SOCIAL NETWORK ANALYSIS

EXPLORING SOCIAL BEHAVIOUR THROUGH TWITTER'S DISCOURSE NETWORKS

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1 CONTEXT

Networks form the building blocks of any group of people, organisations, entities; basically, anything that can be defined as having a relation. The most familiar of these networks are online social network platforms like Facebook, Instagram, Twitter, LinkedIn, etc., where a link between users is establised through a follow, a comment, a like, or a post. Online social media and associated social networks are increasingly becoming an important forum for public debate and influence of individual attitudes and behaviours. In many cases, the decisive actions required to tackle the complex and divisive issues that permeate society can been found in the perceptions and opinions of those with which these connections are formed.

Often the objective of social network analysis is to obtain a better understanding of the behaviour and influence of the systems they represent and the systems they interact with. Ultimately, it is about finding the link between network structure and network function, and vice versa. For instance, we can study social networks to better understand the nature of social interactions and their implications for human experience, commerce, the spread of disease, and the structure of society. We can also study the Internet to better understand the flow of data traffic, or why communications protocols function the way they do, or how we might change the network to make it perform better. In most economic, sociological, and psychological research, the value of social networks is ultimately expressed in how the degree to which a group of people are socially connected with each other reinforces beliefs that are commonly held, and how this could help transmit novel information that could change the dynamics of the interaction and potentially alter outcomes. By leveraging social networks, network intervention programmes have in the past shown evidence of accelerated behavior change, improved organizational efficiency, enhanced social change, and improved dissemination and diffusion of innovations.

Other studies on the role of social networks include:

- labour market participation in referral networks and migrant communities;
- drug use and school attendance in student networks;
- policy views of electoral candidates and coalitions in discourse networks;
- advocacy of climate change in social media networks;
- spread of infectious diseases and financial crises in contagion networks; and,
- adoption and support of new technologies in global networks and local farming networks.

2 OBJECTIVES

Similar to the strategies used in network interventions, this study relies on the social interactions and relationships that individuals have with each other to explore the nature of social networks in online discourses. Specifically, in the discourses surrounding the #Senekal, #Brackenfell and #PutSAFirst movements. Critical to the success of netwok intervention programmes is knowing and understanding the context of the problem as well as the the people, positions and groups that potentially influence the outcome. The main objectives of this analysis are therefore to:

1. Identify key persons of influence based on network properties;
2. Detect group structures formed by persons sharing common goals, interests, or positions; and
3. Determine the spread and adoption of a new idea or social behaviour based on the role or position of the person propagating the discourse.

The report is organised as follows:

- Part I: Descriptive Analysis
- Part II: Community Analysis
- Part III: Positional Analysis
- Part IV: Diffusion Analysis

3 FINDINGS

The #Senekal, #Brackenfell and #PutSAFirst movements exhibit similar descriptive properties. Online users in these networks are found to have a tendency or preferential attachment toward popular users. This means a significant proportion of engagements or interactions in the network are with or between those most prominent or central in the discourse. Like most real world networks, users in this network also share tighter and closer bonds with each other than would be expected in a random network. In other words, users would rather communicate within a close knit group than to communicate with others outside those groups. This may also indicate a greater likelihood of "echo chambers" within groups, where opposite or contradicting views never enter discussions and are easily dismissed. The implication being that there is less opportunity for ideas to be shared, information to be discredited, and perceptions to be changed.

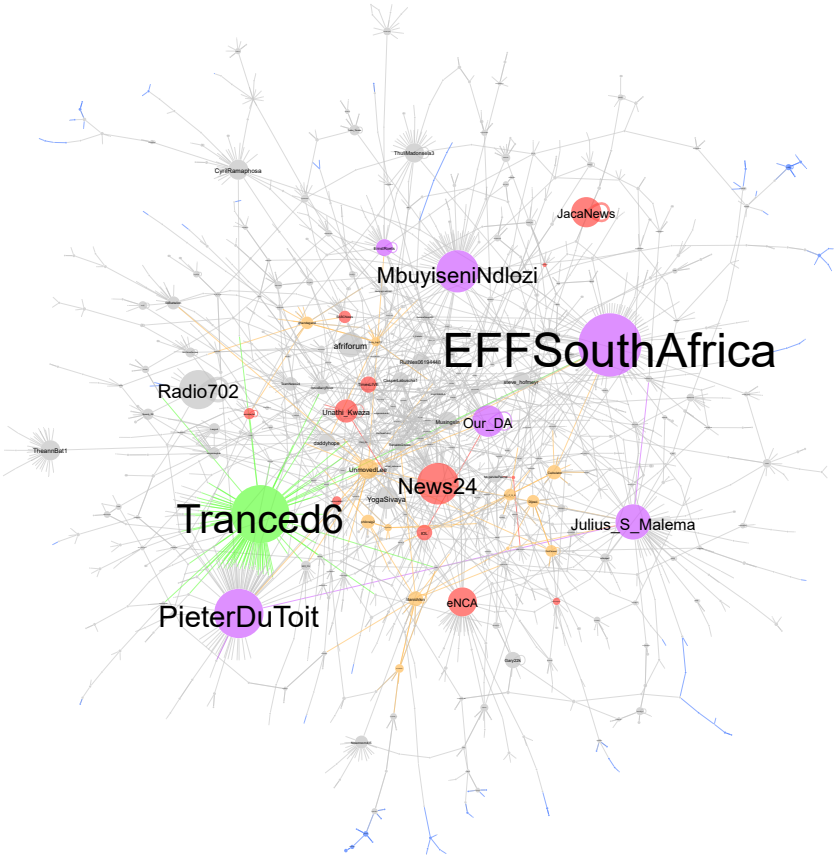
I explore the networks further using community analysis techniques to detect groups or communities of users that share dense connections and have high levels of interaction within the discourse. I find well defined communities in #Senekal and #Brackenfell networks, but fail to find the same robust communities in the #PutSAFirst network. This could however be a weakness in the detection method applied. A further distinction is the type of interactions observed between users in each discourse network. In the #Senekal and #Brackenfell networks, discussions amongst users within the same community and between different communities carried both messages of support and opposition for the movement, much like an online debate. The discussions in the #PutSAFirst network, in contrast, were much more like an echo chamber where the majority of interactions share a consensus and sentiment in support of the movement.

Next, I conduct positional analysis using feature based techniques. This clustering method attempts to group users in similar positions or roles based on their patterns of interactions and distinct network features. Results from the analysis generally revealed 5 distinct clusters. Based on the users assigned to each cluster, I classified them as follows:

- Observer Role: Periphery users that are far away from the centre of the discourse and have little participation or involvement.

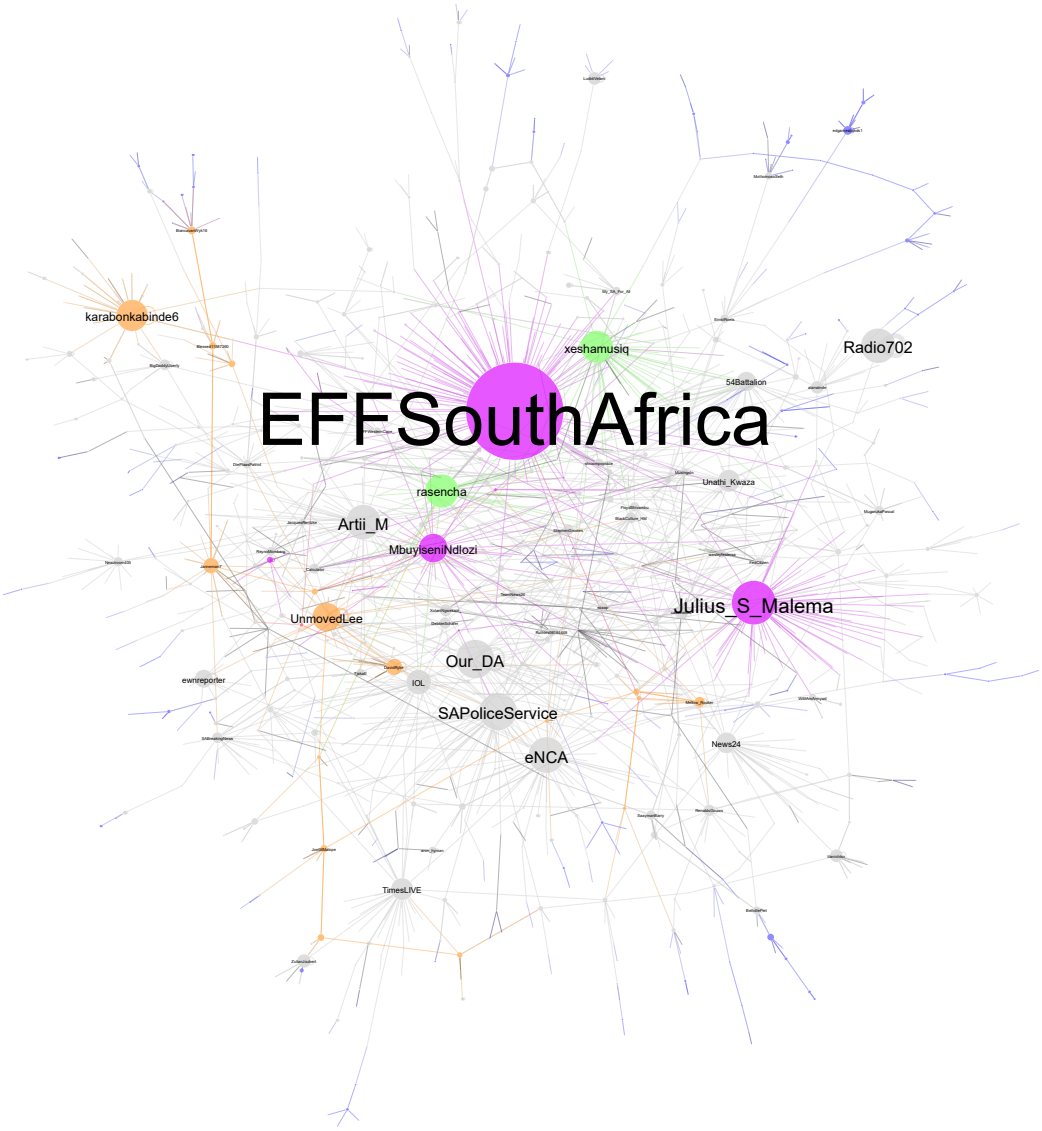
- Spreader Role: Bridge users that are connected to users in various positions and can easily spread information across the network.
- Activator Role: Active users that reply to tweets and have a high interaction and engagement with other users.
- Informer Role: Public users that have many followers, are publicly listed and have a high global tweet count.
- Leader Role: Popular users that receive many replies to tweets and interact with other important users.

Senekal Positions:



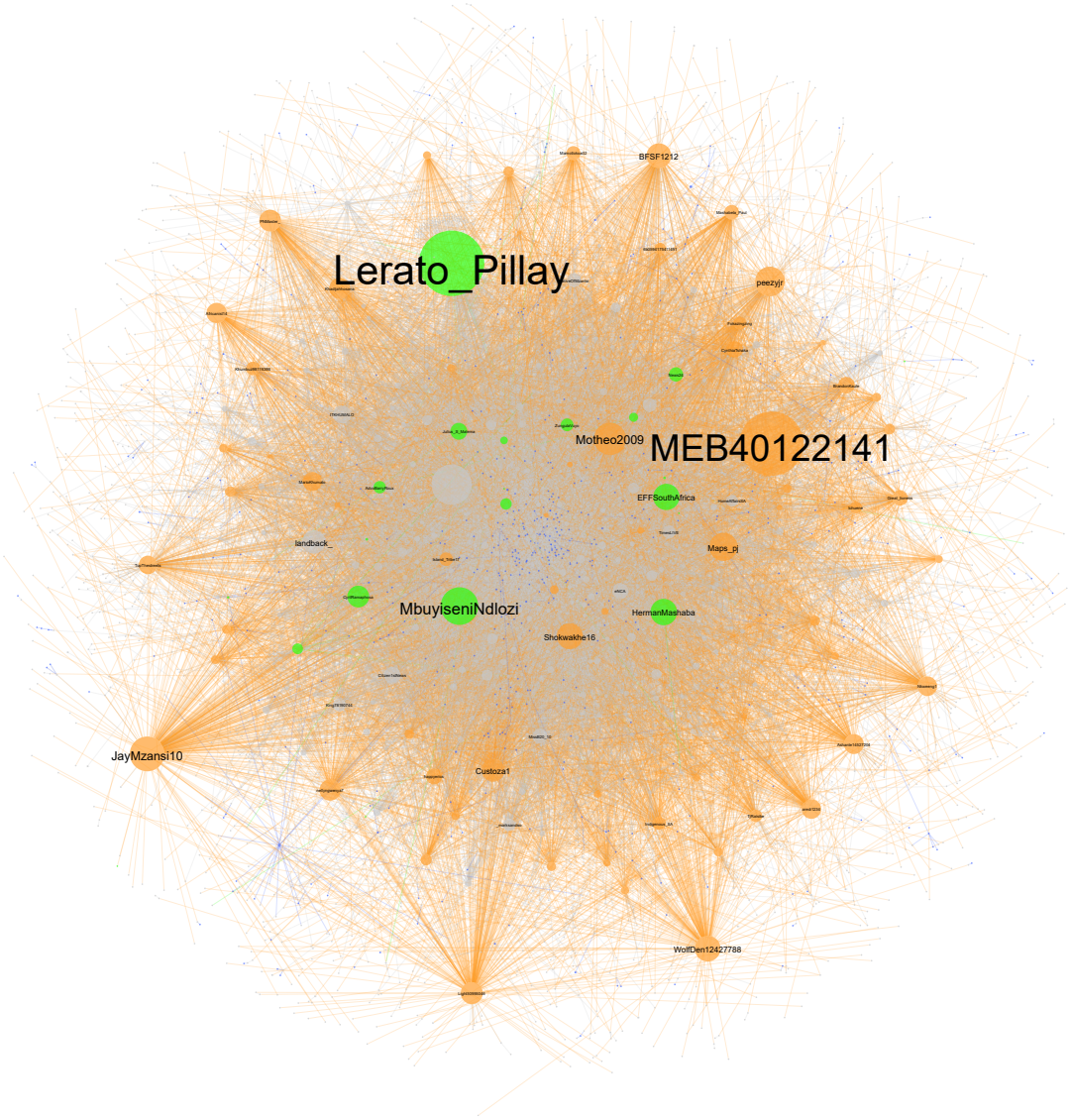
[Observer (blue), Spreader(orange), Activator (green), Informer (red), Leader (purple)]

Brackenfell Positions:



[Observer (blue), Spreader(orange), Activator (green), Informer (red), Leader (purple)]

PutSAFirst Positions:



[Observer (blue), Activator (orange), Leader (green)]

The type of users assigned to each of these roles were fairly consistent across the networks. Typically, members of political parties were positioned in the *Leader* role, and news agencies in the *Informer* role. The most active voices in the discourse, sharing the most tweets, were usually outliers assigned to the *Activator* role, while the least active and most distant were users in the *Observer* role. Active users who held positions that connected distant users in the network were classified in the *Spreader* role.

Building from the results of the community and positional analysis sections, I simulate a diffusion model

to trace the spread of an idea or behaviour. This section essentially tries to predict the spread of a *meme*, hashtag, or protest movement in online social networks by investigating two main questions:

1. Do close knit or dense connections within communities promote diffusion by reinforcing the same social behaviour, or do they inhibit diffusion by trapping the social behaviour in a closed group.
2. Does occupying a certain position in a network increase the capacity to spread a social behaviour.

Simply stated, what is the adoption rate of a new idea or behaviour within a community and outside a community if, for example, a user in the *Leader* role is the initial or early adopter versus a user in the *Observer* role? I define the simulation mechanisms of the 4 positional infection models plus random infection model as follows.

- Random Infection: I evaluate the diffusion process of randomly selected nodes as initial seeds and assess their capacity as a baseline or counterfactual.
- Leader Infection: I evaluate the diffusion process of *Leader* types as initial seeds and assess their capacity as central hubs of authority, capable of leading a movement and gaining the respect of their peers.
- Activator Infection: I evaluate the diffusion process of *Activator* types as initial seeds and assess their capacity as outspoken voices of the movement, capable of inciting activism and support.
- Spreader Infection: I evaluate the diffusion process of *Spreader* types as initial seeds and their capacity as bridge links, capable of reaching distant and isolated users.
- Observer Infection: I evaluate the diffusion process of *Observer* types as initial seeds in their capacity as uninvolved outsiders, capable of bypassing the weight of social pressure and popularism.

The simulations show that *Leader*'s generally achieve the widest reach across communities in all networks, followed by *Spreader*, *Activator*, *Random*, and lastly, *Observer*'s.

This exercise in diffusion mechanics can be summarised by four main observations:

1. Users that occupy certain roles in a network and exhibit key or central network features are better positioned to effectively spread an idea or social behaviour.
2. Users that are able to spread an idea or social behaviour within their community and outside their community in early-stages are likely to attain a higher level of diffusion in late-stages.
3. Users in close knit communities or groups tend to adopt a certain idea or social behaviour when other users within their communities or groups also adopt that same idea or social behaviour.
4. Users in a highly clustered network benefit from a social reinforcement mechanism or multiplier effect that accelerates the spread of an idea or social behaviour, even if the user spreading the idea is not central or popular.

4 CONCLUSION

Exploratory analysis can only go so far in understanding and predicting the mechanisms that underpin online social behaviour and the pressures inherent in the decision to either support or oppose a movement. Given how frequent these movements have become and how visceral and abhorrent the language of protests is at times, the question of interest is more about finding effective tools to monitor, track, and possibly subvert hate speech in online social media platforms.

One intervention strategy not explored by this study is the altering of connections in a network to observe how robust or resilient the network's function remains. This essentially asks how a system behaves while under the threat of an attack. For example, in online social discourses, what is the impact from a suspension or removal of a critical player? Is the movement able to survive or adapt its core activities? Is the attack

more effective if rendered in early stages? Is the impact or extent of damage undermined by the social reinforcement mechanisms found in highly clustered networks?

These next steps will require the application of machine learning techniques to exploit message content, predict virality, and detect the robustness and resilience of a network.
