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Text-free multi-issue attitude mining from social network graph data

Pedro Ramaciotti Morales, Jean-Philippe Cointet, Armin Pournaki

médialab, Sciences Po, Paris

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Social network and media data are increasingly mined for inferring opinions, helping answering numerous questions about online social and political dynamics. Text-based methods are a popular option in opinion mining, but they present some challenges, as they are language- and context-specific: users might express themselves differently when discussing on Twitter, on Facebook group, or on other forums. Other methods rely on topological social choice data: who is friends with whom, who clicks on which content, who *likes* which comment, *etc.*, that may be represented using graph models. These methods can be traced back to *ideological scaling*, pioneered by Poole and Rosenthal (1985) in the NOMINATE method in political sciences to estimate the ideology of members of parliament. Proposing a latent probabilistic model for explaining whether a member of parliament would vote *for* or *against* passing a bill, Poole and Rosenthal used voting behavior to infer the parameters of such a model, ultimately linking these parameters with latent ideological traits. Bond and Messing (2015) and Barberà (2015) were among the first to apply *ideological scaling* methods to large social network choice data (respectively on Facebook and Twitter). They apply *ideological scaling* methods to *likes* and *following* relations on social platforms to infer latent ideological traits on left-right or liberal-conservative scales, now for millions of users. This has yet to be shown to work beyond one-dimensional opinion scales, inspired in applications to the particular two-party system and traditional binary social divides of the US. This limitation has particular importance in studies interested in new emergent polarization and cleavages, such as those hypothesized to be driven, *e.g.*, by anti-elite or anti-internationalization sentiments and attitudes. This limitation is also relevant for the study of digital informational ecosystems that might be structured by additional socio-political dimensions beyond left-right cleavages, as it is the case of most of the rest of the world.

In this work we use graph embedding methods with external attitudinal data of a few users (*e.g.*, from political surveys) to embed social networks in multi-dimensional geometrical spaces where dimensions act as indicators of different –positive or negative– opinions, or *attitudes*, towards several issues of political debate, and that participate in structuring social graphs. Our *attitudinal embedding* method (Ramaciotti Morales *et al.*, 2021, 2022) does not require text analysis and is thus language independent. This allow us to compare estimated opinions across different platforms and different countries. Our method allows us to link emerging latent dimensions in graphs with issues, thus allowing us to hierarchize social cleavages, but it also allows us to project large numbers of users onto referential attitudinal dimensions of existing political surveys, giving our spaces meaningful reference points (*e.g.*, central and extreme

positions in left-right scales), and means to compare opinions at different moments in time in common reference attitudinal opinion scales. Our results show that social graphs alone allows for the estimation of different opinions towards several issues, including left-right stances, ecology, immigration, nationalism and attitudes towards elites among others. We illustrate our method using Twitter networks of users and political survey data from several countries with multi-party systems. Furthermore, we show how the opinions estimated by our method can contribute to the study of relevant phenomena drawing increasing interest in computational social sciences, such as the study of polarization and so-called echo chambers.

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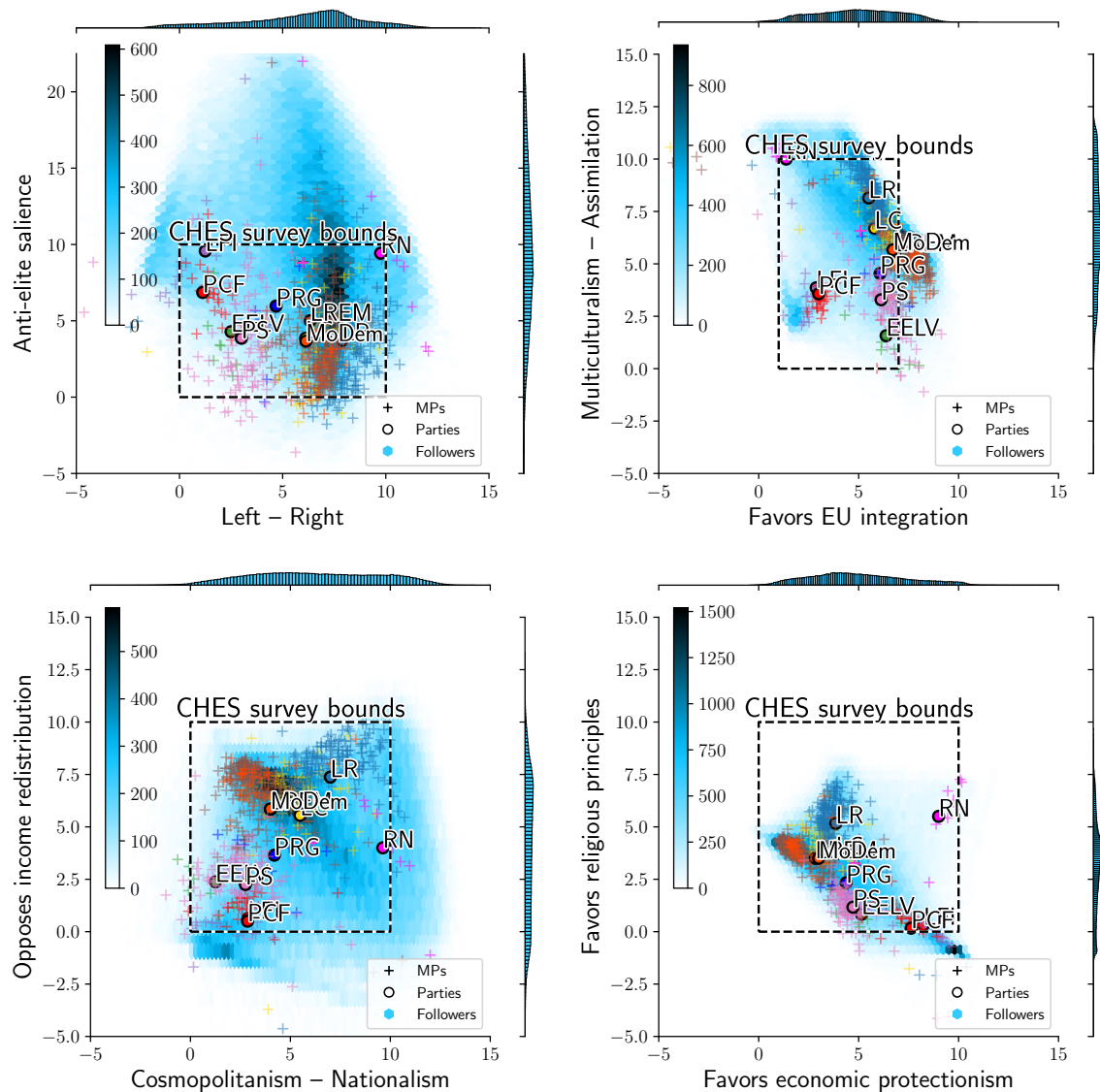


Figure 1: Nearly 240,000 French Twitter users embedded in the multi-dimensional reference attitudinal space of the Chapel Hill Expert Survey (CHES), using only the social graph structure and political attitudes of parties. Figure shows the position of parties, members of parliament (MPs), and their followers in 8 selected attitudinal dimensions.