Analysis of the Evolution of Events on Online Social Networks

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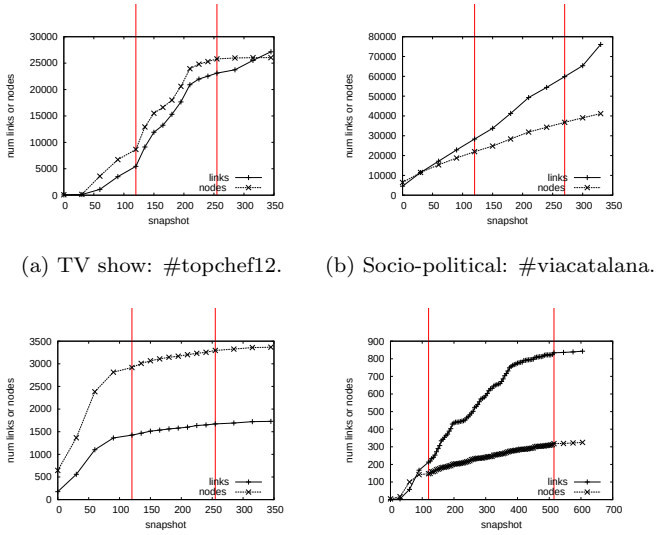
Social networks can be considered as dynamics processes[4], where, as time passes, individuals join, leave, create, or deactivate social ties altering the structure of the network[2]. However, the majority of existing works that analyze on-line social networks focus on the analysis of an specific snapshot. Only a few of them focus on how the social network evolves[1,3].

In this paper, we focus on the analysis of interactions during a scheduled event in Twitter (i.e., it has a scheduled time for starting and for finishing and it has associated a hashtag). We considered events from the following contexts: *TV shows*, *socio-political events*, *technical conferences*, and *keynote* events. For each one, we built a temporally annotated network. We classified messages in: *global* and *individual*. Global messages are used when the update is meant for anyone that cares to read it. Individual messages are those that involve another user. Individual messages can be: retweets, mentions, and reply to user. A user becomes a *node* of the network when it participates writing a message with the hashtag associated to the event or when other user makes reference to it in an individual message that has the hashtag associated to the event. Links are created when a user references an existing or new user in an individual message. We analyzed the evolution of structural properties at network level (i.e., structural metrics such as nodes, links, symmetric links, degree complementary cumulative distribution, path length, or clustering among others) and at node level (centrality metrics).

After the study, we observed that the analyzed *TV show* and *keynote* networks have characteristics in common. In these networks, users prefer to participate through global messages rather than individual messages that create links (i.e., the number of nodes is higher than the number of links). The small proportion of interactions with other nodes of the network are usually unidirectional from anonymous users to nodes that represents a celebrity or an official account. One of the effects of the lack of symmetry in the interactions is that the path length and the diameter are not reduced as the number of interactions increases. Moreover, users do not interact with other nodes in their neighborhood (i.e., there is a low degree of clustering). Inside this group of networks, there are also differences. In the analyzed TV show networks, users interact more before and after the event than during the event. However, in the keynote networks, the majority of interactions only occur before the event, therefore, the structural properties remain almost constant once the event starts.



(a) TV show: #topchef12. (b) Socio-political: #viacatalana.

(c) Keynote: #applekeynote. (d) Conference: #tedxValencia.

FIG. 1: Nodes and links evolution.

The *socio-political* and *conference* networks share some structural properties. Users usually join the network through individual messages. One of the effects is that the number of links in the networks is higher than the number of nodes. Moreover, there is reciprocity in the interactions, which means that there are conversations between users. One of the effects of the reciprocity in interactions is that the average path length and the diameter are reduced as the number of symmetric interactions increases. The main difference is that in conferences, before and during the event, the degree of clustering increases. However, in socio-political events, the degree of clustering remains almost constant.

We observed that there are differences in the network structure before, during, and after an event. The most important changes in the structure of the networks occur before and in the first moments when the event starts.

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