MSC Project Workplan

Social Media Analytics Research and Training for the U.S. Coast Guard

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APPROVED June 13, 2018

Abstract:

This research project will increase the understanding of information and intelligence integration within maritime operations, with a focus on advancements in technologies and command and control systems that utilize crowdsourced information.

The research project's objective is to explore how social media analytics can most effectively lead to improved safety outcomes during natural disasters, emergencies, and other important safety events. We will achieve this objective through structured interviews and targeted questionnaires of the previous use of social media, and the Social Media Analytics and Reporting Toolkit (SMART) during the past several years, including during the 2017 hurricane season. The outcome will be a report on the U.S. Coast Guard's use of SMART with lessons learned and suggestions for improvements and training.

1. Overview and Baseline

Baseline: The DHS Visual Analytics for Command, Control, and Interoperability Environments (VACCINE) Center developed the Social Media Analysis and Reporting Tool (SMART) (Figure 1) to utilize crowdsourced data to increase situation awareness during normal monitoring, special events, and unexpected situations, such as the four hurricanes in 2017.

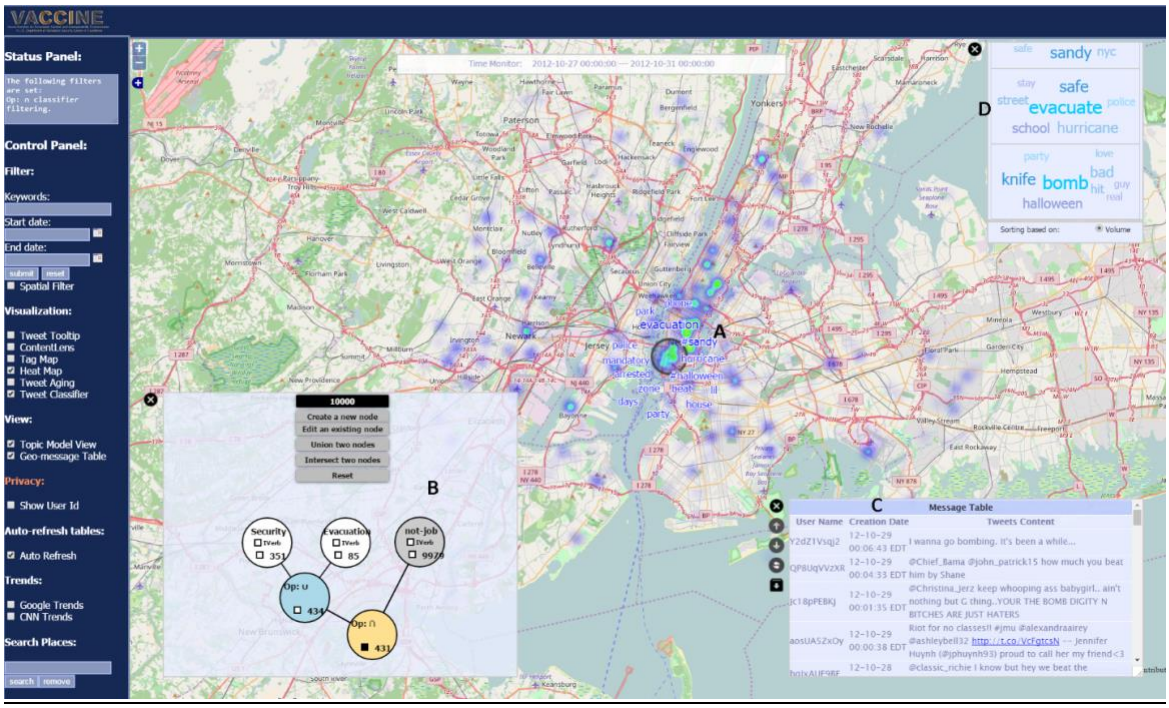

Figure 1: An example screenshot of the SMART software suite displaying social media feeds during Hurricane Sandy. The SMART technology includes a (A) map view, (B) stream classifier view, (C) message table, and (D) topic view. The Content lens in the map view (near the A in the Figure) visualizes in real-time prominent keywords extracted from social media data inside the lens.

Currently, SMART provides users with scalable, real-time, and interactive social media data (e.g., Twitter and Instagram) analysis and visualization that includes heat mapping (Figure 1A), interactive topic lenses (Figure 1A), and task-tailored interactive message categorization. Additionally, SMART allows analysts to interactively configure classifiers (Figure 1B) to monitor their topics of interest and identify trends and anomalies from various social media channels at multiple scales of aggregation. SMART also provides users with the ability to search, examine, and further investigate relevant social media messages (Figure 1C) from the high volume data by utilizing smart aggregation, automated text analysis, and advanced filtering strategies. The system employs the use of several semi-automated text-analysis and probabilistic event detection tools together with traditional zooming, interaction, and exploration to enable the detection and exploration of abnormal topics (Figure 1D). Web and news media sources are also incorporated in the system so that users can search for relevant news articles of interest to further corroborate the intelligence acquired from social media data. Lastly, in order to not require continuous system monitoring, SMART provides an email alert/summary service to send emails related to user-defined topics automatically.

The current iteration of SMART has been successfully deployed by DHS components and both local and regional public safety organizations to a variety of highly sensitive events (see Text

Box 1). For example, SMART was deployed at the 2017 Presidential Inauguration in Washington, DC, the 2016 Republican National Convention in Cleveland, OH, Thunder-Over-Louisville, Cincinnati RiverFest, several state fairs by State Homeland Security Intel personnel, crowded stadiums, maritime hoax call investigations and for disaster management/severe weather analysis. In each case, VACCINE personnel were able to train the perspective end-users regarding the operation of SMART in a one hour webinar. This highlights the intuitive interface of the system.

Text Box 1. Selected Examples of SMART Deployments

- *Presidential Inauguration* – An agency at the U.S. Government Security Operations Center used SMART to monitor and predict the movement of protests and crowds during the 2017 Presidential Inauguration. They discovered valuable information five to ten minutes faster than on the ground reports and public sources of information that enabled them to more quickly and accurately respond to evolving situations.
- *Republican National Convention* - law enforcement agencies and first responder groups used SMART at the Republican National Convention held in Cleveland in July 2016 to provide actionable intelligence and early-warning indicators of potential demonstrations, acts of violence, and disruptions during the event.
- *Thunder Over Louisville* – For the past four years, the U.S. Coast Guard has used SMART to monitor safety and security topics that appear on social media during the Thunder Over Louisville festival, a weekend-long celebration that draws up to 850,000 spectators. Using SMART's email alert system, Coast Guard personnel were able to quickly and efficiently identify suspects posting threatening Tweets that were passed to local law enforcement for investigation.
- *Crowded Stadiums* – Different agencies have used SMART to identify and act upon threats being made in crowded stadiums such as University Police Departments during football games (e.g., Ohio State Stadium, Purdue Stadium) or the Coast Guard during Thunder Over Louisville.
- *Hoax calls* - SMART has been used to support the investigative analysis of hoax distress calls by Coast Guard analysts in order to utilize social media data as another source of information. SMART has identified suspicious geo-tagged tweets and Instagram posts based on the spatial and temporal information of the hoax distress calls. Based on keyword collections and enriched data, SMART identified suspicious Twitter users and messages for review by analysts.
- *Disaster management and severe weather* – SMART has been explored by the American Red Cross for use during severe storms from tornados to hurricanes. SMART is currently being used to analyze movement trends during 2012 Hurricane Sandy and 2017 bushfires in New South Wales Australia. SMART has the real-time potential to corroborate "on-the-ground" reports from the public during disasters, which can provide emergency managers a more holistic perspective of an unfolding emergency event. Example images and posts for severe weather are shown in Figure 2 and 3.

However, SMART's use has been on a case-by-case basis by scattered personnel across the service and for each use by a new group, training sessions need to be run, accounts needs to be created, and situation specific information needs to customized.

Therefore, we will conduct an in-depth user study with the USCG in their use of the SMART software and overall social media analytics. From the study results, we will develop and

deliver a report on the use of social media and SMART, lessons learned, best practices, and suggestions for future use of social media analytics.

2. Objective

The Objective of this project is the following:

- Explore how social media analytics can most effectively lead to improved safety outcomes during natural disasters, emergencies, and other important safety events.

Effective use and improved training in the use of social media analytics tools, such as SMART, will increase U.S. Coast Guard personnel situational awareness, as well as security and performance effectiveness.

3. Research Method

Our overall approach for this project is to utilize strong end-user engagement. The objective and task will be started with an understanding the end-user needs before beginning each task and proceeds with frequent engagement with the end-user, resulting in interactive refinement of the work product. This results in a final work product that delivers more value to the customer.. The specific methodology for Task 1 is described below.

4. Identified Task and Schedule

Task 1 – Report on USCG use of social media analytics: **June 15 to December 31, 2018**

This project requires direct interaction with personnel at the USCG and first responders who have used SMART to understand and enumerate the different ways they have used SMART and other social media analytics methods, with a focus on the 2017 Hurricanes, 2017 and 2018 National Security Events, and other recent events. We will use structured interview techniques to learn about how end users have engaged with SMART and social media platforms before, during, and after potential events. We will apply querying methods to determine a user's comprehension of the information provided. Measures of situation awareness are accomplished using targeted questions to determine whether users attain additional information to achieve desired outcomes. Our sample size will be a minimum of six end users at both USCG and first responder agencies. Each structured interview is expected to last between 30 minutes to one hour. A large focus of the interviews and queries will be on the temporal demands of information. In other words, the efforts will be to enumerate which pieces of information need to be delivered during training, accessible during an event, and extracted in a debriefing. Common gaps or issues with SMART will also be identified and addressed, where feasible, into a new release of SMART.

We will engage Purdue University personnel and personnel at Davista Technologies to perform these interviews and write the report.[1] The collective personnel have experience in knowledge elicitation with homeland security end-user communities, experience in social media analytics, and experience as first responders.

[1] IRB approval is pending. Similar previous review sessions have been considered minimal risk and received expedited approval.

The information from the use of SMART by USCG and first will be disseminated to a broad community of first responders and feedback incorporated to improve the report on effective use of social media.

5. Outcomes and Outputs

Task 1 Outcome – Comprehensively report on how the USCG has used social media analytics, guidelines for use, and improvements to SMART.

- ***Outcome 1a*** – A white paper and briefing delivered to the Coast Guard Cyber Command & Assistant Commandant for Command, Control, Communications, Computers and Information Technology.
- ***Outcome 1b*** – Present research findings at conferences, such as the *2018 IEEE International Symposium on Technologies for Homeland Security* about the use of social media analytics in the 2017 hurricanes, and the *2018 IEEE International Conference on Information Systems for Crisis Response and Management* on more general lessons learned and output of Task 1.
- ***Outcome 1c*** – Deployment of some initial training material and small improvements to SMART for USCG use to increase its utility to USCG. Any simple changes to SMART will be implemented and deployed and a short ppt presentation explaining the use of SMART will be created. We will have SMART available through VACCINE's servers and website.

6. Project Milestones and Performance Metrics

#	Milestone Description	Decision Point (State the criteria and date for "go" decision)	Performance Metrics	Output
M1	USCG social media analytics study	N/A	Min. 8 USCG, 8 first responders participate in study	White paper for USCG to enable more effective use of SMART and social media. IEEE Conference paper 2019, Draft white paper will be completed by **September 1 2018**. After feedback, revised whitepaper will be delivered by **December 31, 2018**. IEEE conference paper deadline is TBD based on deadlines from the conferences.

7. Stakeholder Engagement

We will actively engage USCG personnel and our Midwestern Public Safety Consortium to ensure mission relevancy, effective utilization and dissemination. Stakeholders will be actively engaged in the study to understand the previous use of SMART and social media tools. We will interview stakeholders, have review phone calls, and solicit their feedback on drafts.

Active and frequent engagement will continue throughout the entire project. Identified stakeholders from USCG and DHS include the following:

US Coast Guard –In the future engagements, we aim for a better understanding of how the USCG uses social media analytics and reincorporate our findings into training material. We will also explore dissemination through the Area Maritime Security Committees (AMSC) to engage port stakeholders within federal, state and local agencies, and industry.

First Responder Groups –In the future engagements, we aim to better understand how first responders use social media to support investigations and reincorporate our findings into training material. Our goal is to enable more effective use or SMART and similar tools to increase situation awareness and performance during events. As new users of SMART come onboard, we will elicit feedback through questionnaires and hot washes for improvement suggestions to be included into the training material and software.

Primary USCG POC

Captain Howard Wright,
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Other USCG POCs

Rear Admiral
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9. Student Engagement

One graduate student will be involved in conducting the interviews and improving the SMART system. This student is working in visual analytics, computer engineering/industrial engineering, and computer science. The work on this project will increase their skills in knowledge elicitation, application-driven research, visual analytics, and technology transition. The work on this project will provide research training as part of their degree program, research credit toward their degree, and contribute to their dissertation.

10. Transition plan

The research project will support the utilization of social media analytics and transition of best practices and our report on utilization of social media analytics to the US Coast Guard and other end users in the maritime domain, disaster managers, and first responders groups. We have clearly identified goals of transitioning these material to USCG operations and will work with our USCG POC to design the detailed transition implementation from the start, ensuring the materials and products are available to appropriate USCG personnel. VACCINE has already transitioned SMART to first responder community use and this project's material will increase that transition.

We are working with Captain Wright to determine the best paths and platforms for dissemination and transition of the report and lessoned learn material. Our current USCG transition plan is the following:

- Initially, we will provide the draft of the report to previous users of SMART within USCG, receive feedback, make revisions, and then disseminate the materials. The report and software will reside on VACCINE/Purdue servers and be accessible to USCG personnel. We will also work with Capt. Wright and CG-0922 Office of Public Affairs to identify any possible internal hosting and dissemination possibilities for the report material.
- Determine impact/integration of any of our material with new USCG social media use policy.
- Develop best-practices guide for USCG use of SMART and integrate into appropriate material for USCG.
- Disseminate this material to POCs in CG-0922; Command, Control, Communications, Computers and Information Technology, Coast Guard Investigations; and SAR.
- Work with each user group to explore paths within their office or sector to help determine a sustainable plan for use.

11. Programmatic Risks

The main programmatic risk of this project is the availability of personnel for the interviews. We have had over a dozen previous USCG users of SMART and a similar number of first responder users. However, we need to locate and check the availability of these personnel to participate in the interviews. As a mitigation strategy, we will expand the people we contact to people who have only used the system for a short time to get their experiences and feedback. We make our best efforts to engage the previous users for Task 1.