Analyzing Polarization in Multipolar Social Systems

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Social polarization is a pervasive phenomenon that has been observed in a wide variety of contexts like elections, referenda and around controversial issues. It has been argued that polarization exerts a negative influence, undermining social and economic relationships and reinforcing inequality. Polarization has been traditionally studied in binary conflicts where two groups support opposite ideas. However, in many social systems, such as multi-party democracies, or political conflicts involve multiple dissenting factions. Despite the prevalence of multipolar systems, there is still a lack of suitable analytical tools to study their polarization patterns. In this work, we introduce new polarization metrics for multipolar contexts from social networks.

The multidimensional opinion inference technique is a generalization of a bipolar (one-dimensional) methodology [1] based on models of opinion dynamics. The process consists in building a network of social interactions from empirical data, identifying the opinion leaders and their respective ideological positions [2]. Then, we use the model to propagate the leaders' opinions throughout the rest of the nodes. Finally, the model's outputs give the inferred opinions of the nodes. To characterize and measure the polarization of the inferred opinion distribution we propose different metrics [3] based on the covariance matrix, (multidimensional generalization of the variance). In particular, we use the trace of the covariance matrix (the total variation) as a global measure of opinion extremeness, and principal components analysis to quantify pole alignment (analogue of opinion alignment), obtaining the direction of maximum polarization in the ideological space.

We apply this methodology to two real-world scenarios, one with four poles (3D opinion space) and another with five poles (4D) corresponding to the Twitter conversation on the Spanish general electoral campaigns of 2015 and 2016. We build retweet networks as the interaction networks on which the opinion inference process is performed. Retweets are considered as a proxy of influence because they are a broadcasting mechanism that usually implies that the retweeting user agrees with the original tweet [4].

Our analysis reveals meaningful and complex properties of the systems with direct links to their sociological background. We have found that the ideological differences and affinities between the parties are clearly reflected in the obtained opinion distribution. Those parties with higher affinity tend to form subspaces that are orthogonal to the direction of maximum polarization. Furthermore, the parties' positions along that direction coincide with their location in the left-wing/right-wing axis. However, despite its central role in shaping the opinion space, ideology is not the only driver of polarization. In one of the studied systems, competition between parties of similar ideology was another relevant source of tension. In the other, the perceived extremism of the parties acted as a secondary differentiating axis.

Therefore, our approach extracts the drivers of polarization specific to each system. This adaptability makes our framework suitable for the study of democratic systems undergoing political transitions, where the traditional methods based on qualitative sociopolitical analysis may fail to reveal all the relevant information.

References

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