Analysis of Roll-Calls in EU Parliament (EP)

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Structural Balance and Signed Network Partitioning

Signed network: *network* whose links are *positive* (green lines in Fig. 1) or *negative* (red lines). Interest: modeling of antagonistic real-world systems.

Balanced signed network [1] : can find a partition such that *positive* (resp. *negative*) links are located *inside* (resp. *in-between*) clusters.

In practice: never perfectly balanced → need to measure imbalance by counting misplaced links (see Fig. 1), and find the partition minimizing them.
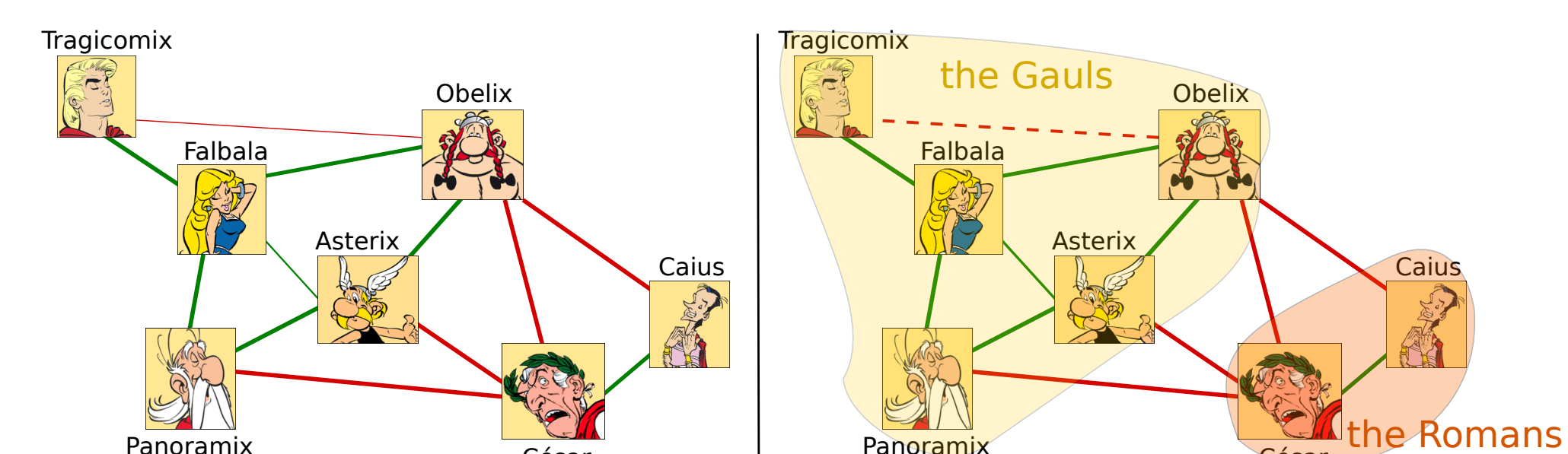

Fig. 1 The signed network representing friendship/hostility relations in the French comics *Asterix* (left), and the detected partition (right). The misplaced link is shown with dashed line.

Problem

Multilayer network: each layer is a network with the same nodes but possibly different links. Example: people communicating through different communication media (e.g. messages, phone calls)
→ How to generalize signed network partitioning to *multilayer* signed networks?

• Some layers may have similar partitions;
• Others may have very different ones;
• But existing methods look for a *single* partition for all.

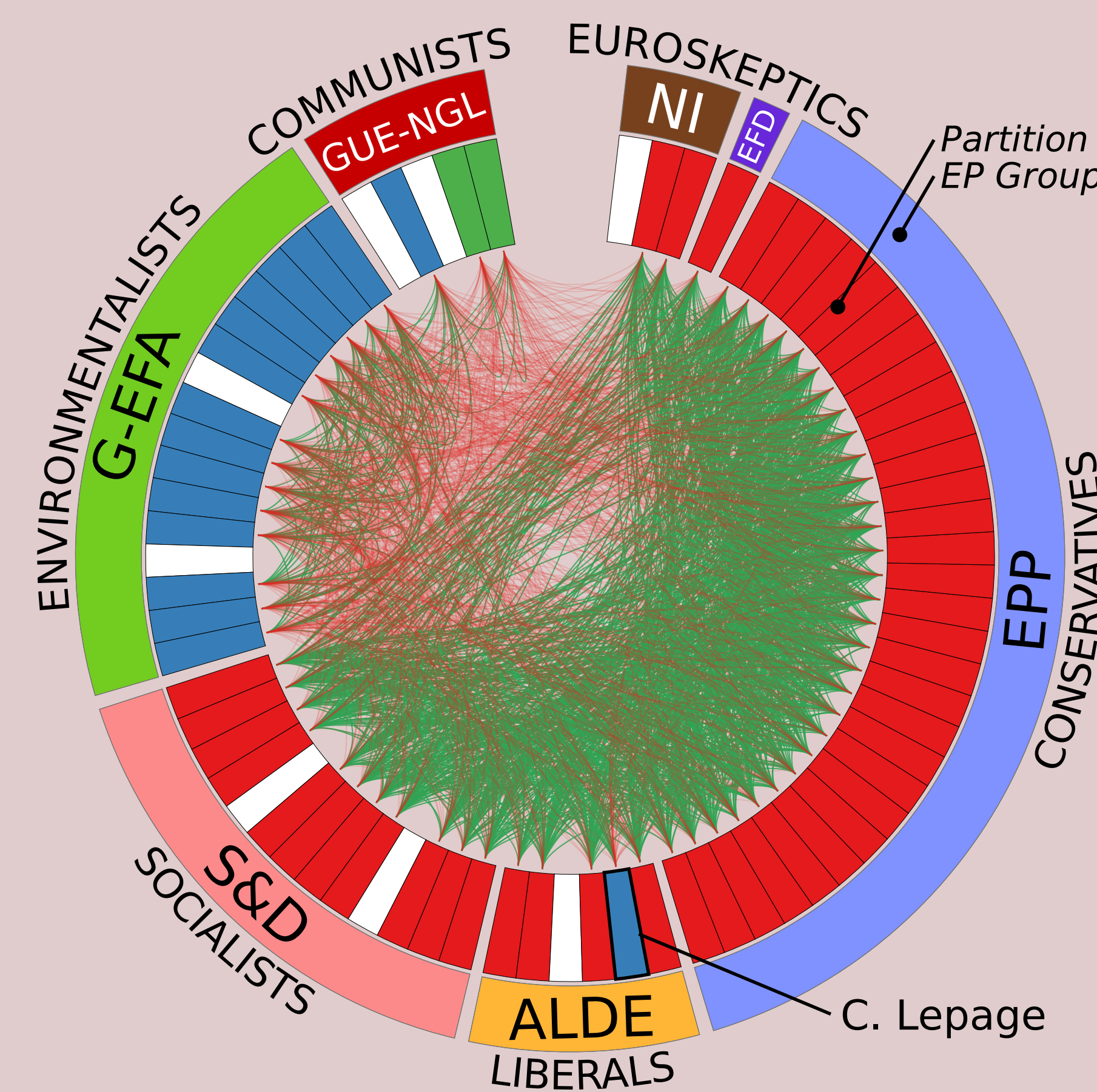**Our goal:** find *all relevant partitions* as well as their *concerned layers*.

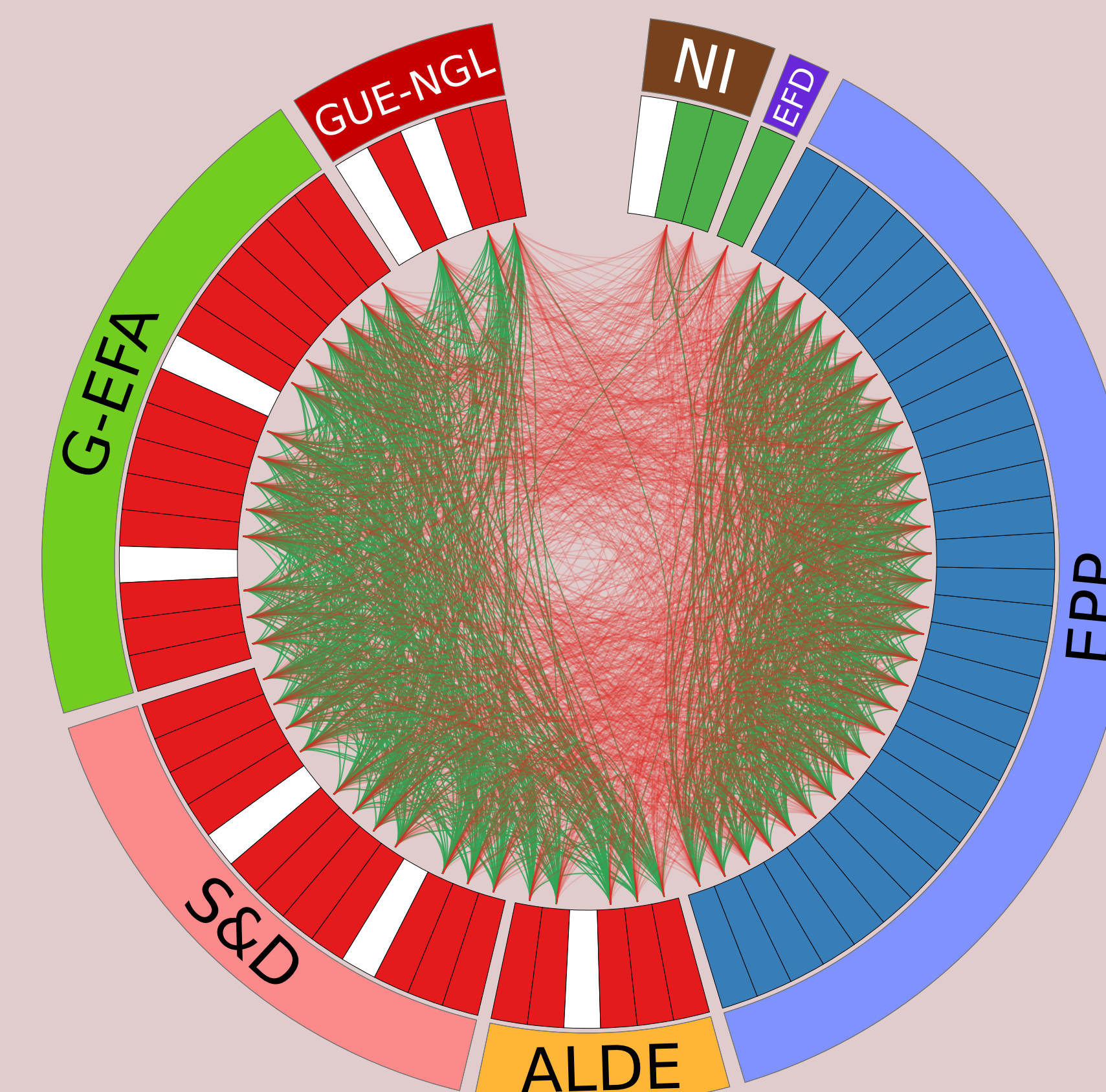**Fig. 2:** *Environmentalists vs. All → 40% of roll-calls (The French case)*

Fig. 3: *Conservatives vs. All → 16% of roll-calls (The French case)*

The **characteristic voting patterns** of EP show that the French socialist and liberal groups alternatively side with the left- and right-wings on **certain agricultural questions.**
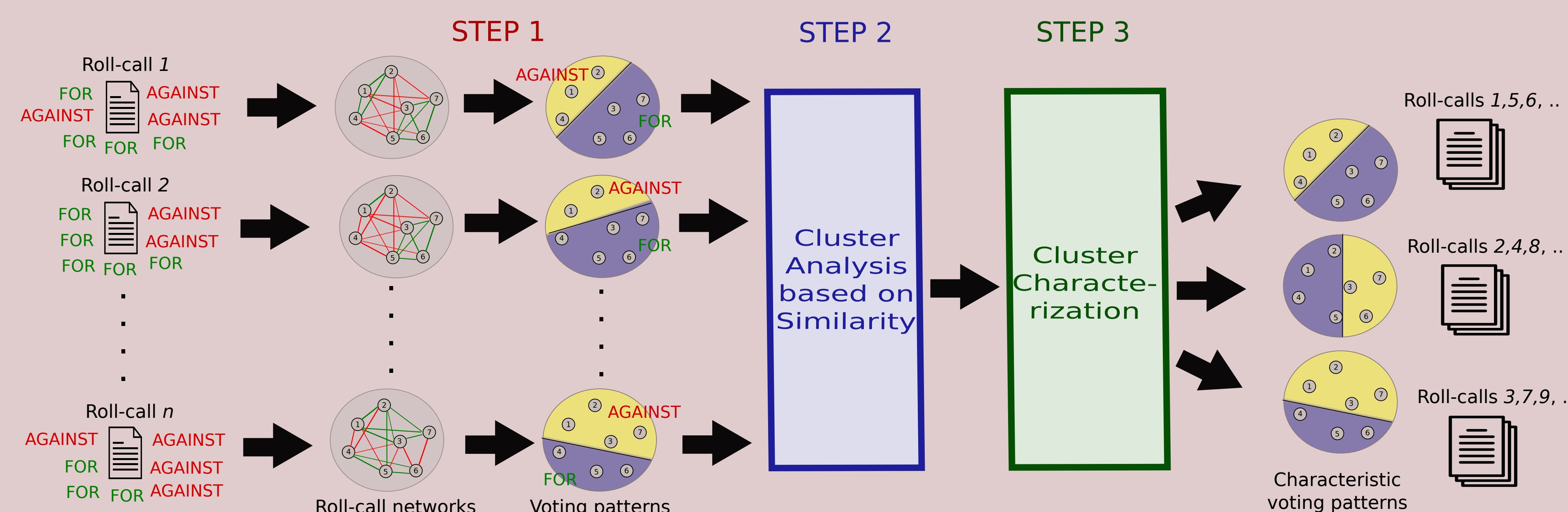

Fig. 4: Workflow of the proposed method

Method

We propose a new, 3-stepped partitioning method for multiplex signed networks:
• **Step 1:** Separately partition each layer;
• **Step 2:** Perform a cluster analysis to gather similar partitions;
• **Step 3:** Identify a characteristic partition for each cluster.

Application

• Voting activity in European Parliament (EP);
• French (Fig. 2 & 3) and Italian (See [2]) Members of the EP (MEPs);
• Focus on agricultural questions in 2012-13;

Results

Here are the mains findings of the French case, see [2] for those of the Italian case and further details

The French case:

• The presence of an environmentalist G-EFA group causes a polarized situation;
• S&D and ALDE sometimes vote like the left-wing groups, and sometimes like the right-wing ones;
• C. Lepage is much concerned for environmental questions while belonging to the liberal group.
• The NI group (here, National Front) systematically abstains most of the times

Conclusion

• Discovery of hidden voting behaviors of political groups (statements vs. practice);
• Discovery of characteristic voting patterns with associated context;
• Identification of unstable antagonistic situations;
• Explicit representation of abstention, which allows detecting relevant groups of abstentionists;
• Generic enough to be applied to any system with similar properties

References

[1] J. Davis, "Clustering and structural balance in graphs", Human Relations, vol. 20, pp. 181–187, 1967
[2] N. Arinik, R. Figueiredo, and V. Labatut, "Multiple partitioning of multiplex signed networks", Social Networks, 2019

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