

Bipartisanship in Congressional Voting Networks

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Introduction

- The House of Representatives (primary legislative body in the U.S.) has seen increasing partisanship recently → legislative gridlock.
- Bipartisanship, where members from different parties collaborate on policy, is crucial for addressing national challenges effectively.
- Political rhetoric, social media, and simplified metrics add to the noise of congressional voting data.

How can statistical network modeling techniques be used to identify bipartisan representatives?

Related Work

- Traditional political science tools (e.g. DW-NOMINATE) focus on ideological placement but overlook nuances in voting behavior.
- Popular network models for politics include:
 - ▶ **SBM (Holland et. al)**: clustering with degree homogeneity only.
 - ▶ **DCSBM (Cerqueira et. al)**: allows for degree heterogeneity but no mechanism for estimating mixed membership.
 - ▶ **DCMM (Jin et. al)**: handles both.

Data Sourcing and EDA

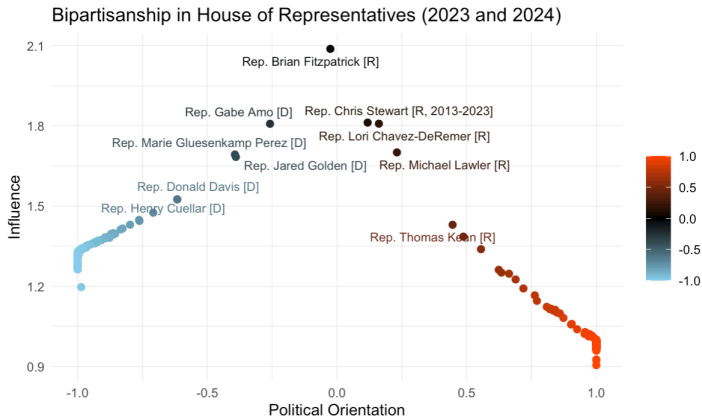
- We scraped roll-call votes from GovTrack from the past five years, filtering for substantive bills using GPT3.5.
- Analyzed distributions of bill margins (validates research question) and voting similarity patterns to set the binary threshold $\alpha = 0.5$.
- Representatives with highest average voting similarity scores serve as baseline for comparison with DCMM.

Matrix Construction and DCMM

- We constructed two similarity matrices and processed in igraph:
 - ▶ Binary similarity matrix: $A[i, j] = 1$ if similarity $S_{ij} \geq 0.5$ otherwise 0.
 - ▶ Continuous similarity matrix: $A[i, j] = S_{ij}$.
- Implemented DCMM for $K = 2$ on constructed graphs.
- Output: Mixed membership vectors (π_i) and influence values (θ_i) for each representative + community interaction matrix (P).

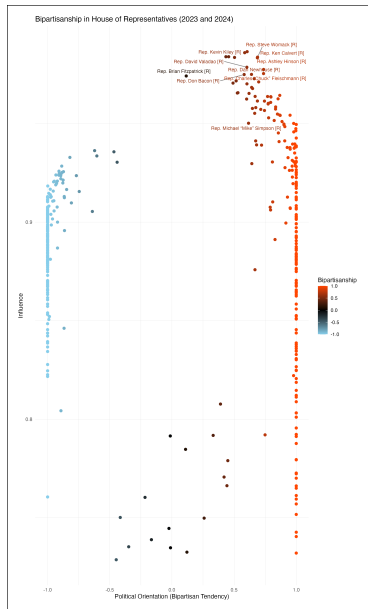
Binary DCMM Results

- Identified two voting communities (Democrat, Republican).
- Observed moderate correlation with Georgetown's Bipartisan Index.



Continuous DCMM Results

- Provides more granularity in voting patterns.
- Highlights sharper partisan clustering for high-influence representatives.
- Reflects GOP control/influence in the 118th HoR session.



Future Work

- Expand analysis across multiple congressional sessions.
 - ▶ Identify temporal trends in bipartisanship and polarization.
 - ▶ Examine the impact of events on voting behavior.
- Consider $K \geq 3$ communities.
 - ▶ Uncover ideological nuances (e.g. moderate factions within parties).
 - ▶ Explore the potential emergence of third-party-like dynamics.