

Effective Social Media Analytics for Public Safety Through Raspberry Pi

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Abstract

The serious issue encountered by people is the danger during natural disaster. To solve this issue and to rescue the people we present field study and adapted approach in research and application. In field study, we research about the particular area and discuss about the tools which will be required for the public safety also based on the comments of the other people. Twitter which is a Social media plays a vital role in our paper using the volunteer twitter's account. Users post their feedback in volunteers account to improve the tools to be used in disaster management. Event digest is the mechanism which provides much more simplified interaction and relies on automatically generated overviews. In adapted approach, using the previous study i.e field study as well as user study volunteer use the tools in disaster occurred area to rescue the people.

Index Terms – Field study, Adapted approach, event digest, twitter, user study.

1. Introduction

Nowadays, research on social media analytics for crisis intelligence has seen tremendous growth in the areas of data mining and data envision. Social media like Twitter, Facebook, and Weibo have initiated a novel information channel which constantly provides real-time observations and situation reports from a worldwide community of users. Once made accessible, data from these sources could tremendously help to support information gathering in domains like natural disaster response, complex infrastructure management, and general public safety. Recent visual analytics (VA) approaches have validated that the tight coupling of machine learning, natural language processing and very interactive graphical network can be utilized to manage with social media data portion. However, at the same time, this research was predominantly driven by technological utility, only tested in hypothetical scenarios, and only spontaneous influenced by domain experts thus creating a gap between theoretical betterment and practical requirement. This paper address the gap and presents results of a broad-scale study that

investigated the real world applicability, practical usefulness, and future prospects of integrated VA tools for social media analytics. This paper has two phases. First is the field study to analyze and to collect feedback using social media. Second is the user study to perform using hardwares in disaster affected area.

Here, we visited various large companies and institutions with sophisticated experience in command and control environments. All of them consider situation assessment a crucial element in achieving their goals. To spin the discussions and to review how the experts feel about novel techniques, so Scatter-Blogs is introduced, a VA demonstrator for social media analytics [3]. Most existing research prototypes for social media analysis are centered on a very specific technology or task. In addition, it is often critical or even impossible to acquire software versions suitable for end user evaluations. As an alternative, we relied on Scatter-Blogs to provide the experts with a broad variety of tools and techniques that are popular in current research such as topic models, real-time overviews, message classifiers, and statistical event detection. Based on Twitter data collected from a recent disaster, the 2013 German Flood, we designed a task-oriented use case, in which the experts were asked to apply Scatter-Blogs for information gathering in a real-world crisis analysis setting. These tasks served a means, both to give the experts a feeling that how they could benefit from social media analytics in their efforts as well as to help us evaluate how they would perform with the specific toolset. In the field study, Scatter-Blogs was thus used as a showcase device to drive the discussion and to collect opinions and feedback about the system itself and the research in general. Detailed results of this field study were also published in [4].

The second phase follows a pivotal result of the field study. We observed that several experts requested to reduce the amount of interactivity and free exploration in the user interface in favor of more automated techniques to detect and highlight relevant information. In context of time-critical decision-making environments, some practitioners formulated the need to rely on simplified and fast indications instead of

having to put significant efforts in thoroughly analyzing the data. Naturally, there will never be a perfect system. Designing a visual analytics system will usually involve a trade-off between fast analysis with high degrees of automation and thorough analysis with capable tools and lower danger of missing important insights. To further elaborate on this trade-off for the specific task of social media analysis, we created a complete re-design of the existing research prototype in the second phase of our study which we named Event Digest. This new prototype improves information highlighting and incorporates novel techniques to generate automated event overviews from unstructured social media text and images. The second phase was concluded by a user study in a controlled lab environment to evaluate the performance of the high-interactivity approach versus the more automated system.

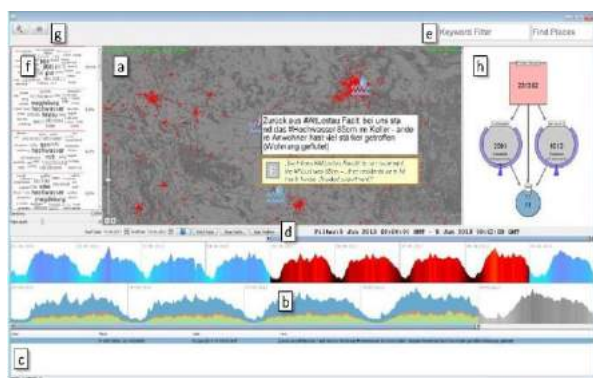


Fig.1. Scatter-Blogs used to drive discussions and collect comments in the field study. Currently, information from the German Flood in 2013 is analyzed. The blue symbols show reported flood damages (with translation). The UI features: a) Interactive map (red dots is Tweets) b) Hierarchical time overview, shows positive (green), negative (red) and neutral (blue) sentiment volumes c) Message contents d) Archive controls e) Textual geosearch f) LDA topics, g) Exploration overlay buttons h) Interactive SVM classifier management.

2. Existing System

In existing system when the natural disaster occurs cannot immediately known that normal people to rescue the people in disaster area. And what states in disaster area rescue people don't know.

3. Proposed System

In the proposed system raspberry pi based system is implemented for surveillance the area and sensors also used for monitoring the natural property like (water level, temperature, vibration, etc). If the sensor value is up normal immediately camera automatically is activated and take snapshots in the disaster area and send

the snaps to the Disaster Management twitter account. So it easily rescue the people in disaster occurred area.

3. Literature Survey

Scatter-Blogs was first introduced during the VAST 2011 Challenge, for which it was initially developed. Through multiple design iterations, this first prototype has since been advanced into a multi-purpose framework for real-world social media monitoring and analytics, which today provides scalable data management, stream-enabled real-time visualization capabilities, and plug-in integration of highly interactive tools. We refer to our previous work for explanations of the different design decisions leading to that current iteration (see [3]). In these three year development process, Scatter-Blogs has served as a platform not just to develop own approaches, but also to adapt, implement, and evaluate recent ideas from ongoing research in the domain. In the field study, Scatter-Blogs thus served as a collective toolbox of approaches at the analyst's disposal, complementing each other to provide a exhaustive picture. To this end, the specific UI layout used in this study was inspired by proposal of disaster management experts that participated in the BMBF VASA research project. Although multiple social media sources, such as YouTube and Flickr, can be analyzed with the system, this evaluation focused on Twitter, as it has most timely information, is simple to understand, and provides large volumes of freely available data. The following paragraphs give an overview of the individual Scatter-Blogs features and tools that were used for the study. They shall also highlight connections to recent related works in the field to illustrate how the various capabilities are firmly rooted in the ongoing scientific discourse. Real-time analysis and filters. Coping with real-time information is a key challenge for web information analytics. Twitter users presently produce about 600 million messages per day, and about 16 million of them are provided with geo-coordinates. Analyzing such information poses high demands on scalable and streaming-enabled data structures and visual interfaces.

A real-time display of up to four million messages through an Open Street Map based visualization using layered tile-rendering. A temporal overview further more shows message volumes and sentiments based on kernel-density estimation. Each visual entity can be interacted with by brushing selections, presenting the user with more details, such as the textual content, authors, and timestamps of Tweets in a list. In addition, the user can load arbitrary historic ranges of data using calendar widgets and time range sliders. Polygon-based brushes and a content search bar can be used to apply spatial and textual filters.

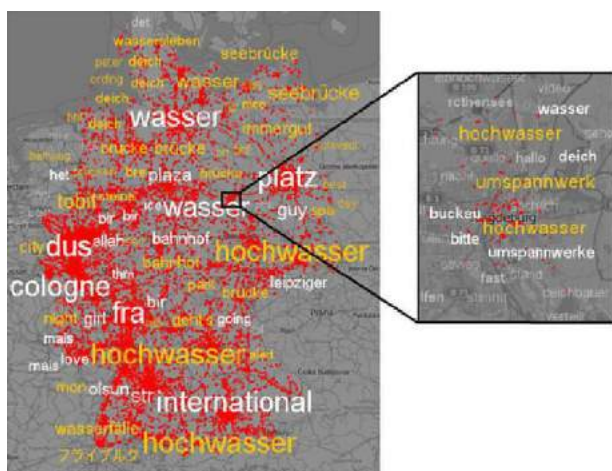


Fig.2. Spatiotemporal clusters of same messages are observed and featured on the TagMap. Cluster size is mapped to tag size, and unusual topics are highlighted in yellow. Zooming into the map shows smaller subevents. (hochwasser is flood, umspannwerk is transformer station)

4. Phase 1: Field Study

This section first provides an overview of the field study design and introduces the domain experts. Based on Twitter data from the flood in Germany, the experts were enabled to evaluate the techniques and tools under realworld conditions and to establish a feeling how the tools would perform on actual data. The details of this dataset and the tasks that we created for our study will be given in the following section. The study procedure will be described in Section 4.1.

4.1. Study Setup

The expert evaluation sessions conducted at their respective sites and were comprised of four stages. The initial timing for the process, including only one analysis session, can be estimated at 2 hours. All studies were made in tape as audio, and these experiments took appended framework notes in prepared spreadsheets. After our team introduced, Scatter-Blogs was presented to the group at the respective institution by explaining the usage of the tools and capabilities using real-time data from provided internet connections. For each and every task, the participants first asked to decide which tools they preferred for the study setup is suitable also much more efficient to solve it and afterwards, they had to use it and apply practically to answer the questions which is the main requirement. At the complex framework groups, six to ten individuals used their system to solve the tasks. In these cases, This presentation took about 10 to 20 minutes and followed a authoritative procedure to safeguard the same expert system. Consequently, the participants were first asked to take determination, and that tasks were solved in the consecutive manner only the



Fig.3. The Content Lens could be used in the third task to assess the ongoing situation in Frankfurt. The three largest tags say police, encircle/em-pocket, and protest. The view below shows the volumes of positive (red) and negative (green) sentiment Tweets for the keyword police in a temporal overview.

participant and the experimenters remained in the room. This experimenter introduced the tasks and collected comments. The participant was allowed to ask the contact person for help, but was encouraged to do so only if he or she had absolutely no idea what to try next. Right after each task was completed, only these participants were asked to rate the tools on a scale from 1 (very useless) to 10 (very useful) and then sensors are placed in that particular place so that it notes the readings if it reaches up the normal then it takes snaps using webcam and send to the volunteer's twitter account through raspberry pi. Here, we are using raspberry pi 3.

4.2. Raspberry Pi

In the raspberry pi3 CPU is 1.2 GHz 64/32-bit quad-core ARM Cortex-A53 and memory 1 GB LPDDR2 RAM at 900 MH which is 10 times faster than the raspberry pi1.

In our paper we are using raspberry pi3 which contain large storage. In the raspberry pi3 it is Linux based circuit and blunded in Wi-Fi, Bluetooth and USB Boot capabilities. SD cards are used to store the operating system and program memory in either SDHC or MicroSDHC sizes.

Most boards have between one and four USB Slots, HDMI and composite video output, and a 3.5mm phone jack for audio. Lower level output I provided by a number of GPIO pins which support common protocols like IC. It guides many languages. The wanted firmware is sealed source, while an unofficial open source is available.



Fig.4. Raspberry pi3

4.3. Temperature Sensor

In our paper we are using LM35 temperature sensor. The LM35 series are exact integrated circuit temperature sensors, this output voltage is nearly proportional to the Celsius. It is rated for full -55°C to +150°C range and suitable for many applications, operates from 4 to 20 volts. It has low impedance output, 0.1Ω for 1mA load.

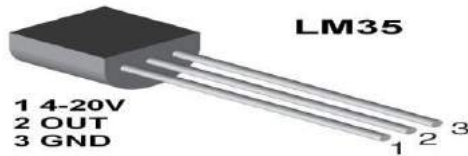


Fig.5. LM35 Temperature sensor

4.4. Water level Sensor

WL400 Water level sensor is used because of its high accuracy and reliability. It is completely submersible sensor. The 0-3 range is great for measuring flows in sewers, drains, tanks, etc.



Fig.6. WL400 Water level sensor

4.5. Vibration Sensor

Vibration sensor is used because this takes the accurate reading during the earthquake occurs. It checks the vibration and notes the reading.



Fig.7. Vibration sensor

4.6. MCP3008

The Microchip MCP3008 devices are successive approximation 10 bit ADC. It is low cost and analog to digital converter provide four pseudo-differential input pairs or eight single-ended inputs.



Fig.8. MCP3008

4.7. Results

This section reports how the experts rated the usefulness of the individual tools after applying them to the tasks. In addition, we will also report observations that our team made about the performance of the tools and possible problems by summarizing the provided comments and suggestions.

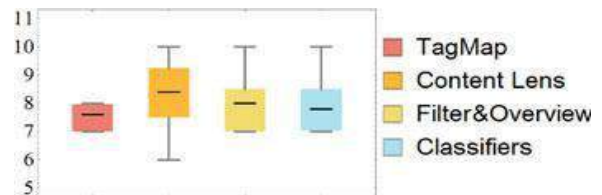


Fig.9. Means and quartiles of ratings for the usefulness of tools. Grades could be given from 1 (very useless) to 10 (very useful). Standard errors of means are: 0.24; 0.67; 0.54; 0.58.

5. Phase 2: Adapted Approach

In the second phase of our study, we will observe how a different design sketch that respects the collected requirements of the experts compares against the original research prototype. According to our lessons learned, we need to create a system that is less interactive and exploratory in nature and instead relies more on automated algorithms to show comprehensive event overviews as well as means to automatically hide irrelevant information. In conclusion, the adapted system should also be much more easy to use and to learn, and it should be faster at delivering event-related information.

5.1. Event Digest

As part of the TagMap in Scatter-Blogs, a relevance weight was computed to highlight most unusual anomalies by color coding (yellow tags in below image). The weighting scheme, is essentially a

geo-aware version of the common tf-idf metric. It follows the idea that terms which suddenly occur more frequently than before are more probably related to an unusual situation. Based on all assigned weights, a threshold was selected, and all tags in the TagMap with higher weight were highlighted in yellow.

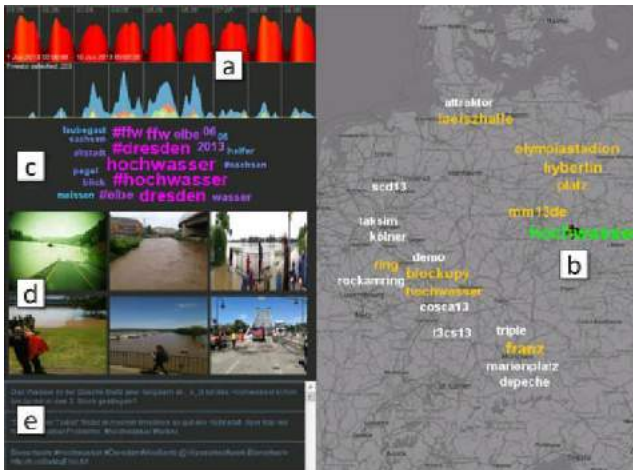


Fig.10. Event Digest: Compared to Scatter-Blogs, the system provides much more simplified interaction mechanisms and relies on automatically generated overviews. After selecting a timeframe (a), the detected events are highlighted on the map (b). The users can zoom in to find filtered events for a specific area. They can select tags to get a comprehensive digest of the topics (c), images (d), and messages (e) that are most closely related to the event.

5.2. User Study

The final step of our study compares the performance of the refined system against the original research prototype. In order to achieve meaningful results, this comparison had to be performed. A major goal here was to see how untrained volunteers would perform with the system after giving them only a brief introductory tutorial. This, however, also meant that we could not conduct the second phase together with our experts from the first phase as they were already familiar with Scatter Blogs and the tasks. We thus recruited 20 voluntary participants by promoting the study. Naturally, these participants are not experts in disaster management or critical infrastructure management. However, as the original domain experts had not been using visual social media analytics systems in the past, they are not more proficient in their application than lay users. While the field study required their domain expertise to evaluate whether proposed techniques are applicable in real-world scenarios, this user study compares the usefulness of two different interaction and exploration approaches that resulted from the feedback.

5.3. Questionnaire

In addition to the statistical performance tests we

also wanted to assess the perceived usefulness of both systems. All questions of the questionnaire were asked in the form of Likert items—i.e., statements to which the participants could express their degree of agreement/disagreement on a symmetric five point scale. The first part asked about the participants’ previous knowledge, including their familiarity with social media, interactive user interfaces, data visualization, and computer science in general. For most of these items we received similar results for both groups. Approximately 20 percent of users of both groups use Twitter themselves and about 40 percent frequently use some form of social media. Based on the data about their previous knowledge in software development (71 percent Event Digest group, 90 percent Scatter-Blogs group) and data visualization (42 percent/20 percent) we can assume that many participants seemed to be students of the computer science faculty. The central part of the questionnaire asked them about their subjective experiences in solving the tasks with the respective system.

The participants were furthermore asked for an overall rating of the respective system, and how they would improve the software. In this case we used German school grades (ranging from 1 (very good) to 6 (inadequate))

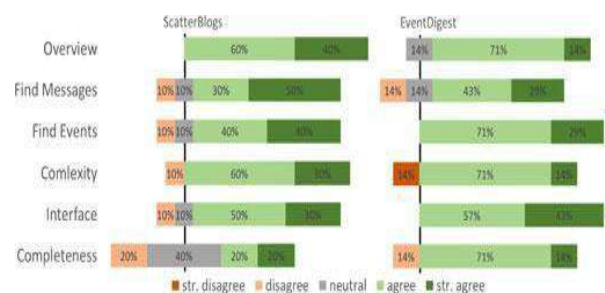


Fig.11. Result of Likert-style questions for Scatter-Blogs & Event Digest.

6. System Architecture

The system configuration consists of gadgets connected across a sensors, CDMA Modem and surveillance camera to the Raspberry pi. The sensors are used to monitor the surrounding situation, if the sensor value is up normal immediately camera is activated and take some snaps in the disaster area and send the snaps to the Disaster Management twitter account. A Modulator Demodulator (MODEM) component helps to send the snaps to disaster management twitter account accordingly using the python algorithm implemented in the raspberry pi. So easily rescue the people in disaster occurred area.

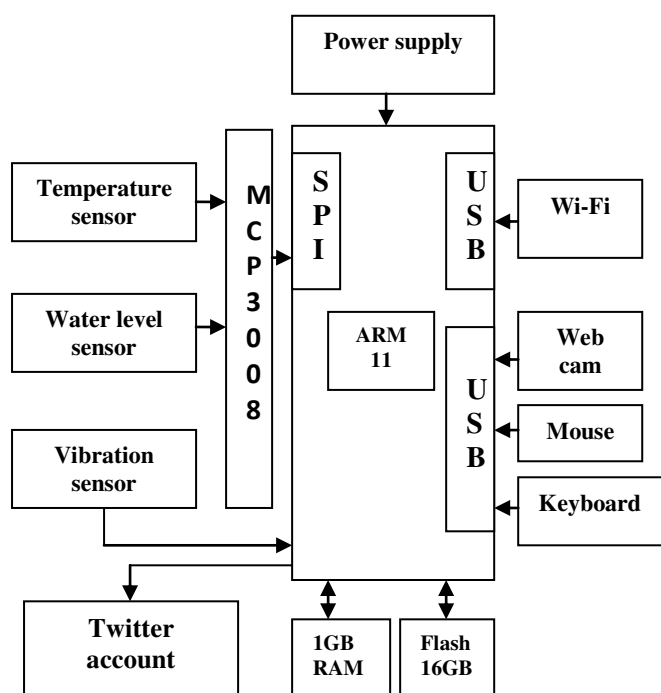


Fig.12. System Architecture

7. Discussion And Conclusion

The results of our broad-scale study indicate that visual social media analytics for public safety is soon ready to be deployed. In the first phase of the study we learned from almost 30 domain experts how they think about the relevance of incorporating social media in their efforts and how a system like Scatter-Blogs may help them to address this challenge. In this phase, the four prepared tasks primarily served as a means to validate with the experts whether the techniques can indeed be applied in the domain. Scatter-Blogs gave the experts an idea of visual analytics techniques, helped to drive the discussions, and allowed us to collect valuable opinions on the general challenge as well as on recent research. The field study demonstrated that the disaster response experts would prefer a system that is less demanding in terms of interaction and exploration and that provides more enhanced means of automatically showing important information. The latter was highlighted by requests for improved event identification system generated media overviews, and automated credibility analysis. Due to the time critical nature of their efforts, the high amount of untrained voluntary helpers, and the limited experience with social media, they seek a system that is easy to use and quickly highlights

The second phase of our study therefore investigated how an adapted system, which fully implements the primary requests of our experts. With

Event Digest, we created a very much simplified system that heavily relies on automated indication and in turn requires only very limited interactions. In addition to a more rigorous event highlighting scheme, we created two sophisticated methods to find event-related images and automatically estimate a message's credibility. The results of this final user study show that Event Digest is indeed more easy to learn and to use than Scatter-Blogs. More importantly, the participants were also often faster at discovering initial insights and quickly grasping the situation. This observation is supported by the two sub-tasks for which Scatter-Blogs performed better than Event Digest, as they both require a more analytical approach to succeed. Here, Scatter-Blogs performed worse than Event Digest. We think that more means of interaction and free exploration can also cause a sense of uncertainty for the users as they could have made wrong analytical choices.

8. References

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