An entropic study of social manifestations

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Throughout history, social protests have been an effective means for individuals and groups to express their demands, concerns and aspirations in the search for a significant change in several dimensions of society. This constant quest for social transformation has evolved over time, and in the current digital era, social media have emerged as a revolutionary tool that has completely transformed the dynamics of social protests. These digital platforms have provided an instantaneous and global avenue for effervescent individual ideas and opinions to connect and amplify, overcoming geographical and cultural barriers.

Beiro et al. [1] have shown that the high connectivity during a manifestation process has some characteristics similar to the critical transitions studied in physics. Specifically, it resembles the divergence of the correlation length in critical transitions. They argue that the simplifications caused in the statistics of the manifestations studied in that article are a consequence of those high correlations.

They found that in all the demonstrations, the distribution of hashtags at the time window during the protests itself presents the highest heterogeneity. They showed that this was not due to the highest activity but to the heterogeneity in the users' posting. However, there are at least two possible sources of such heterogeneity, one due to the users' activity and the other due to the users' heterogeneity in the hashtags posting. In the same work, the authors argued that the user's activity should be the cause. However, a precise proof was not provided. Therefore, in this communication, we set out to use entropic measures to discern between the two types of heterogeneity.

As a preliminary result, in figure 1, we show the temporal activity in one-hour time windows in terms of the number of hashtags, the number of users, and their corresponding entropy measures. As we can see, in all the manifestations, the points of maximum activity (marked by red vertical lines) are characterised by high users' entropy but low hashtags entropy, showing a similar sign in all the manifestations studied, and which could possibly be a sign that always occurs.

We show results for three massive social protests. The first dataset (No al tarifazo) involves a protest against Argentina's high tax rate, which took place between January 4 and 6, 2019. The second dataset (9n) also concerns an Argentinian protest against the government's justice reform plans on November 9 of the same year. The last dataset (Charlie Hebdo) is related to the tragic terrorist attack that occurred at the offices of the weekly satirist magazine Charlie Hebdo in Paris, France on January 7, 2015 and the corresponding massive demonstration.

For our presentation, we will also show the user entropy regarding hashtags in order to be able to discern the source of heterogeneity. We will also discuss the entropic characterisation of the modular to nested transitions studied in the same work by Beiro et al. Moreover, we will show some relationships between entropic measures and some centrality metrics of the networks created through the hashtags during the processes of social protests.
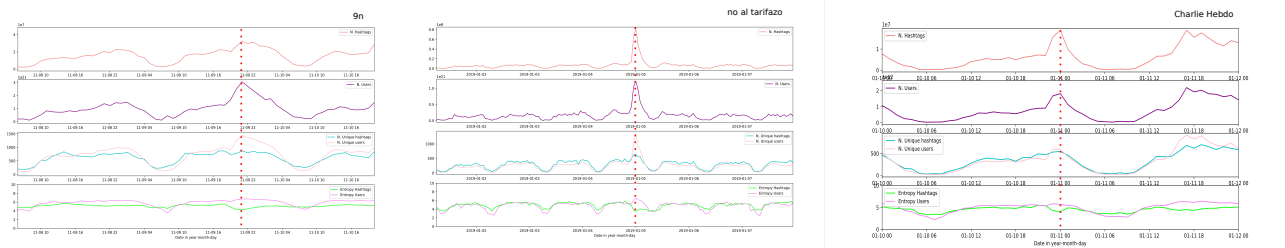

Figure 1: We show, from top to bottom, the number of hashtags, number of users, number of unique hashtags and users, and entropy for hashtags and users.

References

[1] Signs of criticality in social explosions. Mariano G. Beiró, Ning Ning Chung, Lock Yue Chew, Stefan Thurner and Yérali Gandica. https://arxiv.org/pdf/2305.01944.pdf.