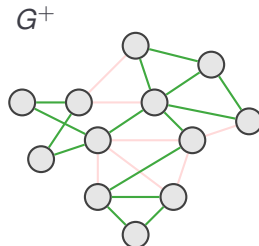
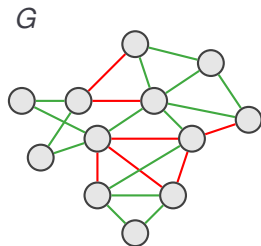
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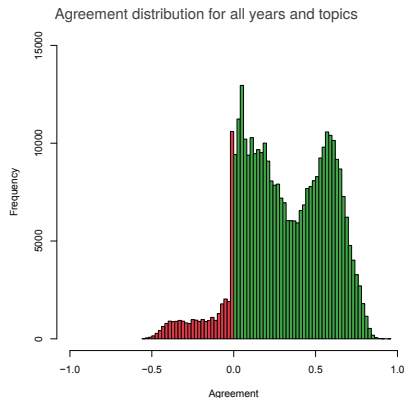
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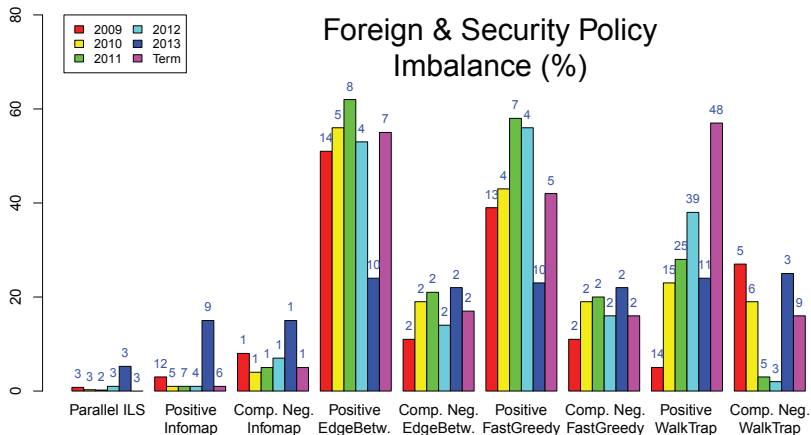


EXTRACTED NETWORKS

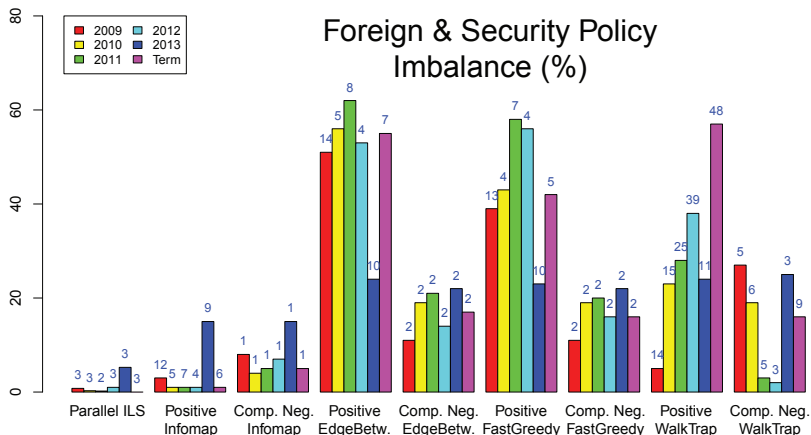
- Same observations for all topics/durations
- Positive side: bimodal distribution
 - Left peak: certain MEPs are frequently absent
 - Right peak: most MEPs often vote similarly
- Negative side: less extreme values
 - Clear majority, in average



PARTITION COMPARISON



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Partition comparison: near-zero NMI

CONCLUSION

- Considering negative links on our dataset leads to:
 - Lower imbalance (at least 3 times better)
 - Only InfoMap outputs CC-like results (imbalance)
 - Different partitions (fewer clusters)
- Contradiction with Esmailian *et al.*'s conclusions
 - (but not their results)
- Perspectives:
 - Consider more data, different types of networks (collection)
 - Exhaustive exploration of vote-based extraction methods
 - Political interpretation of the VoteWatch results

ONLINE RESOURCES

- Data available on Figshare:
 - <http://dx.doi.org/10.6084/m9.figshare.1545599>
- R source code available on GitHub:
 - <https://github.com/CompNet/NetVotes>

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