

Twitter Learning Analytics in R

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There is presently no literature about the application of learning analytics to student learning activities that use Twitter beyond those describing the Twitter activities themselves and/or student survey feedback about these activities. This paper seeks to address this gap by examining the application of some data visualisation analytics to student activities on Twitter using the R statistics software programme. For those who already use Twitter as a teaching tool it illustrates some useful methods for analysing learner data in order to more effectively use Twitter in their teaching. For those who do not use Twitter in their teaching, they will hopefully still find the descriptions of various ways that Twitter is currently used, and the application of learning analytics informative for their teaching practice.

Keywords: Learning analytics, data visualisation, statistical software,

Introduction

Twitter is increasingly being used as a tool for student engagement and interaction in tertiary education (Lowe & Laffey, 2011). However, the analysis of the use of Twitter in academic literature to date has been based around either student surveys and/or the reflections of the teacher. This paper contributes to the conference theme of “leading in a climate of change”, extending the existing research by illustrating some learning analytics techniques that can be applied to Twitter data in order to examine student’s patterns of usage and interaction.

The goals of the paper are twofold. The first is to describe some of the ways in which Twitter is being used in tertiary education. The second is to encourage the use of learning analytics to enhance this teaching by providing examples of using Twitter-based data. In particular, this paper focusses on using the R statistical software programme (www.r-project.org), and showing how it can be used to extract and work with Twitter learning data. R is an open-source, free to download, statistical software tool. It has a wide user base, particularly in academia, and is well supported by email and web groups.

Learning Analytics

Learning analytics, which is also known as academic analytics, is the application of statistical analysis to learning data. Baepler and Murdoch (2010) describe it as the business intelligence tools to teaching and academia, with the goal of enhancing student outcomes. They state that, “academic analytics combines select institutional data, statistical analysis, and predictive modeling to create intelligence upon which students, instructors, or administrators can change academic behaviour”. Learning analytics involves the use of objective quantitative data rather than just quantitative measures of student surveys (Phillips et al., 2011) and provides richer data that can be analysed to help inform instructor practice. Dawson, McWilliam and Tan (2008) highlight the importance of academic analytics, especially the ability to take data that is generated by learning activities, analyse it, interpret and then translate the findings into practice. This paper will focus on using several visualisation tools from R to examine some of the data generated by students using Twitter. This data visualisation will be the precursor to quantitative analysis to be completed in future research.

Twitter as a Teaching Tool

Twitter is used in a number of different ways in teaching. These include information transmission (student and/or teacher), collaboration and discussion (both in-class and outside of class), and micro-blogging. Kassens-Noor (2012) showed how Twitter can be used in and out of class, providing instant feedback in lectures, as well as being used as a discussion and collaboration tool. Twitter’s asynchronous nature allowed Saeed and Sinnappan (2011) to have students micro-blogging, and interacting across time and space in an e-commerce course. Rinaldo, Tapp and Laverie (2011) describe how to use Twitter as a pedagogical tool in a marketing course to engage students in class activities, and also to demonstrate to the students how social media are used in that discipline.

Cochrane (2010) showed how web 2.0 tools, including Twitter, could “facilitate learning experiences that bridge time and distance” and allowed students to collaborate internationally. Cochrane describes how Twitter was

used to facilitate communication between students and lecturers in New Zealand and Ireland. Crews and Stitt-Gohdes (2012) describe how twitter was used as part of a business communication course. They had students use Twitter as a business communication tool, tweeting messages in order to promote a non-profit organization. Twitter can also be used in a large lecture theatre situation to create dialogue between individuals, and to increase student engagement (Tyma, 2011).

In each of these examples, the use of Twitter is described, and is generally supplemented by the reflections of the academic, and in some cases, student feedback or surveys. However, learning analytics could provide additional information to help direct efforts and use Twitter more effectively in teaching.

Tools for Analysing Twitter in R

The R software provides the ability to download Twitter related data, and to be able to plot and analyse it. One of the more useful downloadable packages is *twitteR* (<http://cran.r-project.org/web/packages/twitteR/index.html>). This package allows users to extract information on followers, those following, posts, hash tags, etc. It can be integrated with other packages to allow for data visualisation and analysis. The three areas where analytics could help to investigate student usage of Twitter are: examining the frequency of use, mapping users and their social networks, and examining the content of student tweets.

Frequency and intensity of use

The simplest analysis of Twitter is to examine when, and how often students are posting. Rinaldo *et.al.* (2011) comment on the positive impact that Twitter has had on their teaching but lament the fact that it is difficult to monitor usage, particularly for a large class, and that this is problematic if they wish to include Twitter contributions as a summative component of their course. However, the usage information required to track and grade students can be accessed using the *twitteR* package, and much of the tracking and analysis could then be automated.

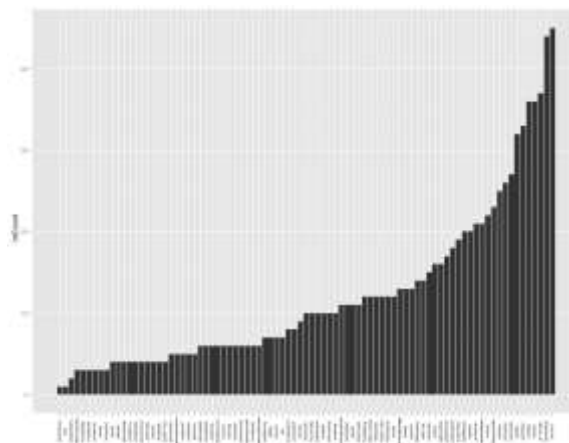


Figure 1: Tweet counts by user (from <http://www.r-bloggers.com/a-quick-view-over-a-mashe-google-spreadsheet-twitter-archive-of-ukgc12-tweets/>).

Figure 1 shows a sorted bar graph of the number of tweets for a selection of users. In this example, the tweets were saved to a Google spreadsheet for archival purposes, then loaded into R and plotted. However, the *searchTwitter* function in the *twitteR* package also allows for the retrieval of tweets. This could be used as a grading tool, or to inform future activities in Twitter.

Mapping relationships and social networks

Kassens-Noor (2012) and Saeed and Sinnappan (2011) talk about using Twitter to create collaborative communities, and to foster collaboration between students. However, in each case little was done to examine whether this was occurring. Figure 2 shows a map of Twitter followers (left) produced using the *twitterMap* function (<http://biostat.jhsph.edu/~jleek/code/twitterMap.R>) and a social network diagram (right). For online education, the ability to track student locations on a world map can be useful for tracking where your students are working from, which in turn can be useful for organising interactions and collaborative work, such as the activities described by Cochrane (2010).



Figure 2: Map of Twitter followers (left) and social network graph (right)

Student interactions can be examined in more detail by looking at how students are interacting with one another using social network analysis and social network graphs. Dekker (2011) describes the social network analysis of discourse, where interactions between individuals are graphed and modelled. By mapping the connections between students we can examine relationships and get a more detailed picture of interactions between participants (and identify non-participants). Figure 2 also shows a social network map, with the points representing students, and the lines representing the connections between them. In this example we can see that all of the students are interconnected, but with this kind of analysis we can identify students who have disengaged from Twitter based activities. This graph was produced using the *sna* (social network analysis) package in R.

Hashtags, word clouds and sentiment

One further level of advancement in the analysis of tweets is to examine the content of the tweets themselves. Bollen, Mao and Pepe (2009) describe how text-mining can be used to extract mood and sentiment information from tweets over a period of time. These can be graphed in terms of positive or negative, but also examined by translating key words into a word cloud, where the size of the word represents how often it occurs.



Figure 3: Word cloud

Figure 3 shows a word cloud, produced using the *tm* (text mining) and *wordcloud* packages. It allows for a quick visual analysis of keywords that are being used. Using the *twitteR* package, tweets can be searched and organised, and examined by keywords, hash tags or other patterns. This can give an instructor an idea of the key themes that are running through student Tweets, and help inform future teaching, and can be shown to students to help them see the patterns in their collective tweets. The student activities presented by Crews and Stitt-Gohdes (2012), where students are promoting a non-profit organisation, could be collaged and used in future classes, where students could examine patterns and themes in their tweets.

Conclusions and Future Research

This paper has described some examples of how Twitter is used in tertiary education, and how the R statistical software could be used to analyse Twitter information generated in some of these teaching activities. Although R is not the only analytics tool that can be used to analyse Twitter usage, patterns and networks, it is free, open-source, and has a well-supported user community. The analysis packages are flexible and integrate with easily with one another. This makes it a good choice for those looking to start working with learning analytics.

For those who already use Twitter in their teaching, learning analytics can improve the practice of current Twitter activities in higher education by allowing users to examine patterns in student usage, student interaction, and message content. Beyond this, one of the appealing future possibilities is to make the teaching/learning/analysing process with Twitter more circular, where learning analytics will not only inform the teacher but also the learner. Students can be provided with analysis and output of the analytics during the course, allowing them to reflect on Twitter their use, and possibly alter their learning behaviours.

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