Evaluating Twitter for Use in Environmental Awareness Campaigns

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***Abstract*—Many studies have shown that the effective harnessing of ICTs is critical in local, national, and global efforts to adapt and mitigate the effects of climate change. Citizens must be provided with accurate information about environmental issues and should receive this through the most effective communication channels available. In this paper we describe work in progress in evaluating Twitter as a means of distributing environmental information to citizens. This work will attempt to measure how effective the Twitter medium can be in environmental awareness campaigns for issues such as climate change by carrying out an analysis of a regularly updated database of Twitter messages. This work will also look to establish if users are environmental issues through their Twitter networks.**

I. Introduction

The online social network Twitter.com (http://twitter.com/) and environmental issues such as climate change and pollution are both inextricably linked with today's popular culture and mass media. In this introductory section we provide a brief overview of both Twitter and the natural environment in order to emphasise their individual positions in modern society, popular culture, and the mass media. We also provide a brief literature review of research carried out on the applications of Twitter and its social impact.

A. Influence of Twitter

Twitter is used by millions of people around the world to stay connected to their friends, family members and coworkers through their computers and mobile phones. The interface allows users to post short messages (up to 140 characters) that can be read by any other Twitter user. Users declare the people they are interested in following, in which case they get notified when that person has posted a new message. A user who is being followed by another user does not necessarily have to reciprocate by following them back, which makes the links of the Twitter social network directed. Zeichick summarises Twitter as the ability to "post and follow text messaging using a browser, special desktop applications, or mobile applications on smartphones" [1]. He comments that with key news media, such as the New York Times and the Telegraph, writing frequently about Twitter we have an indication that "it (Twitter) has passed the stage where it is only for *early adopters*". Some newspapers have begun to publish *getting started guides* for Twitter such as "How to make the most of Twitter" from The Guardian [2]. The ubiquitous nature of Twitter is reflected in media reports in the UK from early 2009 where proposed primary school curriculum changes were discussed. These changes would allow schools greater flexibility in what they teach including plans to teach school children the fundamentals of using Web 2.0 technologies such as Twitter and Wikipedia [3].

B. Environmental Problems

Since the end of 2006 climate change has gradually become *the* hot topic [4] amongst all other environment problems. A large number of events, reports, movies, etc. for example the Stern Review, Fourth Assessment Report of the Intergovernmental Panel on Climate Change [5], Conference of Parties 13 in Bali, the Live Earth Global Concert have generated increasing media coverage on climate change issues [4]. Conventional environmental awareness campaigns strongly rely on information to change attitudes. To make climate change communication effective, more sophisticated alternatives are suggested, such as harnessing tools and concepts used by brand advertisers, so as to make being climate-friendly desirable rather than a duty or matter of obedience [6]. Climate change affects every citizen at every level - local, regional, national, and global [7]. Some authors [8] have looked at the reporting of climate change in the mass media. Results of this analysis[8] show that scientists tend to be associated with an emphasis on environmental problems and causes while politicians and special interests tend to be associated solutions and remedies. A major European Commission survey revealed that "pollution in towns and cities and climate change" are the most frequently discussed environmental topics amongst EU Citizens and this reflects the intense public discussion on these topics[9]. Almost 57% of EU Citizens surveyed placed climate change as the number one issue that "worried them about the

environment'. The report states that "this further reinforces the observation that climate change has become one of the top concerns in the environmental debate".

C. Users and Usage Patterns on Twitter

As we will discuss in Section II below Twitter.com provides an API to access the Twitter service. This has assisted researchers in carrying out research on various aspects of Twitter. Many novel applications have been developed. Twitter has allowed professionals in the area of health-care simulations [10] and education to begin "open sharing of relevant and useful knowledge allowing the community to adapt and evolve faster to the rapidly changing health care environment". The social possibilities of mobile technology in transitional spaces such as public transport has been investigated where researchers designed a location-based friend finder for Twitter that displays only people in the same train as the user in the Stockholm subway [11]. Java et. *al* present a taxonomy characterising the underlying intentions users have in making Twitter posts by aggregating the apparent intentions of users extracted from Twitter posting data [12]. This analysis shows that Twitter users with similar intentions connect with each other successfully and find each other amongst the many other millions of users. Other work [13] has gathered Twitter posts from nearly $100,000$ users using deep searches of the Twitter network sampled collections from the publicly available timeline. The authors identified *three* distinct classes of Twitter users. Firstly there are users who have a much larger number of followers than they are following themselves. These include media outlets, Hollywood stars, etc. The second group called *acquaintances* are users exhibiting a certain symmetry in their Twitter relationships - that is they follow people who follow them. The final group is a small group who have the common characteristics that they are following a much larger number of people than they have followers. These are usually people who contact *everyone* in the hope that they will get a high following. Other research has investigated if Twitter operates a form of online "word of mouth branding" [14]. The authors analysed almost $150,000$ Tweets containing branding comments, sentiments, and opinions. Of the 20% of these tweets found to contain branding comments almost 50% contained positive sentiments about certain brands. Twitter was seen to have had an influential role in the successful presidential campaign of Barack Obama. "On election day, the Obama campaign used Twitter to post toll-free numbers and texting strings for finding polling locations, connecting to volunteer opportunities, and making contributions" [15].

II. Using the Twitter API

Twitter.com provides a REST API (REpresentational State Transfer Application Programming Interface) which allows developers to perform most tasks that users might otherwise perform with their Twitter account using the forms on the Twitter website. With the API developers can retrieve the last 20 tweets of the accounts the authenticated user is subscribed to, of all unprotected users, or of a specific user. The API provides a means for the programmatic sending and deleting of tweets, direct messaging, friendships, notifications, account blocking, favorite messages, etc. The REST API is relatively easy to use from any programming language that can perform and handle HTTP GET actions for sending URLs to a server. For most popular programming languages developers can find a Twitter API library allowing the sending and receiving of tweets and performing of other Twitter-related search and query information using the syntax and data structures of the specific programming language. There are libraries for the Twitter API in Java, PHP, C++, Ruby, .NET, and PERL. To retrieve information (tweets, searches, user lookups, etc) from Twitter one can easily use command line tools such as `wget` or `curl` to send a specially formatted URL to the Twitter server and receive information back in plain text format (JSON or XML). To make use of this information it must be parsed. This is where the Twitter API Libraries for the programming languages mentioned above becomes very useful. By querying the Twitter system using the Twitter API within programming code the returned information can be parsed, analysed, searched, stored in a database, etc. It also provides developers with an opportunity to build in Twitter functionality to existing web-based applications.

A. Web-based Applications using the Twitter API

Given the simplicity of the the Twitter API several web-based applications have gained quick popularity on providing value-added services for Twitter users. **Twuffer** http://www.twuffer.com allows users to schedule tweets for a later date. A tweet is typed into twuffer with a specified date and time for broadcast. At the specified date and time twuffer posts the tweet on Twitter. **Twidentify** http://www.twidentify.com is a search engine for Twitter. There are 3 ways to search using a keyword. Trend search allows tracking the popularity of a keyword over time. The second is a basic Twitter search of who is using the keyword in their current tweets. The final search option is *Search on influence*. The results of this search are sorted in order of users who are retweeted (directly quoted in other tweets or conversations). This usually gives the opportunity to see what *influential people* on twitter are tweeting about your keyword search term. **TwitterCounter** http://twittercounter.com/ is a user statistics application allowing users to track their progress on twitter. The information is presented in time series graphs and allows customisation of the timeframe. Other functions includes the ability to compare your statistics to other users.

B. Offline analysis of Twitter messages

To supply data for this research it is necessary to build up a large corpus of Tweets. We downloaded and stored all tweets which contained revelvant keywords: climate, environment, *climate change*, etc. This corpus of Tweets is stored offline due to restrictions placed on the Twitter API in terms of number of server accesses per day. Figure 1 shows a flowchart of the process of accessing Twitter messages. A PHP script sends the appropriate HTTP GET (keyword search, user search,

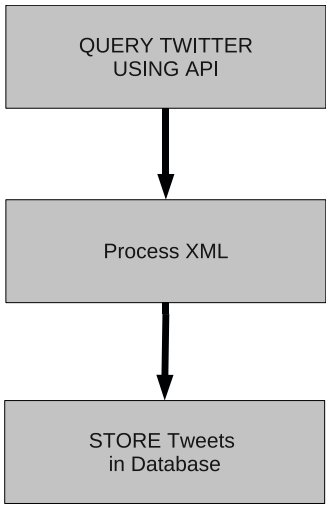

Fig. 1. Download of messages from Twitter.com using the Twitter API

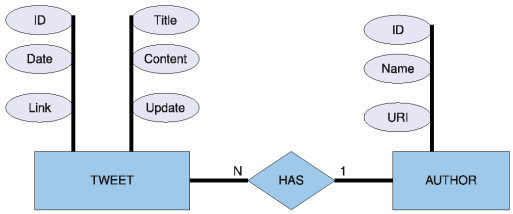

Fig. 2. Entity Relationship Diagram for Message Database

trend request, public timeline) request to the Twitter server. The Twitter server replies with XML formatted output. Each tweet object contains the message text, information about the author, and the timestamp of the tweet. This XML is processed by the PHP script. The PHP script parses each tweet message which includes reformatting of special characters and extraction of usernames within messages and inserts the tweet into a database. The Entity Relationship diagram for the message database is shown in Figure 2. The Twitter API restricts calling applications to 70 requests per hour unless otherwise arranged with Twitter.com. For this reason we cache the results of public timeline requests and keyword searches. Each tweet has a unique alpha-numeric identifier. This helps to avoid duplication of tweets within our offline database. Textual analysis of this dynamically updated database of Twitter posts is then performed. We are currently investigating a number of issues which are summarised as follows:

- Investigation of temporal correlations between the use of climate change related vocabulary during periods of major media coverage of climate change issues and events
- Specific analysis of Twitter messages from Ireland containing climate change related vocabulary. The Twitter API provides geocoding based on a user's location from their Twitter profile. A circle of N kilometers is searched centered on a $(lat, long)$ pair.
- Analysis of the number of *retweets* for climate change related issues. A retweet is when one individual copies a tweet from someone in their network and shares it with their network. It is acknowledged as the highest degree of content approval on Twitter.

III. Conclusions and Future Direction

In this short paper we have described research we are currently undertaking to establish how effective Twitter could be as a tool in environmental awareness campaigns. We looked at the specific issue of climate change to establish if people using Twitter were communicating about environmental issues in their Twitter networks.

A. Future Direction of Twitter

Honey et. *al* [16] predicts that tools such as Twitter "will soon come to be used in formal collaborative contexts, as well for example in work involving distributed teams just as instant messaging was used before". Other researchers [17] comment that as the new generation of scientists "grow up" with instant messaging, blogging, Twitter, they are beginning to explore ways to use these technologies for information exchange and collaboration. The future direction of Twitter is somewhat unknown with Lucky [17] stating that "we are in the middle of something happening around us and nobody really understands the consequences". Twitter has come "from nowhere to become the third most visited social networking site in the US in just three years by allowing its users to broadcast their thoughts, actions and news instantly" [18]. This rise has caused Google to "admit to losing out to Twitter in the race to meet web user demand for real-time information". Interestingly young adults and teenagers have not taken Twitter seriously yet according to Internet surveys such as Nielsen Net Survey [19]. Some research indicates that as long as teenagers can update their online status via MySpace and Facebook for their friends as well as Instant Messaging and SMS Texts, Twitter doesn't really add to the existing technology. Many young adults are only seeing the media and business aspects of Twitter.

B. Using Twitter Securely

We believe that as Twitter becomes more widely adopted by citizens the issues of information and personal security using Twitter will need to be addressed. This was also the case when email became ubiquitous [20][21]. Some literature has begun to appear regarding the security of Twitter. Some research shows that many users, often willingly, "share personal identifying information about themselves but do not have a clear idea of who accesses their private information or what portion of it really needs to be accessed" [22]. For those organisations who have "a business need to use Twitter then there must be training provided on how to use Twitter in a secure manner" [23]. The authors emphasise the need to "provide ongoing

awareness communications about Twitter information security and privacy issues". Vulnerabilities in Twitter's Javascript programming code leaves the "microblogging service with major holes in its security"[24]. This is expanded upon by Bradbury who gives examples of how worms and other malicious code could be transported around the Internet by the exchange of links within Twitter messages[25]. For Twitter to gain acceptance as a communication device for serious issues such as Climate Change the authors feels that it is necessary that the problems of the email world: spam, junk mailing, phishing, etc are tackled aggressively and effectively. Otherwise users will follow the same usage patterns as they use when managing their email - only trusting a small set of users, or friends, and deleting any material which looks dubious.

C. Public Awareness of Climate Change

Public awareness is key to making a real difference in fighting environmental problems such as climate change [4]. However, due to ineffective communication strategies, much effort to educate the public on climate change issues has not translated into a great degree of concrete progress. As outlined in [26] the authors show that the experiences of the UK, Canada and Sweden demonstrate that climate change communication campaigns appear to influence large numbers of people in relatively short periods of time. These campaigns were based on pro-social behavioral campaigns but had little success in changing peoples habits and behaviours. Harnessing the pro-social aspects of Twitter could prove a useful tool in informing the public better about environmental problems. "This is low-hanging fruit in the fight against climate change that our society really cant afford not to harvest" [26]. We believe that Twitter can assist in communicating information about Climate Change. Tools such as Twitter can address "the dichotomy of high awareness and low priority strongly related to ineffectiveness of some environmental communications"[4].

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