

Visualization Techniques for the Analysis of Twitter Users' Behavior

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Abstract

One of the most popular social networking sites in Brazil is Twitter, which is used by one in five people who have internet at home. Based on that, we investigated how information visualization techniques can improve the analysis of the behavior of Twitter users'. These studies were done through a set of standard visualization techniques implemented in an interactive system entitled DeepTwitter.

Introduction

Considering the amount of information published in social networks, and the growing speed in which this information is updated and exchanged, our research focus is about how interactive information visualization techniques can help in the relation and extraction of – new – information from the original ones.

Whereas Twitter is one of the social networks most popular in Brazil (Fastenberg 2010), it was chosen as our first research focus. In this case, information visualization techniques can help to better view the network of contacts, and to analyze the frequency that individuals or groups send tweets – the Twitter Users' Behavior. In order to investigate this, we implemented a system prototype called DeepTwitter. DeepTwitter as well as an evaluation of the visualizations provided by it will be following presented.

DeepTwitter

DeepTwitter is a portable system developed in Java programming language, using the Twitter4j Java library, Prefuse toolkit and the JDOM library. It implements standard visualization techniques that were initially chosen to allow the understanding of how they can help in the users' behavior research in social networks. These techniques are used to analyze users' connections and the frequency of tweets sent by one or a group of users, as well

as ways to classify these tweets. Other tools available are tag cloud and the most popular users. All these functionalities enable the learning about the social network and the behavior of its members, as described in the next subsections.

Social Network Visualization

Figure 1 shows the DeepTwitter main window. It has, on its left side, a panel that displays, among other things, the most recent tweets, messages and answers received by the user. On the right side the user's social network is presented. The superior area contains a toolbar, which permits the modification of elements of the network's layout and interaction with it, through the creation of groups or search for users by name, description or location.

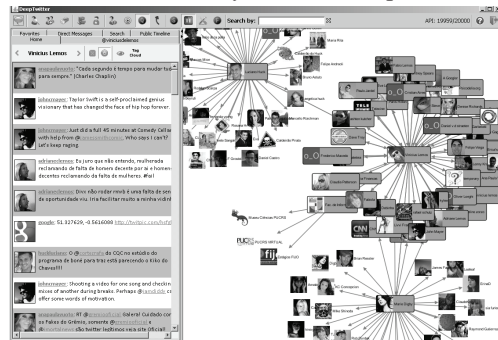


Figure 1 – DeepTwitter main window.

In the social network visualization, the friendship relations (following) between members of the network are indicated by directed edges. If two users follow each other, then the edge will be bidirectional. The relations can also be observed when moving the mouse over a user and the members connected to it receive the colors: blue, if they are just being followed; red, if they are just following; green, if they are following and being followed by the user.

The social network is automatically organized to allow the visualization of friends in common between large clusters. It's possible to select users or create groups in the

network to, among other things, read the tweets that they posted, send them messages or follow them.

Tweets Classification

DeepTwitter allows the creation of categories, and, within these, the addition of different tags that will track the corresponding tweets in both timeline and tag cloud visualization. The goal is to differentiate tweets by subject, clustering all the tweets that contain a given set of tags inside the same category that holds these tags.

Analyzing the Tweets in a Timeline

When visualizing tweets from individuals or groups it is possible to open the respective timeline visualization. This visualization organizes the tweets on a graphic, based on the day (x axis) and time (y axis) in which they were sent. Thus, it is possible to easily observe user behavior, i.e. the frequency in which a user sends tweets and what times are predominantly devoted to it.

Besides that, it is possible to classify tweets according to the created categories. By doing this, the pictures are outlined or ellipses are filled with different colors, in order to facilitate the identification of which tweets belong to each category. The tweet and the date it was posted are highlighted when the mouse moves across the ellipses, as shown in Figure 2.

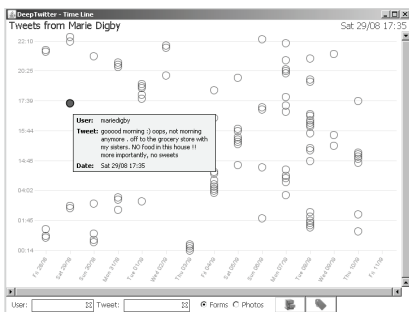


Figure 2 - Example of a Timeline with tweets classification.

With timeline and classification, it is also possible to analyze if users have the same habits, i.e. post tweets in the same period of time or often with similar subjects.

Tag Cloud and Most Popular Users

The tag cloud visualization shows the tags specified by the user, as well as the tags that are currently the Popular Topics at the Twitter homepage. The main goal is to provide a quick way to detect the most talked-about subjects by the DeepTwitter user.

The visualization of most popular users can be applied to a group of users, to selected members or to all users of the contact network. The classification can be made by the number of friends, followers, favorite tweets, or tweets that have already been written. According to the selected

option, the most active user, e.g., appears with the biggest picture, and the less one appears with the smallest picture. Thus, with just a quick look the user can identify the most active or important members from his network of contacts.

Analysis of the Visualization Techniques

In order to verify users' impressions about the visualization techniques implemented, two experiments were conducted: the first one focusing on the general public, characterized by people who use Twitter for personal use, and the second focused on professionals who use Twitter as support for their work or even as their main focus.

From the analyses carried out we can clearly see that different profiles of users are interested in different features (and in different visualization ways): for instance, the general public preferred the social network visualization, and professional users, the timelines.

Conclusion and Future Works

In this work we show possibilities to allow an integrated manner to explore the interactions of one user or a group of users in a social network, as well as to easily classify - or even identify feelings from - tweets.

Comparing with some related works (Barata et al. 2012; Marcus et al. 2011), the main contribution of this work is to demonstrate how interesting from the user point of view is to allow an integrated manner to explore the interactions of one user or a group of users in a social network, as well as to easily classify or even identify feelings from tweets.

The analysis carried out and the trend of users to simultaneously use several small applications to monitor the use of social networks led us to reflect. In this sense, DeepTwitter is, at present, being redesigned, and instead of a single tool, with different types of visualizations available, distinct small tools have been created, focusing on specific market niches.

Acknowledgments

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