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# THESIS

**APPLYING INFORMATION DESIGN PRINCIPLES AND METHODS TO OPERATIONS IN THE INFORMATION ENVIRONMENT**

by

Bruce A. Manuel Jr.

June 2021

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The flood of information has saturated the battlespace, and it is imperative that commanders and their staffs are able to sift through the irrelevant information and pull out the actionable information required to make decisions. The objective of the proposed project was to apply Information Design (ID) principles and methods to communicate clear, effective, efficient, and relevant information to decision makers when planning operations in the information environment (OIE). The information received was prioritized according to the CARVER Methodology in order to smartly design information presented to Marine Expeditionary Force Information Group (MIG) commanders. Visual Analytics was the mechanism to present visually appealing information that was clear, engaging, and easily absorbed. The focus of the research centered on the spread of influence within communities of interest discovered through use of the Scraawl software suite. While a useful tool for discovering large amounts of social data quickly, the practical use of Scraawl to the Marine information practitioner would be limited due to classification issues. However, it was found that influence within the analyzed communities spreads rapidly and widely according to experience of the source, physical geography, meaningful and consistent engagements, and media utilized. This thesis showed how effective an open-source tool can be to reduce the cognitive load of the MIG commander, enhancing efficient decision-making.

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information, information design, ID, operations in the information environment, OIE, information command center, ICC, Marine Expeditionary Force Information Group, MIG, measures of performance, MOP, measure of effectiveness, MOE, Department of Defense, DOD, People's Liberation Army, PLA

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# APPLYING INFORMATION DESIGN PRINCIPLES AND METHODS TO OPERATIONS IN THE INFORMATION ENVIRONMENT

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Submitted in partial fulfillment of the
requirements for the degree of

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The flood of information has saturated the battlespace and it is imperative that commanders, and their staffs are able to sift through the irrelevant information and pull out the actionable information required to make decisions. The objective of the proposed project was to apply Information Design (ID) principles and methods to communicate clear, effective, efficient, and relevant information to decision makers when planning operations in the information environment (OIE). The information received was prioritized according to the CARVER Methodology in order to smartly design information presented to Marine Expeditionary Force Information Group (MIG) commanders. Visual Analytics was the mechanism to present visually appealing information that was clear, engaging, and easily absorbed. The focus of the research centered on the spread of influence within communities of interest discovered through use of the Scraawl software suite. While a useful tool for discovering large amounts of social data quickly, the practical use of Scraawl to the Marine information practitioner would be limited due to classification issues. However, it was found that influence within the analyzed communities spreads rapidly and widely according to experience of the source, physical geography, meaningful and consistent engagements, and media utilized. This thesis showed how effective an open-source tool can be to reduce the cognitive load of the MIG commander, enhancing efficient decision-making.

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AM | account monitoring |
| CA | civil affairs |
| CARVE | Criticality, Accessibility, Recuperability, Vulnerability, and Espy |
| CARVER | Criticality, Availability, Recoverability, Vulnerability, Effects, Recognizability |
| CIA | Central Intelligence Agency |
| COMMSTRAT | strategic communications |
| DCI | Deputy Commandant for Information |
| DIME | Diplomatic, Informational, Military, Economic |
| EABO | expeditionary advanced base operations |
| EMSO | electromagnetic spectrum operations |
| GDP | gross domestic product |
| ICC | Information Command Center |
| ID | information design |
| IE | information environment |
| IOT | internet of things |
| IWC | Information Warfare Coordinator |
| LOCE | littoral operations in a contested environment |
| MEF | Marine Expeditionary Force |
| MHF | Marine Expeditionary Force Headquarters Group |
| MIG | MEF Information Group |

| | |
|---|---|
| MILDEC | military deception |
| OIE | operations in the information environment |
| OPSEC | operations security |
| PPP | purchasing power parity |
| PSYOP | psychological operations |
| QGIS | Quantum Graphical Information System |
| SIGMAN | signature management |
| SIPR | secure internet protocol router |
| SNA | social network analysis |
| STO | special technical operations |
| US | United States |
| VA | visual analytics |

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# I. INTRODUCTION

## A. PROBLEM STATEMENT

The United States was universally known as the world's sole superpower at the beginning of the 21st century. One way that the U.S. military perpetuated that status was the ability to move about the globe freely. This freedom of movement enabled another unmatched capability: the ability to securely and reliably access and transmit sensitive information around the globe instantly. It is no longer assured. This dominance in the information environment (IE) is no longer uncontested. America now has near-peer competitors and irregular threats that threaten our freedom of movement (Department of Defense [DOD], 2018). In addition, the prevalence of the internet of things (IoT) and internet access is growing for our competitors and adversaries alike. The ability of our competitors and adversaries to wage warfare and influence mass populations in the IE is easier than ever and increasing exponentially. In recognition of future competition in the IE, the Secretary of Defense established Information as one of the seven joint warfighting functions in 2017. That same year, Deputy Commandant for Information (DC/I) was established under to an authorization granted in the FY 17 National Defense Authorization Act. A lieutenant general now controls all facets of IE operations for the Marine Corps. In addition, the Marine Corps renamed the MEF Headquarters Group (MHG) to be called the MEF Information Group (MIG). The purpose of the MIG is to enable the Marine Corps to operate with "freedom of action in and through the information environment to preserve, generate, and apply informational power in concert with fires and maneuver to accelerate tempo and achieve physical and cognitive advantage." (Capt Bud Geldmacher, email to author, July 20, 2020). Two years later, in 2019, the Commandant of the Marine Corps established "Information" as the seventh warfighting function for all Marines.

The commander of the MIG established the Information Command Center (ICC) as a sub-agency to function as the command-and-control center for operations in the information environment (OIE). The ICC is led by the Information Coordinator (IC). The ICC is comprised of various cells that provide capabilities based on the following functional areas: Communication strategy and operations (COMMSTRAT), Cyberspace

operations, Electromagnetic spectrum operations (EMSO), Space operations, Psychological operations (PSYOP), Intelligence operations, Signature management (SIGMAN), Civil Affairs (CA), Military deception (MILDEC), Operations security (OPSEC), and Special technical operations (STO) and activities. The composition of the ICC is dependent on and tailored to mission needs and the MIG commander's discretion. In support of the commander's priorities, each cell within the ICC provides the commander a comprehensive understanding of threats, vulnerabilities, and opportunities in the IE. These collectively are called "running estimates." The running estimates provided to the MIG commander support their decision-making by ensuring their commander's intent is implemented and that feedback on OIE is continuous.

The flood of information in OIE has saturated the battlespace and therefore the MIG commanders and their ICC staffs need ways to efficiently filter out the irrelevant information and pull in the actionable information required to make decisions. This thesis' purpose is to apply Information Design (ID) Principals and Methods to communicate clear, effective, efficient, and irrelevant information to decision makers when planning operations in the flooded and saturated Information Environment (IE). The running estimate produced by the ICC cells is the primary means by which assessment of OIE is conducted and disseminated.

Jacobson defines Information Design as both an "art and science" that is focused on the utility of information by human beings (Jacobson, 1999, p. 15). This definition also captures the essence of the metrics with which we gauge the value of ID; information is assembled purposefully, transmitted thoughtfully, and received (understood) effectively. With the successful implementation of these principles, effective action can be taken on the subject information. In terms of the MIG commander / ICC staff, this translates into the meaningful tactical application of military information power that seeks to edify the MIG commander and ICC staff, through an effective and efficient transfer of information.

General Berger, 38th Commandant of the Marine Corps, has prioritized managing the IE more responsibly and sensitively. He states the following: "Preserving the ability to command and control in a contested information network environment is paramount" (United States Marine Corps [USMC], 2019, p. 12) The burden is on information

practitioners to institute the ID principles to maximize success within a contested battlespace.

There are multiple streams of input received by the MIG commander and the ICC staff. Creating a systematic process for the assembly, transmission, and receipt of information at the MIG is a worthwhile effort then to minimize confusion. The various cells within the ICC utilize sophisticated technical equipment and software that create military information power at the MIG (Information Command Center Concept of Employment, 2020). Military information power is "the total means of force or information capability applied against a relevant actor to enhance lethality, survivability, mobility, or influence" (Reynolds & Smith, 2020), two issues arise when attempting to synthesize these capabilities coherently. First, not all the systems integrate into a common platform for efficient utilization. Second, there is no agreed upon or universally used standard with which to evaluate and prioritize information. Information Design can streamline how the information is assembled, transmitted, and received so that the information pertinent to OIE can be communicated more effectively.

## B. PURPOSE AND RESEARCH QUESTIONS

The purpose of this research is to create a systematic process that can be of benefit to all Marine OIE practitioners. Quality information that is presented well and is actionable enables the Marine Corps to become more credible and lethal. The process to curate that information should be efficient, purposeful, visually understandable, and duplicatable. This project seeks to leverage information design to do that.

The research questions to be evaluated are as follows:

- In what specific ways can information flow at the Marine Expeditionary Force Information Group (MIG) be enhanced?
- How can information pertinent to OIE be communicated more effectively?
- What are the relevant metrics and the current standards (MOEs / MOPs)?
- How does ID enhance the above?

## C. THESIS ORGANIZATION

Chapter II describes the information environment in the 21st century, introduces the overarching field of Infology, discusses how this project will achieve the tenets of Information Design, introduces the CARVER methodology and its application to the information environment, describes the field of visual analytics, and finally sheds light on the Marine Corps' efforts in operating effectively in the information domain. Chapter III outlines the main tool of this project, Scraawl, the modules within Scraawl, and how these will be utilized in the case study that follows. In addition, Chapter III describes a notional case study in which the information received from Scraawl will be used to meet the principles of Information Design through the CARVER Methodology. Chapter IV describes the results and analysis of the previous chapter. Chapter V summarizes the conclusions and potential applications to future work.

# II. BACKGROUND

## A. DEFINING THE INFORMATION ENVIRONMENT

The Information Environment (IE) comprises all people, entities, systems, and organizations that interact with information in various ways (Cordray & Romanych, 2005). As recognized by the Marine Corps, these interactions can be the collection, dissemination, processing, or acting on the information. The people operating in the IE are typically classified as information practitioners, who, like other military professionals, maintain a part of their focus on improving decision-making and the decision-making cycle, the "O-O-D-A Loop" (Olsen, 2015, p. 58). Thus, the people, entities, systems, and organizations all fuse together to observe, orient, decide, and act on data and information (Enck, 2012, p. 123). The prevalence of information to military operations has compelled commands at all levels to fundamentally change how information is prioritized within traditional military operations (Potts, 2003, p. 20).

Nested within the information environment are three intertwined domains: the physical, informational, and cognitive (Cordray & Romanych, 2005, p. 7). First, the physical domain is composed of the people, systems, and structures that "enable individuals and organizations to create information-related effects" (Joint Chiefs of Staff [JCS], 2012, p. x). Next, the informational domain is composed of the content (information) itself, including how it is collected, processed, stored, disseminated, and protected (JCS, 2012, p. x). Last, and most importantly, is the cognitive domain, which contains the "attitudes, beliefs, and perceptions of those who transmit, receive, respond to, or act upon information" (JCS, 2012, p. x). This is the most important domain in the information environment as information generates and terminates in the minds of people. The cognitive (human) domain is impacted by and registers everything that occurs in the physical and informational dimensions of the IE (JCS, 2012, p. x). Thus, it is the central focus of operations in the IE.

## B. THE FIELD OF INFOLOGY

### 1. The Communications Process

Pettersson and Forlag define infology as, " the science of verbal-visual presentation of information." They go on to further specify that Infology is concerned with how verbal-visual information should be designed to achieve the best communication between sender and receiver. Figure 1 attempts to visually represent the communication process.

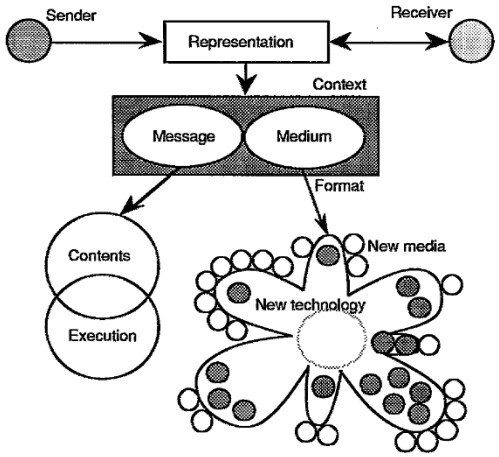


Figure 1. Pettersson and Forlag Communication Process. Source: Pettersson and Forlag (1990).

As the graphic displays, the communication process can split into three separate but intertwined levels that are fluid and mutually support one another. The process naturally begins with the sender as the originator of an idea that desires to convey it to a target audience. The sender, as explained: "creates a representation of reality" (Pettersson et al., 1990). The representation is produced and prepared to be sent to the receiver. When the representation is designed in a way that the receiver interacts with it in the most intuitively and efficiently possible, then it has been smartly designed. This project attempts to leverage the principles of Information Design and apply them to OIE. These principles are the summarized as follows: the creation of information that is clear, targeted, and purposeful; is engaging and easily absorbed by the receiver; and is intuitive to the receiver on how to act on that information.

## 2. Meeting Information Design

An international group of Information Design faculty, appointed by the International Institute for Information Design, IIID, argued: "information design is the defining, planning, and shaping of the contents of a message and the environments in which it is presented, with the intention of satisfying the information needs of the intended recipients" (Simlinger, 2007, p. 8). This project seeks to meet this scope through the usage of the CARVER Target Analysis and Vulnerability Assessment Methodology and Visual Analytics, a subset of Information Design (Figure 2).

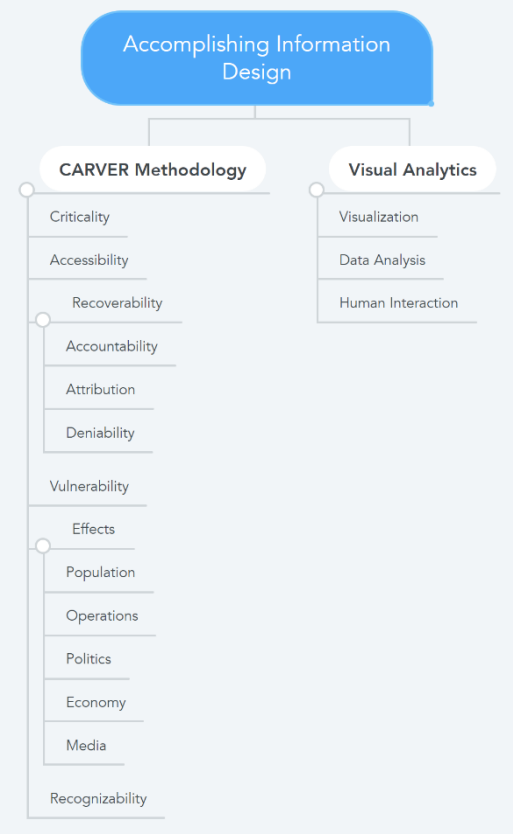


Figure 2. Visualization of "Meeting Information Design"

## C. CARVER THREAT ANALYSIS AND VULNERABILITY ASSESSMENT

### 1. Origins

During the height of the Vietnam War, the CIA developed a methodology to assist CIA paramilitary units and U.S. military special operations forces select targets for destruction, in support of operational objectives (Labaj & Bencie, 2018, p. 15). The methodology was abbreviated with the acronym "CARVE" and stood for Criticality, Accessibility, Recuperability, Vulnerability, and Espy. As targets were selected, they were ranked according to the CARVE numerical metrics and given a value from 1 to 5. The higher the assigned number, the higher the likelihood that the target met those criteria.

In the latter years of the Vietnam War, the CARVE analysis would be universally taught as the most reliable way for the military to conduct target analysis (Labaj & Bencie, 2018, p. 15). However, with the rise of international terrorism, it became apparent that CARVE would no longer be suitable. Terrorist attacks all seemed to be predicated on particular goals, which would broadly be either political, economic, or religious. Operators in the CIA and military found that CARVE had no way of accounting for the effects of these attacks on a nation's politics, operations, populace, economy, or media. Therefore, CARVE transformed into CARVER as we know it today. It stands for Criticality, Accessibility, Recoverability, Vulnerability, Effect, and Recognizability (Labaj & Bencie, 2018, p. 18). Table 1 summarizes CARVE considerations.

Table 1. CARVE Metrics and Considerations.
Adapted from Labaj and Bencie (2018).

| Criteria | Consideration(s) |
|---|---|
| Criticality | Is this asset a single point of failure for the adversary? |
| Accessibility | How easy is it for friendlies to access the target? |
| Recoverability | How much time is needed to restore operations from a destroyed target? |
| Vulnerability | Can the desired results be achieved on the target? |
| Espy | Is the target easily recognizable? |

As a targeting system, it utilizes a numerical matrix to do the following: identify high payoff targets, categorizes, and prioritizes those targets, and can assess vulnerabilities and consequences so that resources can be efficiently utilized.

## D. VISUAL ANALYTICS

### 1. Understanding How to Use CARVER

This system has been adapted among many different entities from Special Operations Forces (SOF), the Department of Energy (DOE), Department of State (DOS), Department of Homeland Security (DHS) and other various private and public sector groups (Labaj & Bencie, 2018, p. 20). Within the MIG ICC, this methodology can be applied to the information received by the various cells. The cells can utilize CARVER analysis to prioritize what information needs to be communicated and how to present the data.

#### *a. Criticality*

Criticality is a measure of how important a target is to our adversaries and to achieving friendly objectives. Within each cell of the ICC, they will weigh information received based on its uniqueness and impact on the mission of the ICC and the commander's priorities.

#### *b. Accessibility*

Accessibility is a measure of how easily a target can be accessed. This measure works well within the context of information, as the majority of information the ICC processes is acquired by multiple means, based on technology used and classification.

#### *c. Recoverability (Attribution, Deniability, Accountability)*

Recoverability measures how well a system can recover from an attack. Within the information domain, this will measure how responsive an agency is once the MIG acts upon information received about it. Additional considerations for recoverability measure the ability of friendlies to attribute the information to an adversary, the deniability of the

information by that adversary, and the ability to hold the adversary accountable for those actions.

#### *d. Vulnerability*

Vulnerability is a measure that demonstrates how easy it is to act upon a target, or how easy it is for the ICC cells to act upon information received. The ability to exploit the information is what distinguishes this from Accessibility.

#### *e. Effect*

Effect will measure the amount of direct loss from an attack. This is nuanced within the information domain, although effects of the use of military information power can be measured through a variety of indirect means (sentiment analysis, etc.). As stated above, the Effect can be further defined by their impacts on a nation's politics, operations, populace, economy, or media.

#### *f. Recognizability*

This attribute measures how easy it is to identify a target as significant by friendlies or adversaries. Within the information space, the targets of exploitation can be harder to verify. However, since all entities send and use information in some respect, the significance placed on the communicated message can provide clues into an adversary's weight on the information.

### 2. What Is Visual Analytics?

Daniel Keim et al. ( n.d., p. 1) define Visual Analytics as, "the science of analytical reasoning supported by interactive visual interfaces." Data and information have been produced faster than mankind has been able to analyze it without the aid of computer resources. Domo, a cloud software company, issued a report estimating that there were 2.5 quintillion bytes of data are created every single day (DOMO, n.d.). The teaming of humans and machines to process information has proven to be the decisive factor with which the United States maintains its global technological advantage. Furthermore, storage requirements for that data are increasing at an exponential rate.

Computer automation is central and fundamental to life in the 21st century. However, the complexity of the modern digital world necessitates that humans remain in relative degrees of control over decisions made by machines. The methods that comprise the field of Visual Analytics methods allow decision-makers to combine their experience, creative abilities, and ability to adapt to changing situations in concert with modern machines to make sense of the complex modern world (Keim et al., n.d., pp. 1–2). Thus, Visual Analytics strives to ensure that information received is clear, engaging, and easily absorbed to allow those decision-makers to make the best decision in real-time. Figure 3 concisely describes Visual Analytics in a three-node visual.

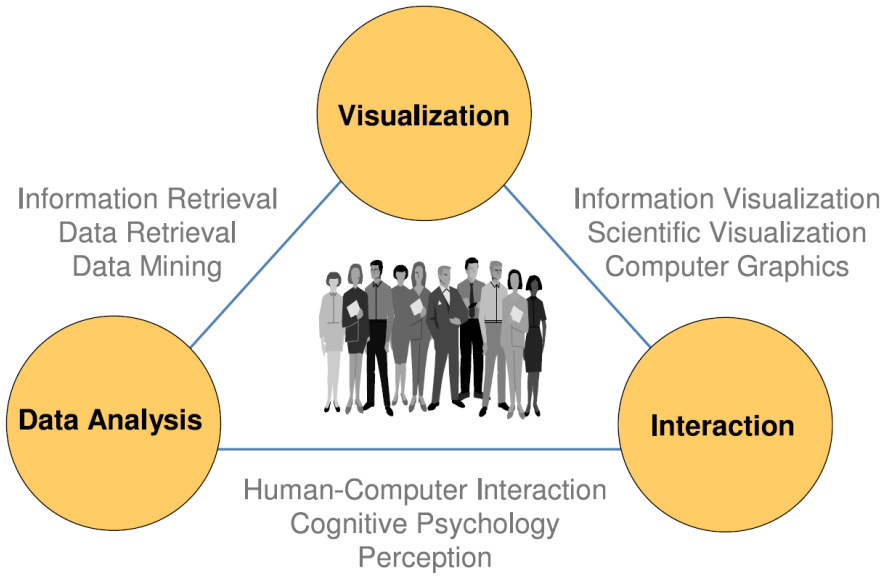


Figure 3. Daniel Keim graphic of Visual Analytics. Source: Keim et al. (n.d.)

These areas are completed fields of study in themselves and have overlapping areas that all tangentially serve the conversation at hand. Simply though, if researchers extract valuable information from raw data by automatic processes, seek to meaningfully display those data, and interpret them responsibly through human reasoning and creativity, then one is conducting Visual Analytics (Keim et al., n.d.).

### 3. Social Network Analysis

The field of social network analysis is germane to Visual Analytics. Cunningham et al. states "Social network analysis (SNA) is a collection of theories and techniques to understand social structure." (Cunningham et al., 2016, p. 6). A social network consists of two primary elements, the entities within a social network and their relationships. The entities can be people, their online user accounts, organizations, businesses, countries, or the like. Those relationships can be based on certain roles, derived from similar behaviors, or describe interactions between entities (D. Cunningham, PowerPoint Slides, August 12, 2020). Any basis of relationship between entities in a social network is acceptable. Network entities are also commonly referred to as actors, nodes, or vertices, and the relationships as ties or edges (D. Cunningham, PowerPoint Slides, August 12, 2020). This thesis will utilize the terms "vertices" and "edges." A visual depiction of all vertices and edges is a social graph (Robins, 2015, pp. 3–4).

To gain a deeper understanding of a network, there are two other concepts that can be utilized to describe it, graph density and degree. The density of a network is a measure of how wholistically connected the network is. Between any two vertices there can only be one edge. The density is usually given a number between 0 and 1. A network that has no edges present would be a density=0, whereas a network with density=1 contains all possible edges (Robins, 2015, p. 7).

The degree of a vertex on a network is the number of connections to other vertices, measured by edge count. This will form the basis of influence as used in this thesis, without specific regard to the more defining network characteristics of average degree, or in-degree or out-degree (Robins, 2015, p. 7).

## E. CHALLENGES WITHIN THE MARINE CORPS

### 1. 21st Century Competition

General Berger stated in his article "The Case for Change: Meeting the principal challenges facing the Corps" that:

> [I]n light of the unrelenting increases in the reach, effectiveness, and lethality of modern weapons, the rise of revisionist powers with the

> technical acumen and economic heft to integrate those weapons and other technologies for direct or indirect confrontation with the United States, and the persistence of rogue regimes possessing enough of those attributes to threaten U.S. interests, I am convinced that the defining attributes of our current force are no longer what the Nation requires of the Marine Corps." (Berger, 2020b, p. 8)

### 2. The Necessity to Dominate the Information Domain

General Berger also stated that a military challenge emerges in light of our global competitors:

> The threat today accepts the (present) reality of U.S. conventional force superiority, and he has an answer for it in the form of the complex of aggressive behaviors 'short of war' that we have come to characterize as gray zone operations. Credible 'lethality' is only a part of the answer to this challenge—the ability to compete directly, daily, and globally, by means acceptable to the American people and the rule of law, is the missing piece. (Berger, 2020b, p. 8)

Considering Marine Corps Force Design efforts focused on building the Fleet Marine Force (FMF), fully integrated with the naval partners, the quote above illustrates two primary elements: (1) credible lethality, and (2) direct, daily, global competition. Both elements depend upon the success of institutionalizing the newest warfighting function—information. Concerning credible lethality, competitors and adversaries are developing capabilities to disrupt the data and underlying networks of information upon which combat power projection depends (USMC, 2020). With respect to direct, global competition, competitors and adversaries are rapidly expanding their arsenal of information capabilities and employing them broadly, ranging from classic propaganda, influence, and disinformation operations to manipulating and degrading algorithmic-based decision-making (USMC, 2020).

## F. MARINE CORPS INFORMATION OPERATIONS

### 1. ICC Composition and Functions

The ICC is the MIG commander's command and control center for OIE (USMC, 2020). It exists to support the MIG, and ultimately the MEF commanders' decision making

by providing a comprehensive understanding of threats, vulnerabilities, and opportunities in the IE by ensuring the implementation of the commander's decisions and intent; and by providing essential feedback of MEF OIE (USMC, 2020). The ICC provides a physical location where the MIG commander may exercise command over assigned units, adjust command action based on feedback, or coordinate with MEF CE staff elements planning and advising OIE. Its structure is a flexible and scalable grouping of interlinked functional cells supporting OIE planning, execution, and assessment. The cells are manned by functional experts who are organic to the MIG, or who augment it. Cells support the operation of the ICC watch floor to assist in near real-time OIE coordination and deconfliction. Depending upon mission requirements the ICC can grow, divide, or flex to meet the demands of the specific situation. Creating this flexible structure is an area of discovery that should be a primary focus of Force Design 2030 analysis and wargaming (Berger, 2020). A smartly designed Marine force is necessary to ensure OIE can be sufficiently planned coordinated across multiple nodes of the MLR or other Marine units conducting DMO and EABO missions. The ICC is persistently engaged in support of naval and Joint operations. A notional watch floor at the MIG is shown in Figure 4.

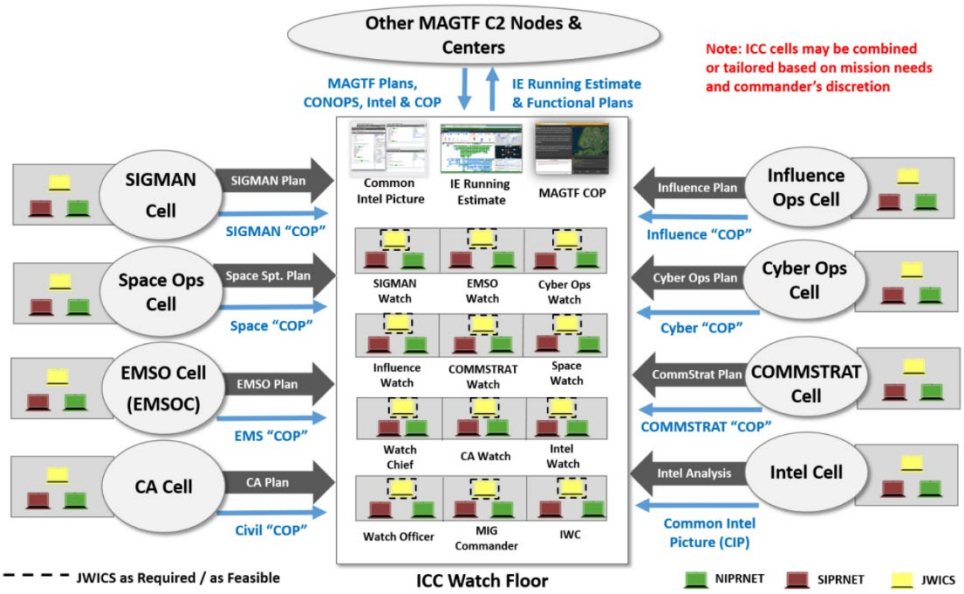


Figure 4. Notional MIG ICC Watch Floor. Source: Information Command Center Concept of Employment (2020)

## 2. Software / Systems

In pursuit of the MIG commander's information objectives, the ICC utilizes many software systems. Including, but not limited to the following: Scraawl, Microsoft Power BI, Pulse, Open IO, Talk-Walker, Meltwater, Palantir, C2IE, Web-ISSA, and FadeMist. Each portion of the ICC utilizes a different software suite or combination of software systems in pursuit of the tasks to meet the MIG commander's / IC intent. This research project solely utilizes Scraawl, a robust suite of tools to provide social, video, and text analytics. Within the Scraawl suite, this project simulates information received by the ICC cells through embedded reporting.

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# III. METHODOLOGY

## A. INFLUENCE CELL

In answering the research questions (In what specific ways can information flow at the Marine Expeditionary Force Information Group (MIG) be enhanced? And How can information pertinent to OIE be communicated more effectively?)we will start working with a notional, unclassified scenario involving the Influence Cell of the MIGThed scenario that will be analyzed is analogous to the current involvement of the U.S. military in Oceania. I will analyze countering fictional Country of Red (CoR) influence on the countries in the fake Great Sea Region (GSR) Oceania, leveraging the Influence Cell. The Influence Cell description and tasks are below.

From the ICC Concept of Employment (CoE): "The influence cell is focused on leveraging information to affect the perceptions, attitudes, and other drivers of relevant actor behavior (USMC, 2020). The Influence Cell is the MIG's primary entity focused on influencing target foreign audience in support of friendly operations (USMC, 2020). The purpose of influence operations is to shape perceptions (JCS, 2018, p. viii). The IE capabilities most often associated with influence include but are not limited to psychological operations (PSYOP), CA, OPSEC, SIGMAN, MILDEC, and STO (USMC, 2020). Fires and maneuver may also be considered by this cell for creating an influence effect. This cell is primarily responsible for understanding and developing options for OIE and for leveraging operations and activities to impact the IE. The influence cell's tasks include the following:

- Coordinate influence operations with the MEF staff and naval mission partners to support global campaigning and naval operations.
- Support the development of Annex G (Civil Military Operations (CMO)).
- Coordinate and de-conflict themes and message dissemination.
- Support the development of the protected target list.

- Support MILDEC, SIGMAN and OPSEC.
- Support MEF operational assessments.

As can be seen from the description, the influence cell is primarily concerned with the perceptions, attitudes, and drivers of behavior for relevant actors and populations. The internet, combined with the rise of social media over the last two decades, people easily connect across the globe with others with whom they would have not previously ever met. These connections, while a necessary human desire, have enabled influence to spread across all borders and groups. The powerful suite of analytics tools in Scraawl makes it a natural tool for exploiting social data through qualitative and quantitative analysis.

As with many of the other cells, the Influence Cell's doctrinal tasking lacked specificity. This lack of specificity was attributed restrictions based on one of two things: classification considerations and the fact that the source document (ICC COE) is listed as only a "concept" of employment, rather than doctrine. In addition, the kinds of information that some of the ICC cells discover cannot be accurately replicated without the use of many of the software / systems mentioned previously. Software utilized by the MIG was created by various contractors who, because of proprietary concerns, do not always create their software for integration (Rendon et al., 2019). The case study at hand will also be analyzed with a bias towards what can be found open-source / unclassified (e.g., through the Scraawl suite).

## B. SCRAAWL

Scraawl is a data analytics tools suite created by Intelligent Automation, Inc(Intelligent Automation, Inc., n.d.). The suite contains four primary modules which give Scraawl the ability to analyze publicly available data, pictures, video, and unstructured data. They are SocL ("social"), PixL ("pixel"), Txt ("text"), and TrndZ ("trends")(Intelligent Automation, Inc., 2020b). Each tool allows for a different type and depth of data analysis. Scraawl SocL is a performance and analytics intelligence tool that searches, analyzes, and visualizes online conversations and news data. Scraawl PixL is a powerful tool for processing and analyzing image and video data. Scraawl Txt facilitates

the discovery of patterns and trends in unstructured text. Scraawl TrndZ creates "monitors" to collect data that cross-matches usernames, hashtags, and keywords for indexing, searching, stream processing, and visualization of posts. This project will primarily utilize the SocL module.

Scraawl SocL has specific criteria with which to use to effectively search and obtain relevant information. Within Scraawl SocL, four searches are available and utilized based on specific keywords and Boolean logic entered by the user. The four searches are Multi-feed Search, Premium Search, Premium Advanced Search, and Account Monitoring (Intelligent Automation, Inc., 2019). Multi-feed Search and Premium Search can be used for keywords and only up to ten keywords. Premium Searches require selection of a primary data source (Twitter, Instagram, Facebook, Tumblr, YouTube, VK, Sina Weibo, or other performance analytics and intelligence [PAI] sources). This project will leverage Twitter data only. Premium Advanced Search allows for full Boolean expressions, but limits searches to Twitter or other PAI sources. Account Monitoring is a way to collect posts from specific Facebook, Tumblr, or Twitter accounts.

Multi-feed Search and Account Monitoring will utilized. Within Multi-feed, search terms included permutations of "US," "DOD," "PRC," "PLA," and five specific countries in Oceania. Four of the countries (Australia, New Zealand, Papua New Guinea, Fiji) led Oceania as those with the highest gross domestic product (GDP) for purchasing power parity (PPP), according to a 2017 Central Intelligence Agency report. The fifth country, Palau, was chosen for the intimate partnership with the United States (Office of Insular Affairs, 2015).

Account Monitoring searches will comprise primary U.S. and Chinese defense accounts, and their interactions discovered through Scraawl with relevant defense accounts of their Oceanic counterparts. The defense accounts used in the Account Monitoring Searches are annotated in Table 2.

Table 2. Scraawl SocL Search Accounts

| United States Defense Accounts | Chinese Defense Accounts | Oceanic Defense Accounts |
|---|---|---|
| @USPacificFleet<br>@thejointstaff<br>@INDOPACOM<br>@PacificMarines<br>@Global_Mil_Info | @SinoDefence<br>@zlj517<br>@sonoftaiwan | Regional<br>@IPDefenseForum<br>@WIONews<br>@Japan_pac<br><br>Australia<br>@CDF_Aust<br>@DeptDefence<br>@CN_Australia<br><br>Fiji<br>@Rfmf_Media<br><br>Papua New Guinea<br>@ADFinPNG<br>@CDF_PNGDF<br><br>New Zealand<br>@NZDefenceForce<br>@CDF_NZ |

### 1. Communities of Interest

In discovering the sources and impacts of influence in social networks, it is helpful to analyze how people organize themselves. Through meaningful data interpreted responsibly, it can be shown where the sources of influence are and their impacts. Depending largely on the social network in question and the keywords used, the amount of information received back can be staggering and the analyst can be left with hundreds of thousands or even millions of posts, tweets, links to news stories, and users to sift through. Social media analytics tools aid in the "sifting" through large volumes of data to focus interests into relevant information, and then derive actionable insights from those data.

Scraawl SocL has an advanced analytics tool called "Community Detection" which allows users to search keywords and interpret the meaning out of the results The techniques for community detection are based around several algorithms that utilize hierarchical clustering, clique-based methods, statistical inference modularity maximization, and label propagation (Intelligent Automation, Inc., 2020a). Figure 5 is an example of one such result

from a search for influential Twitter accounts concerned with the Oceanic region. Through Community Detection, Scraawl provides the size of the community, number of subcommunities, sizes of each of the subcommunities, and (upon inspection of the subcommunities) users/links within each.

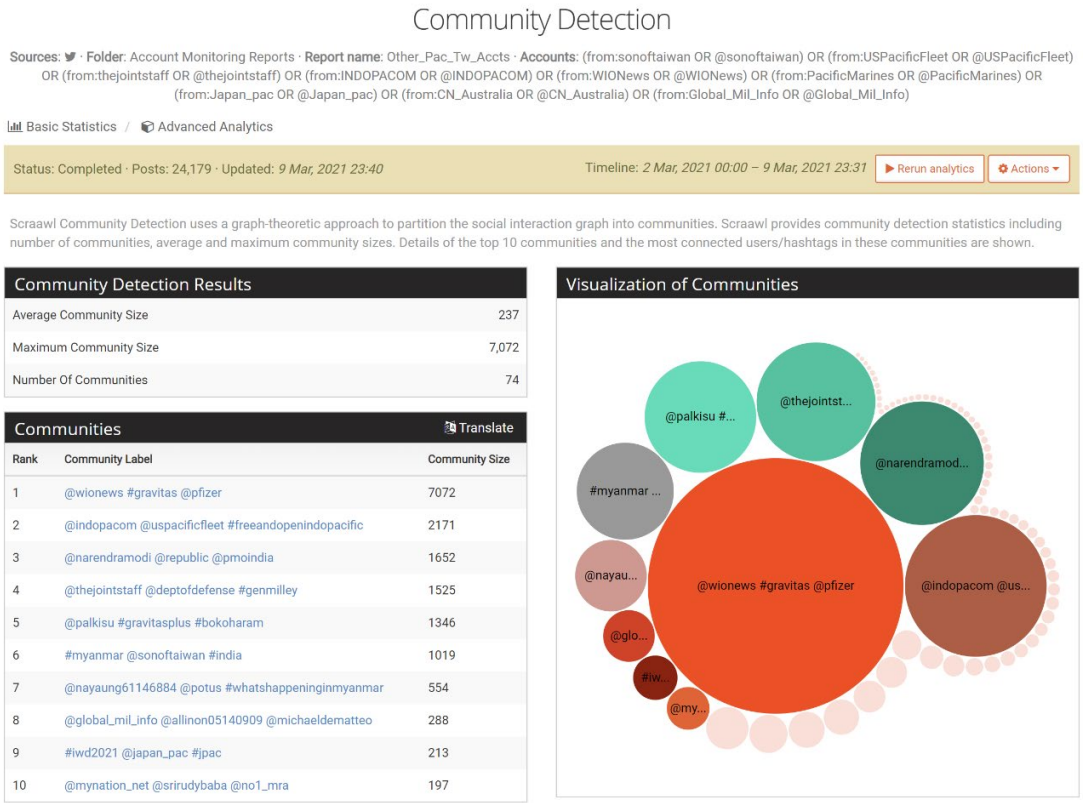



Figure 5. Scraawl Community Detection Image. Source: Scraawl (2021)

## 2. Influence Discovery and Influence Analytics

Members within communities tend to influence one another to different degrees, in different ways, and at different times. Furthermore, all members are not equally skilled in their abilities to influence one another. Therefore, after rigorous analysis and given enough time, those members who do possess influence should naturally stand out(Singer, 2018, p. 169). Rightly so, study of influence in digital/social media has generated much debate in the two previous decades. Just as companies are looking to spread their influence and reach

a broader audience to increase their influence and profits, the DOD (and the Marine Corps as a result) seeks to understand the connections and influences between the populations of allies and competitors across the globe. The DIME-levers of national power are all subject to the influence of human interactions and thus are all of interest to the current research project.

Furthermore, the preeminent task for the information practitioner is the identification of key influencers, agents that can leverage and be accurate measures for a target population. A thorough study of these influencers also give insight into why and how members in a target population might respond to certain messaging or information campaign. It is then considered to be actionable military information power.

While simple in concept, the challenge is implied: correctly identifying influencers matters.

Scraawl SocL provides two other advanced analytical reports: Influence Discovery and Influence Analytics. These two reports give specific feedback for influence in a community of interest based on a set of input keywords or phrases. This allows the analyst to answer some basic questions:

- What does influence in social networks mean?
- Does "follower" count or reach imply that a user is influential?
- Does being mentioned multiple times (by various other users) in a conversation thread imply influence? What about retweets?
- Is there a correlation between influence and frequency of posts/tweets?

Specific keyword searches will be utilized to measure the movement of influence in communities. The observation of significant influence in communities will be analyzed. Measures of performance (MOP) will be numbers of: retweets in a community, likes, follows, hashtags, and mentions. Measures of effectiveness (MOE) are users generating influence in their communities in the time window searched. Measures of effectiveness

indicators (MOEI) will not be considered due to the short time window (seven days) that most of the data was generated.

The captured data from the keyword searches will be analyzed for trends that will feed the fictional geographic region mimicking Oceania. According to the algorithmically significant information presented in Scraawl, I will categorize and rank it. Strong MOP/ MOE will be ranked as more significant according to the CARVER analysis and this produce better information with which to generate a running estimate. The use of the extensive visualizations within these reports will constitute effective use of tools of visual analytics. Examples of Influence Discovery and Influence Analytics are Figures 6 and 7.

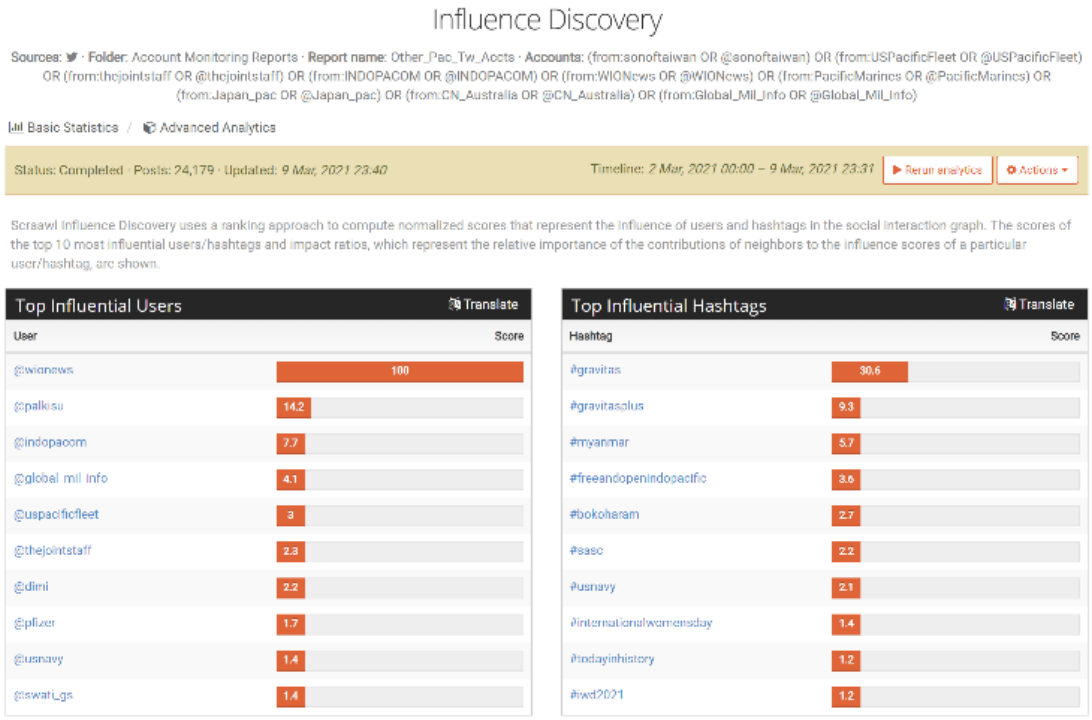



Figure 6. Influence Discovery Graphic. Source: Scraawl (2021)

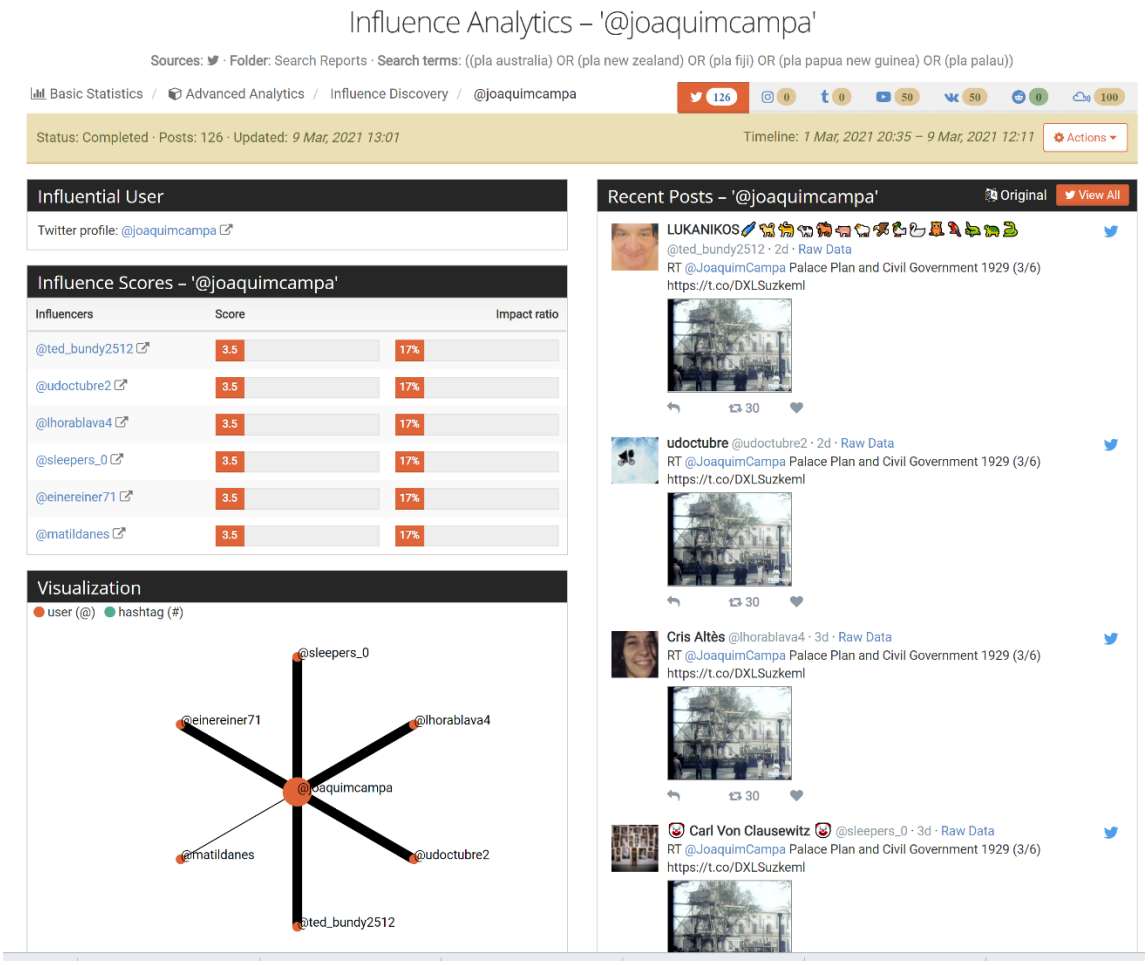



Figure 7. Influence Analytics Graphic Source: Scraawl (2021)

The keyword searches within Scraawl provide the realistic information with which to attribute to the notional strategic scenario. The information received contained actual Twitter profiles, pictures, and other potential PII in the aggregate. However, only the relationships and information that leads to reasonable assumptions of influence in communities was of interest in the project; specific identifiable information and locations of people and organizations was not. The keyword searches are shown in Table 3.

Table 3. Scraawl Keyword Searches

| Scraawl Module | Search Type | Keywords |
|---|---|---|
| SocL | Multi-feed Search | ((dod australia) OR (dod fiji) OR (dod new zealand) OR (dod papua new guinea) OR (dod palau)) |
| SocL | Multi-feed Search | ((prc australia) OR (prc new zealand) OR (prc fiji) OR (prc palau) OR (prc papua new guinea)) |
| SocL | Multi-feed Search | ((pla australia) OR (pla new zealand) OR (pla fiji) OR (pla papua new guinea) OR (pla palau)) |
| SocL | Multi-feed Search | ((us military australia) OR (us military fiji) OR (us military new zealand) OR (us military papua new guinea) OR (us military palau)) |
| SocL | Account Monitoring | @USPacificFleet<br>@thejointstaff<br>@INDOPACOM<br>@PacificMarines<br>@Global_Mil_Info<br>@sonoftaiwan<br>@WIONews<br>@Japan_pac<br>@CN_Australia<br>@SinoDefence<br>@zlj517<br>@CDF_Aust<br>@DeptDefence<br>@Rfmf_Media<br>@ADFinPNG<br>@CDF_PNGDF<br>@IPDefenseForum<br>@NZDefenceForce<br>@CDF_NZ |

## 3. CARVER Metrics

Tables 2 through 9 outlines the metrics that information discovered through Influence Discovery will be evaluated into a CARVER Matrix.

Table 4. Criticality Values

| **Critical Value** | **Scale** |
|---|---|
| Information discovery would significantly impact unit mission or commander's priorities | 5 |
| Information discovery would considerably impact unit mission or commander's priorities | 4 |
| Information discovery would impact unit mission or commander's priorities | 3 |
| Information discovery might impact unit mission or commander's priorities | 2 |
| Information discovery would not affect mission performance | 1 |

Table 5. Accessibility Values

| **Accessible Value** | **Scale** |
|---|---|
| Information freely accessible. No additional interpretation or analysis needed to access. | 5 |
| Information easily accessible without significant effort, analysis, or interpretation. | 4 |
| Information not clearly available but accessible through deduction of available data. | 3 |
| Information not clearly available except through significant effort, analysis, or interpretation of combined or associated data. | 2 |
| Information unavailable/accessible, or unavailable/accessible except through nonstandard analytical techniques. | 1 |

Table 6. Recoverability Values

| **Recoverability Value** | **Scale** |
|---|---|
| Information clearly attributable, undeniable, and accountable | 5 |
| Information easily attributable, undeniable, and accountable with little effort | 4 |
| Information somewhat attributable, undeniable, and accountable with significant effort | 3 |
| Information not easily attributed, can be denied, and potentially accountable | 2 |
| Information not attributable, deniable, and unaccountable with ease | 1 |

Table 7. Vulnerability Values

| **Vulnerability Value** | **Scale** |
|---|---|
| Target populations easily influenced with no effort | 5 |
| Target populations easily influenced with little effort | 4 |
| Target populations may be influenced with effort | 3 |
| Target populations unlikely influenced with effort | 2 |
| Target populations not susceptible to influence or unresponsive to efforts | 1 |

Table 8. Effect Values

| Effect Value | Scale |
|---|---|
| Very high effects of the influence information on a nation's politics, operations, populace, economy, or media. | 5 |
| High influence effects on a nation. | 4 |
| Moderate influence effects on a nation. | 3 |
| Little Influence effects on a nation. | 2 |
| No influence effects on a nation. | 1 |

Table 9. Recognizability Values

| Recognizability Value | Scale |
|---|---|
| Target population easily recognizable by all with no confusion. | 5 |
| Target population easily recognizable by most | 4 |
| Target population recognizable with some training | 3 |
| Target population difficult to recognize; probable confusion | 2 |
| Target population extremely difficult to recognize; unrecognizable susceptibility | 1 |

## C. OPERATIONAL VIGNETTE CASE STUDY

### 1. Strategic and Operational Context

It is 15 JUL 2030 and since 2024 United States naval forces have been securing the nation's interest by countering competitor nation interests and bolstering coalition partners in the Great Sea Region (GSR). Within the GSR, the country of Red is the United States' main rival, while the countries of Blue and Green are friendly, and Yellow remaining neutral. Beginning in the early 2000s, the authoritarian regime of Red has pursued a gradual, regional and global strategy of coercion, ambiguity, and public persuasion to assert territorial claims over the GSR to slowly degrade Western influence from turning Yellow sympathetic to the ideology of the United States. The Red Government sees the U.S. as a threat to its way of life as a faction of the population in Red is now calling for an end to one-party authoritarian rule and hold the country's first democratic elections. The United States, as well as other developed democratic nations continue to pressure Red towards that end and are leveraging partnerships with Green and Blue in the GSR to accomplish this. Red asserted claims throughout the region through various tactics—such as land reclamation, island militarization, and by pursuing legal arrangements and diplomatic

pressure—without triggering military conflict in the region. Green, Blue, and Yellow are historical allies of the United States and have also asserted territorial claims in the GSR (Figure 8).

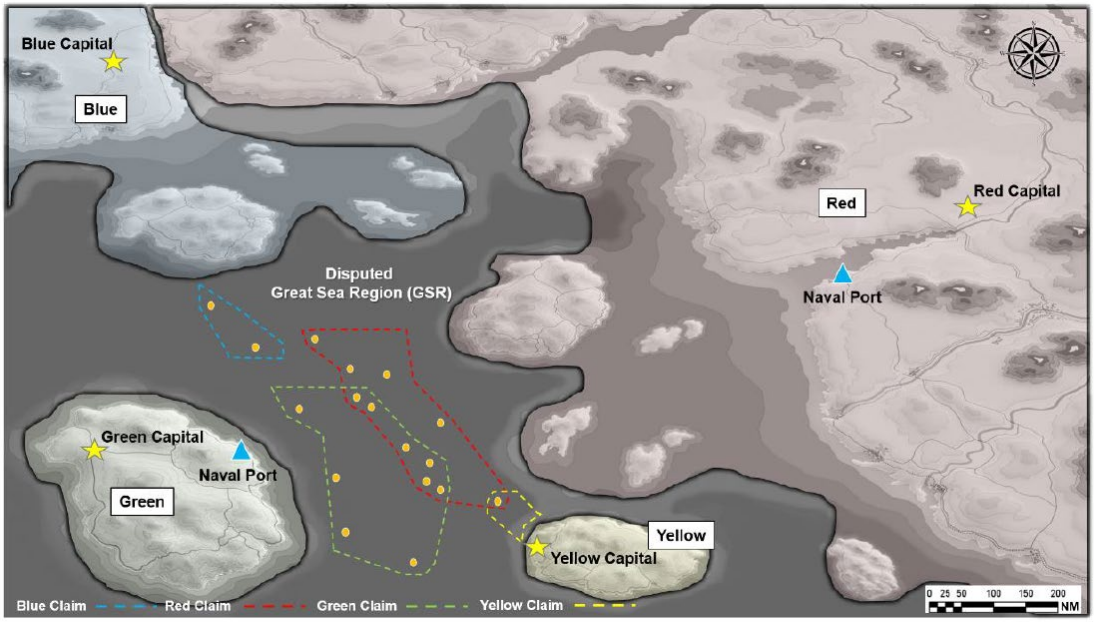



Figure 8. Great Sea Region

It is within the United States' national interest to prevent Red, a historically competitive and adversarial nation, from enforcing its claims in the GSR. Assuring this strategic waterway remains free and open is crucial for global economic stability and for upholding freedom of navigation. However, upon recommendation from regional experts, senior civilian and military leaders decide on a non-military course of action. Red's ability to control key choke points in the GSR would spell strategic failure for the United States as it would result in a significant reordering in the region's balance of power. U.S. Officials see democratically-appointed military leaders as the key to strategic wins in the GSR. It is thus decided that diplomacy and a systematic influence campaign will commence. Preventing Red from controlling the GSR has been a primary objective of the United States since 2014 and is the reason the GSR remains a vital area for U.S. military presence in 2030.

## 2. Situation

Red asserts vast swaths of the GSR to be an indisputable part of its territory. Although Red has been cautious in asserting sovereignty, the highest tension has been between Red and Green over the last 10 years (USMC, 2020). Red sees the biggest threat to achieving its destiny as failing to achieve strong national unity. To achieve this, Red enforces an aggressive policy of controlling information within its borders and protesting foreign narratives that run counter to its state-provided messages. Red views the United States' presence in the GSR as a threat to how its citizens view the legitimacy of the authoritarian regime and its ability to expand Red's influence in the region and globally (USMC, 2020). As a result, there are indications Red may increase pressure in the GSR and assert firm control over its claims to threaten freedom of navigation throughout the region (USMC, 2020).

Of late, there has also been a strong societal shift towards individual rights and social liberties in Red. It is historically suppressed women's right to vote, driving, involvement in politics, government, and other areas of societal influence. Brought about by international pressure and influence from the United States and other nations, large protest groups are organizing into a movement where thousands of women and demonstrators are planning marches and protests against the authoritarian Red regime.

### *a. Adversary (Red) Situation*

Red has used the ESG's presence to promote the narrative of American imperialism and has accused the United States of meddling in Red's internal affairs by aiding Green and Blue to counter Red's assertion over its "sovereign territory" in the GSR (USMC, 2020). Since the ESG was established in 2024 Red has:

- Conducted "public opinion warfare" through an aggressive propaganda and disinformation campaign to discredit the Task Groups' presence in Green and the GSR. Targets of this campaign include: U.S. political leaders (national, state, and local), the U.S. population writ large, and U.S. Navy, Marine Corps, and Coast Guard leaders, ESG units operating in

Green and Blue, as well as leaders and people in Green, Blue, and Yellow (USMC, 2020).

- Militarized numerous islands in the disputed areas of the GSR and conducted aggressive naval patrolling and joint exercises from these islands to demonstrate competency in controlling the sea lanes of communication through the GSR.
- Used its "shadow militia"—a secret government force to conduct surveillance, collect intelligence, and enforce Red's claims of sovereignty and status quo against the women's movement through intimidation in the most liberal and populous areas of the GSR.
- Conducted civil infrastructure projects in Blue to create a wedge between Blue and Green.

# IV. RESULTS AND ANALYSIS

## A. RESULTS FROM KEYWORD SEARCHES

The following six sections outline prominent information extracted from the data retrieved from the Scraawl keyword searches. Analysis of this data will facilitate population of the final CARVER Matrix for the operational vignette case study, adhering to the metrics from Tables 4 through 9. The Basic Statistics for Keyword Search 1 are captured in Figure 9.

### 1. Keyword Search 1: ((dod australia) OR (dod fiji) OR (dod new zealand) OR (dod papua new guinea) OR (dod palau))

#### *a. Basic Statistics*

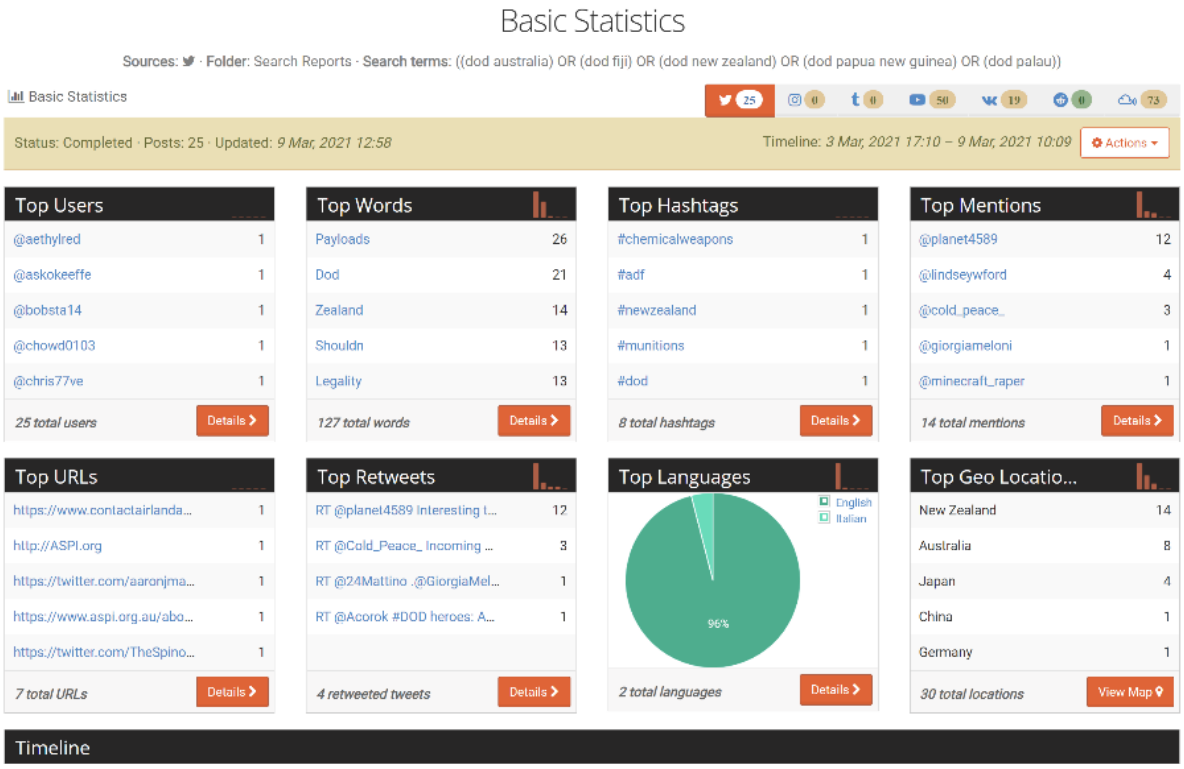



Figure 9. Keyword Search 1: Basic Statistics. Source: Scraawl (2021)

The results from the Multi-feed generated 25 matching posts over a seven day period. There were no users that showed prominence over the others for these keywords. However, user @planet4589 was mentioned in three times as many posts than the next referenced user. In addition, this same user was retweeted many times in the search, with half of all tweets (14 out of 28) as geo-referenced to New Zealand. Word statistics showed the word "payload" (26 times used out of 127 words) as the most used word, followed by "DOD" (21 times used) and "Zealand" (14 times used).

### *b. Mention Statistics*

Indicated in Figure 10 are Mention Statistics, annotating total mentions, percent of total mentions, percent of total posts, and recent posts that involve user @planet4589. From this search, and related to the keywords, the mention statistics indicate that 40% of all mentions involved @planet4589. This is a significant portion of engagement from the community specifically referencing @planet4589. This suggests a high measure of influence.

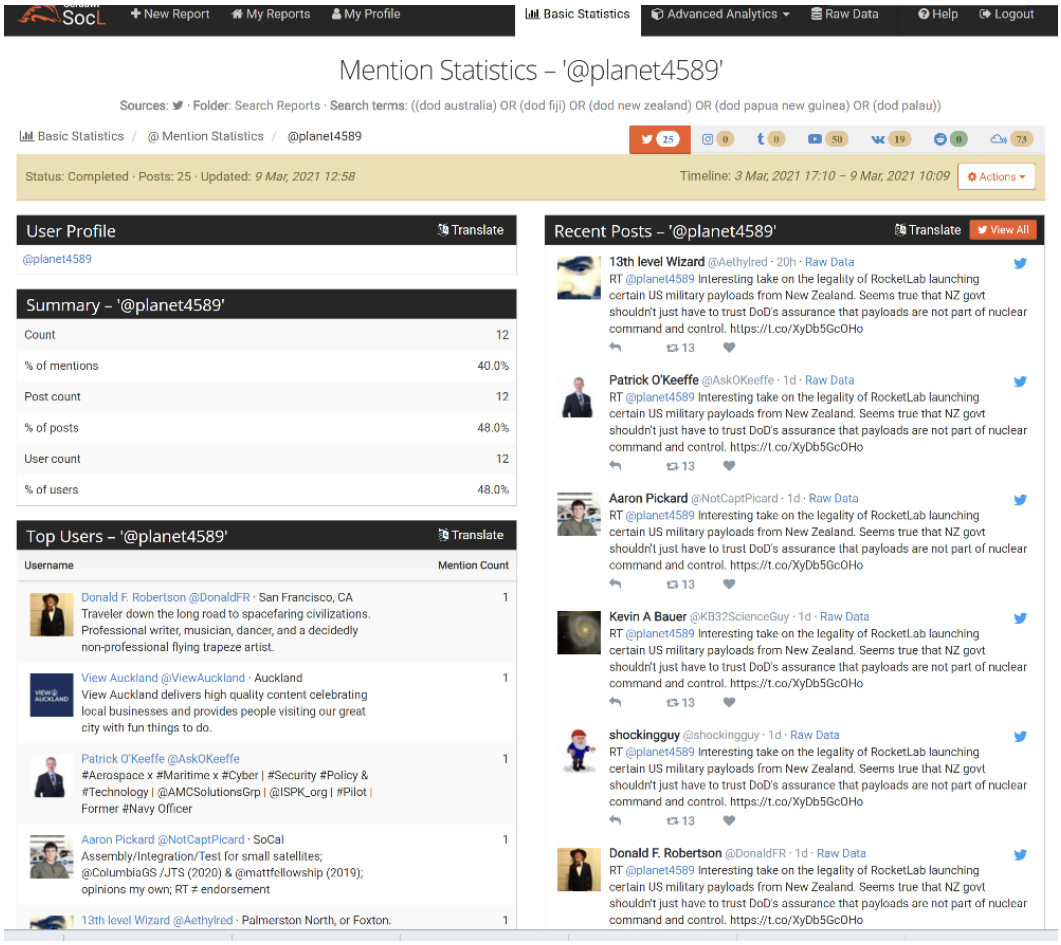



Figure 10. Keyword Search 1: Mention Statistics. Source: Scraawl (2021)

### *c. Retweet Statistics*

Like the above discussions, retweets indicate affirmation of communications, and are a useful metric of influence. In addition, the tweet from @planet4589 that references the Rocket Lab news story demonstrates skepticism at the DOD's motives for the Rocket Lab launches and could be viewed as a more progressive viewpoint (Figure 11).

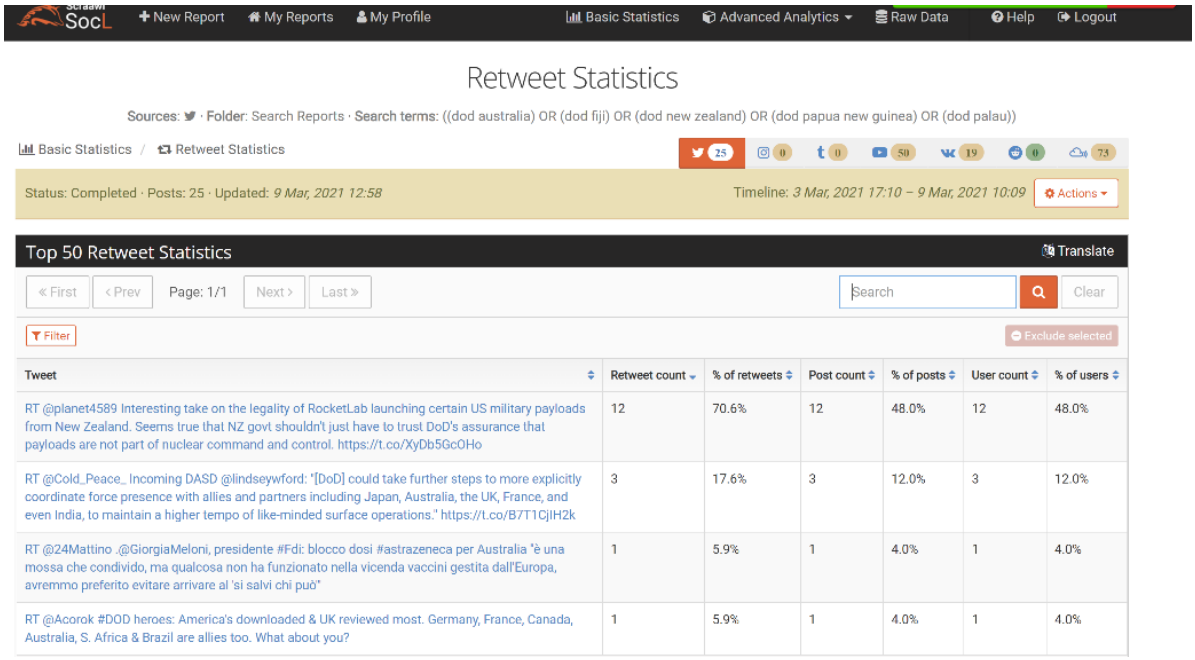



Figure 11. Keyword Search 1: Retweet Statistics. Source: Scraawl (2021)

### *d. Locations*

Each post potentially has three different types of geographic data associated with it:

- A "geo-code" if there's a latitude / longitude associated in the post (from a check-in or use of other location services);
- A "geo-profile" from the location in the user's profile; and / or
- A "geo-reference" - any geographic location mentioned in the user's post

Each type of data can tell a different story about the collected data. Furthermore, a post can appear on the map multiple times depending on the geo data it includes. The location data included below comprises geo-referenced data only. From the Scraawl SocL subsection "Locations" that overlays tweet data on a map, it is seen that zero posts were geo-coded, 30 geo-referenced, and zero geo-profiled (Figure 12).

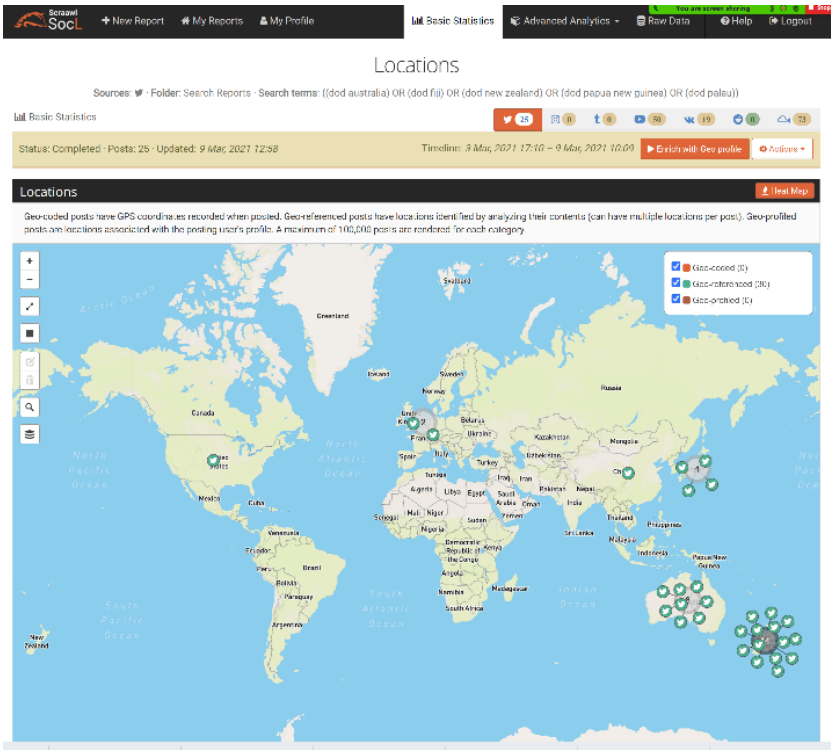



Figure 12. Geographic Tweet Data Organized by Data Type. Source. Scraawl (2021)

### *e. Influence Discovery*

The Influence Discovery leverages ranking to provide a visual of a user's influence ranking in a specific community based on the keywords used in the search. User @planet4589 ranked 100% on the influence scale for this search topic (Figure 13).

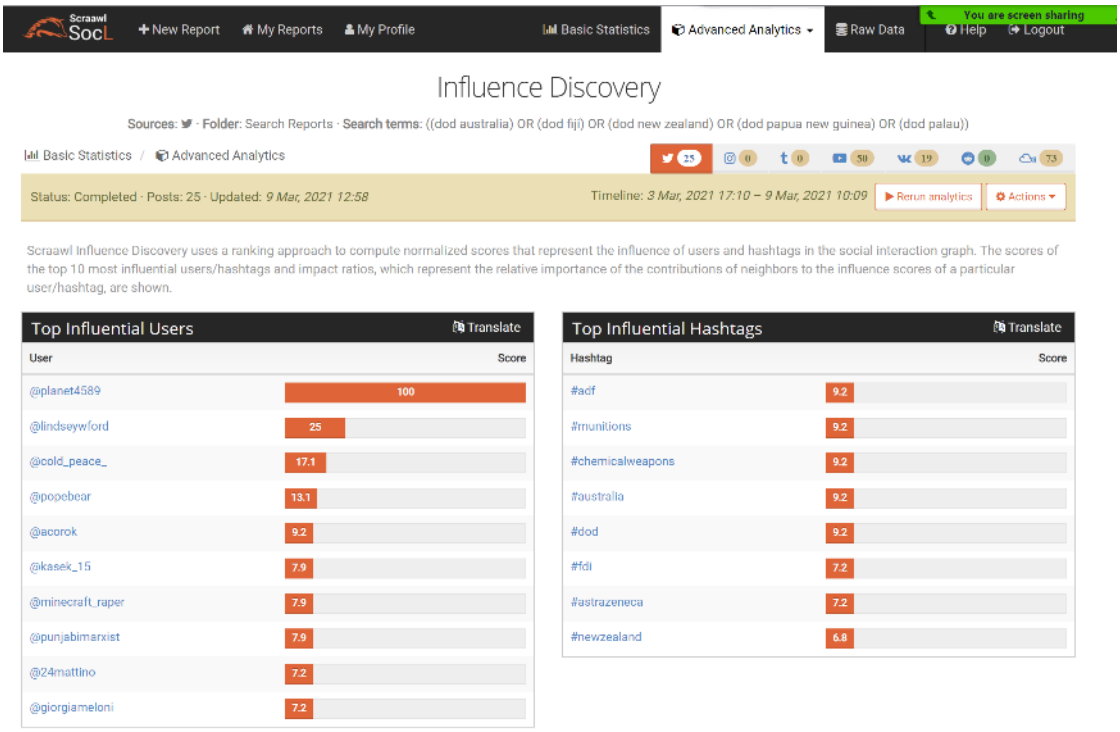



Figure 13. Keyword Search 1: Influence Discovery. Source: Scraawl (2021)

### *f. Community Metrics and Detection*

The following two figures show user @planet4589's influence scores relating to his closest neighbors. Of note, user @planet4589 is directly linked to users @askokeeffe and @aethylred. These three users compose the biggest community for this keyword search. Community Detection visualization (Figure 15) social graph shows the relative community strength of each community when compared to the others. The largest community contains 13 members and carries the most influence among these circles. The average community within this search contains four members.

In generating these influence metrics, Scraawl computes all normalized scores for a community and ranks users by influence score (Intelligent Automation, Inc., 2020a). The influence score is computed directly from degree comparisons which allows for ranking of a user's connectedness, referencing the social network graph (Figures 14 and 15). User @planet4589 ranks highest for degree within his community (Figure 16), although there

were several other smaller communities that were generated through this keyword search. Figures 17 and 18 provide enhanced analysis of user @planet4589's community influence.

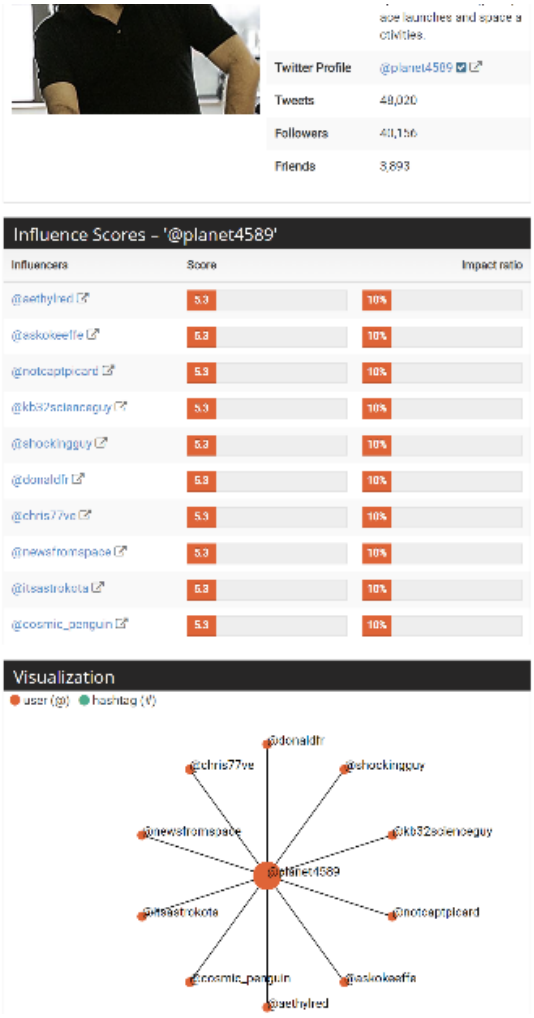



Figure 14. Keyword Search 1: Comparative Influence Scores for user @planet4589. Source: Scraawl (2021)

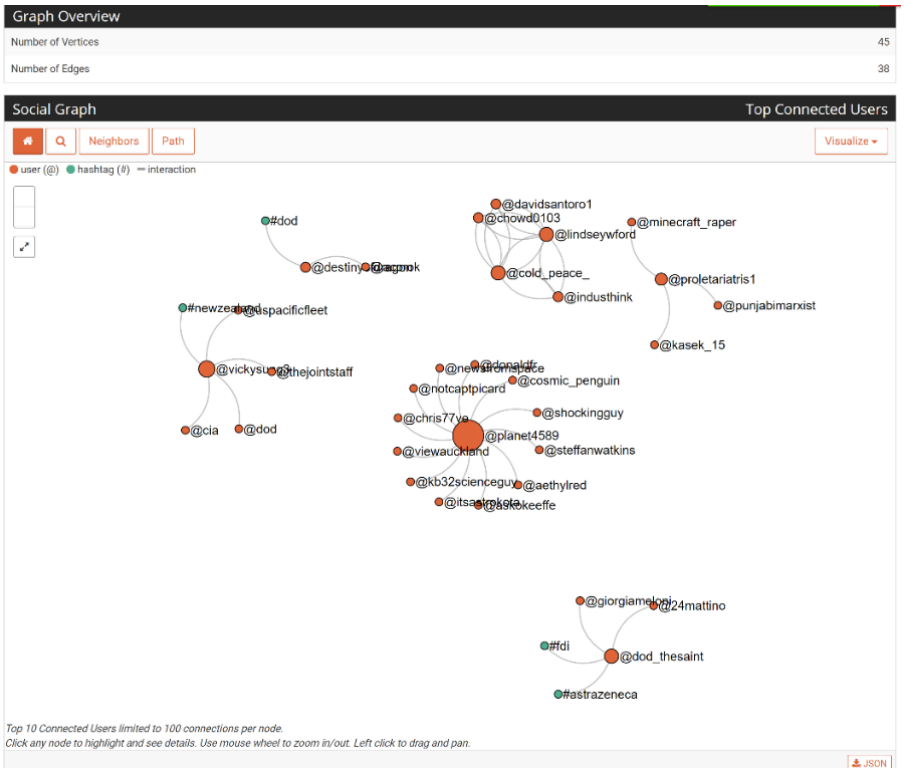



Figure 15. Social graph for user @planet4589's social cluster. Source: Scraawl (2021)

**Top Connected Users**

| Label | Degree |
|---|---|
| @planet4589 | 12 |
| @vickysung3 | 5 |
| @dod_thesaint | 4 |
| @lindseywford | 4 |
| @cold_peace_ | 4 |
| @proletariatris1 | 3 |
| @davidsantoro1 | 2 |
| @chowd0103 | 2 |
| @industhink | 2 |
| @destinyofdragon | 2 |

Figure 16. Top Connected Users by Degree. Source: Scraawl (2021)

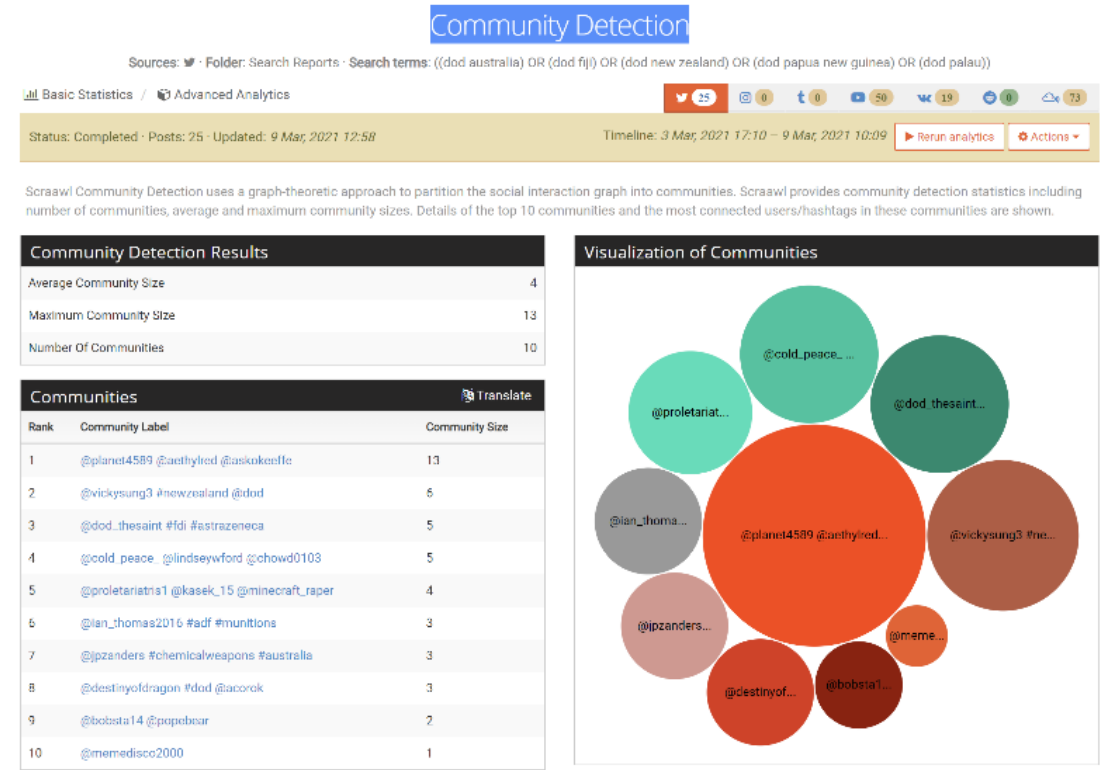



Figure 17. Keyword Search 1: Community Detection Metrics and Visualization. Source: Scraawl (2021)


Figure 18. Keyword Search 1: Community Analytics for top three users in community. Source: Scraawl (2021)

User @planet4589's community is the largest in the overall social graph for Keyword Search 1. The centrality of user @planet4589 demonstrates influence as he functions as the primary information conduit within this community. Directionality of the edges was not considered, although would enhance the understanding of the social graph.

## 2. Keyword Search 2: ((prc australia) OR (prc new zealand) OR (prc fiji) OR (prc palau) OR (prc papua new guinea))

### *a. Basic Statistics*

The results from the Multi-feed Search generated 156 matching posts over a seven-day period. User @tommy_cleary tweeted the most in these search results, although was not highly ranked for mentions and retweets. This user @eluttwak was the most mentioned and retweeted by far among all users in this search. In addition, this same user was retweeted many more times in the search, with the overwhelming majority (over 11.5 times as many as the next highest) of retweets for this search originating with @eluttwak. Of the 354 locations referenced in this search, 164 (46.3%) of them have geographic association to Washington, D.C., 122 (34.4%) are geographically associated with China, 42 (11.8%) to Australia, with the remaining 7.3% allocated to multiple other nations. The top words used mirrored the top locations with the top four words being "Washington" (D.C.), "PRC," "Australia," and Beijing (Figure 19).

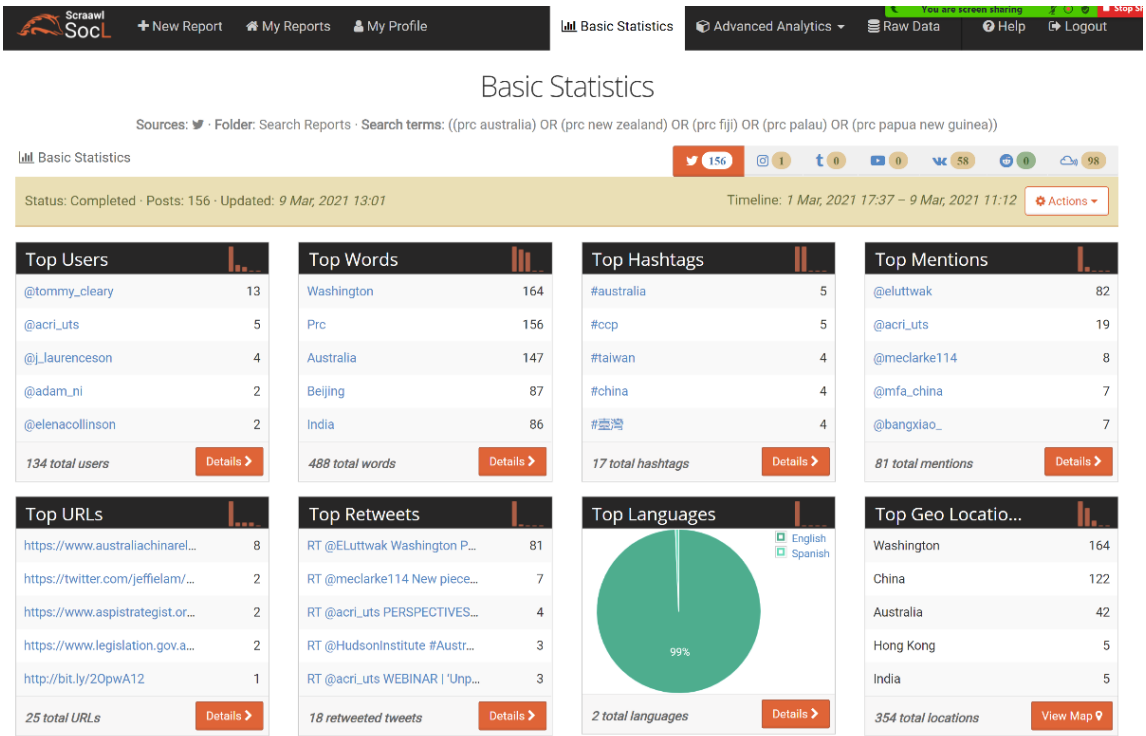



Figure 19. Keyword Search 2 Basic Statistics. Source: Scraawl (2021)

### *b. Mention Statistics*

One-third of the user mentions in this keyword search (82 mentions) belong to user @eluttwak which constitute 34.9% of the total. Half of all user posts (52.6%) in this search mention @eluttwak. The next highest user mentioned is @acri_uts with 19 mentions, that make up just 8.1% of total mentions in this keyword search (Figures 20 and 21).

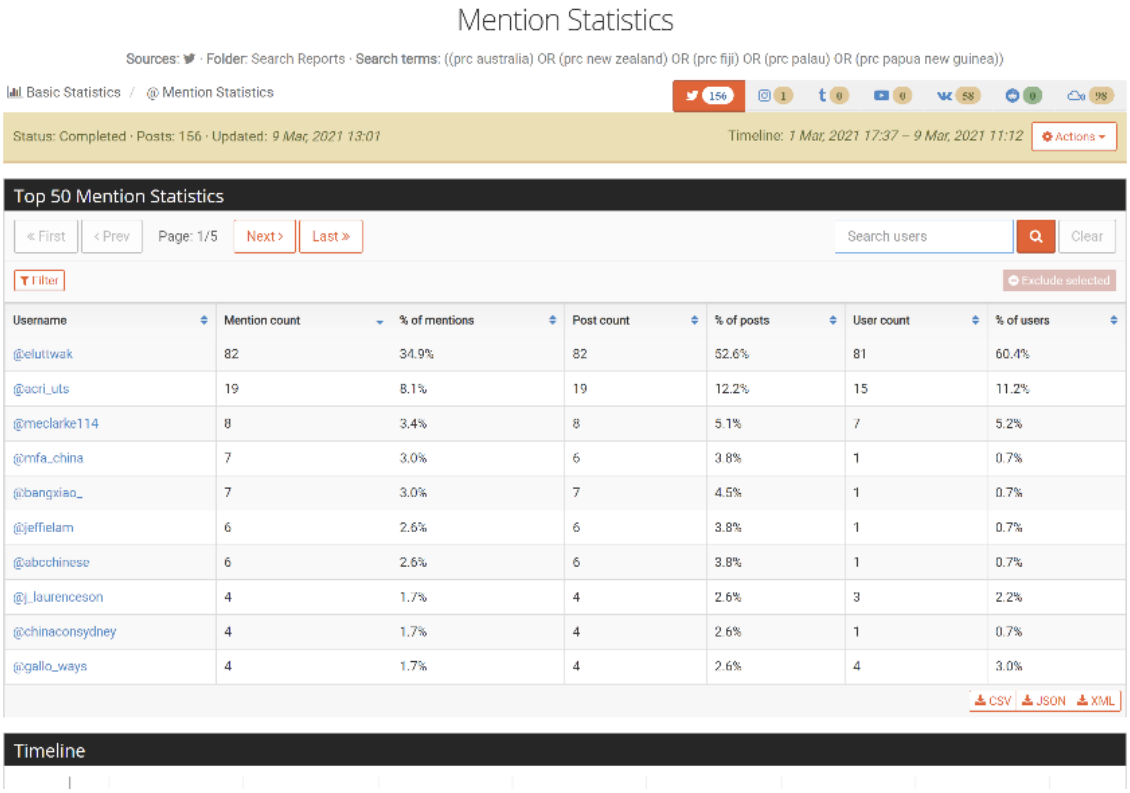



Figure 20. Keyword Search 2 Mention Statistics. Source: Scraawl (2021)

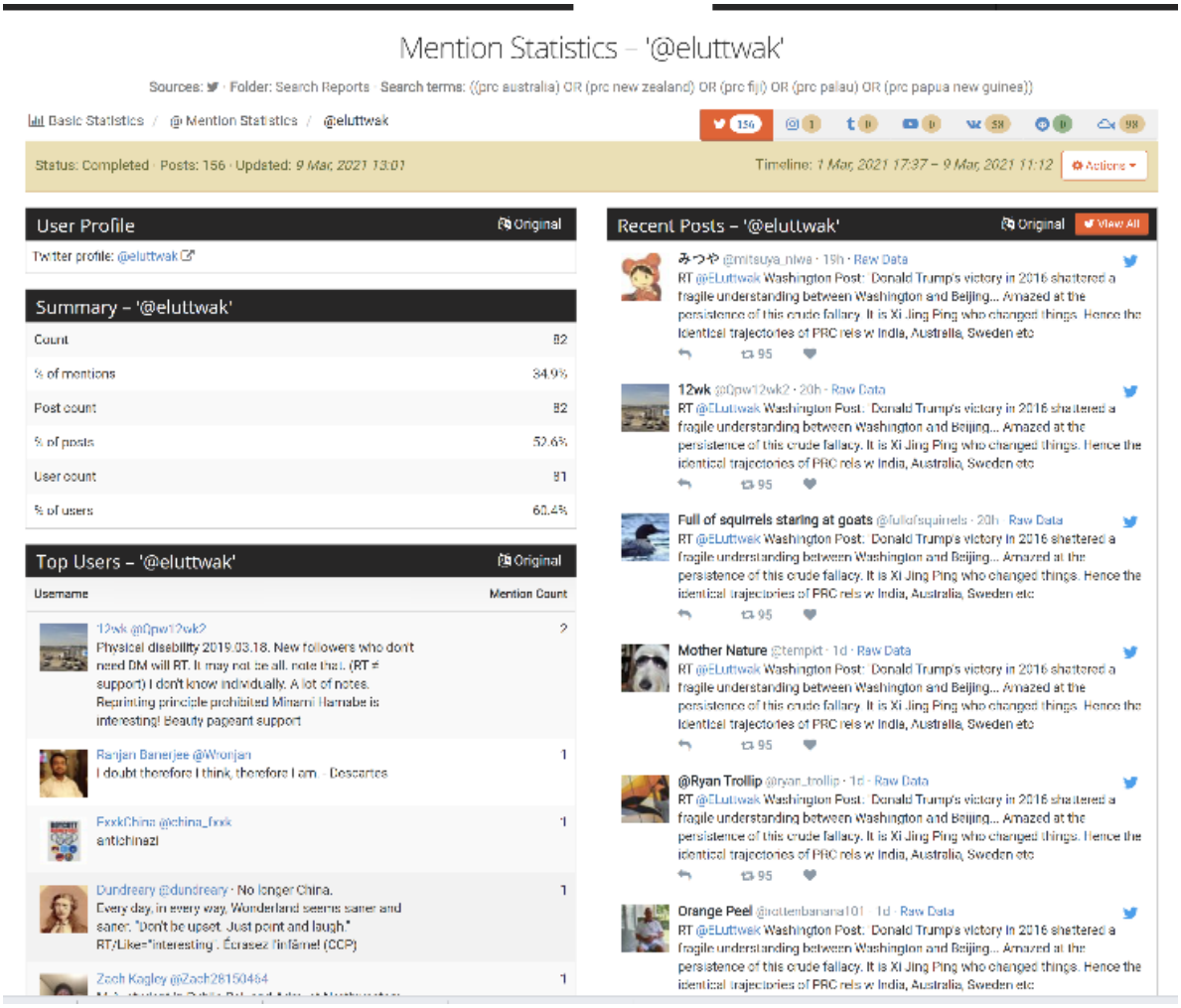



Figure 21. User @eluttwak's Mention Statistics. Source: Scraawl (2021)

### *c. Retweet Statistics*

A story comparing Chinese influence across time originally tweeted by User @eluttwak was retweeted 81 times during this search. That constituted 71.1% of all retweets and more than half of all posts in this search (51.9%). These would suggest a high amount of trust in User @eluttwak based on the large number of individuals recycling the tweet. The user is a historian based in Bolivia. The knowledge of history and status as a third-party observer would bolster his reasons for informed and fair observations, which would favorably explain the trust in his tweets (Figures 22 and 23).

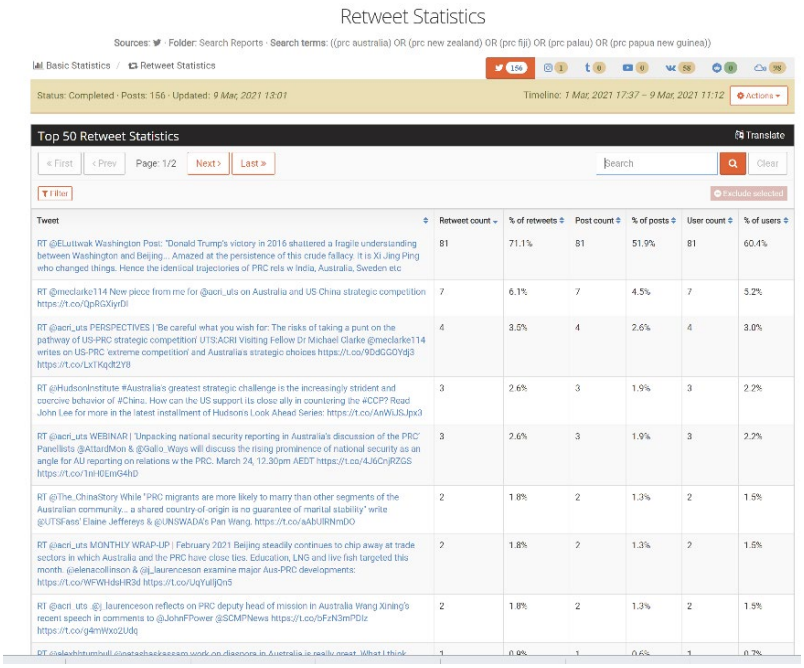



Figure 22. Keyword Search 2 Retweet Statistics. Source: Scraawl (2021)

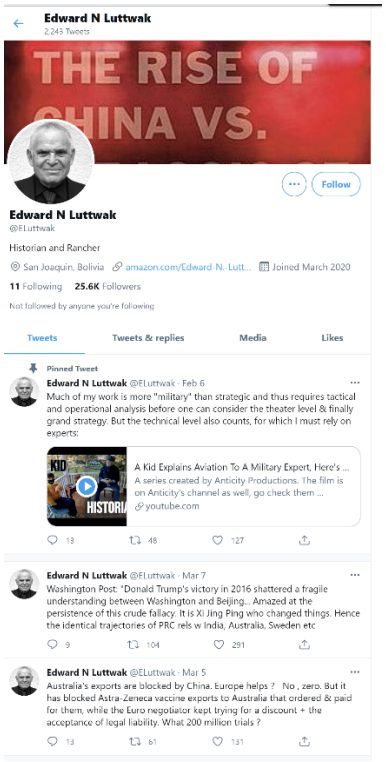



Figure 23. Twitter Profile Analysis: @eluttwak. Source: Scraawl (2021)

### *d. Locations*

Each location map tells a different story about the collected data. Furthermore, a post can appear on the map multiple times depending on the geo data it includes. Figure 24 comprises geo-referenced data only. From the Scraawl SocL subsection “Locations” that overlays tweet data on a map, it is seen that zero posts were geo-coded, 30 geo-referenced, and zero geo-profiled.

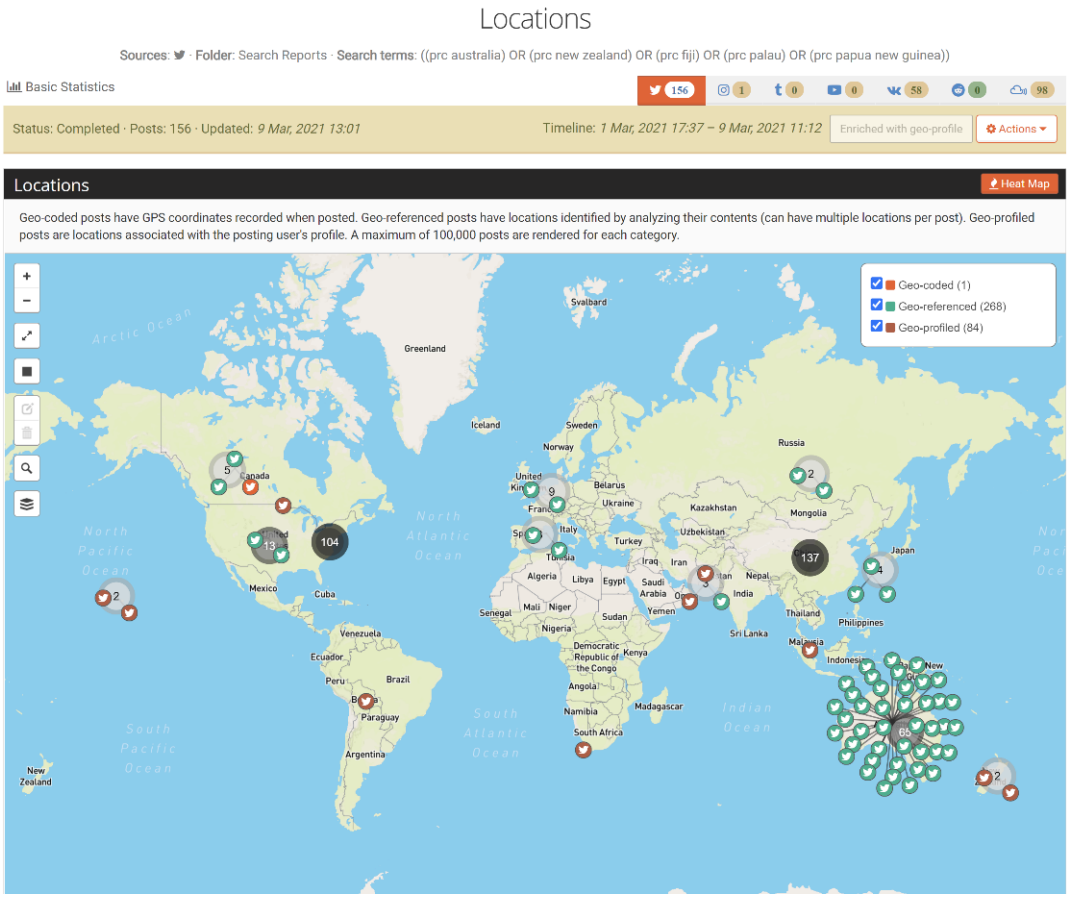



Figure 24. Keyword Search 2 Geographic-associated Tweets. Source: Scraawl (2021)

The composition of the geographically associated tweet data shows a high preponderance of tweets in Washington, D.C., China, and Australia. This corresponds strongly to the top word statistics and loosely to the top hashtag statistics. One tweet is shown as geocoded

(Canada), and the geo-referenced (268 total tweets globally, green color) and geo-profiled tweets (84 total tweets globally, brown) are largely divided between the United States (117 tweets), China (137 tweets), and Australia (65 tweets).

### *e. Influence Discovery*

The Influence Discovery score matches the level of influence by user degree as measured on the social graph. User @eluttwak ranked 100% on the influence scale for this search topic. This is consistent as he is the most connected user in the community with nearly double the degree of the next closest influencer (Figures 25–27).

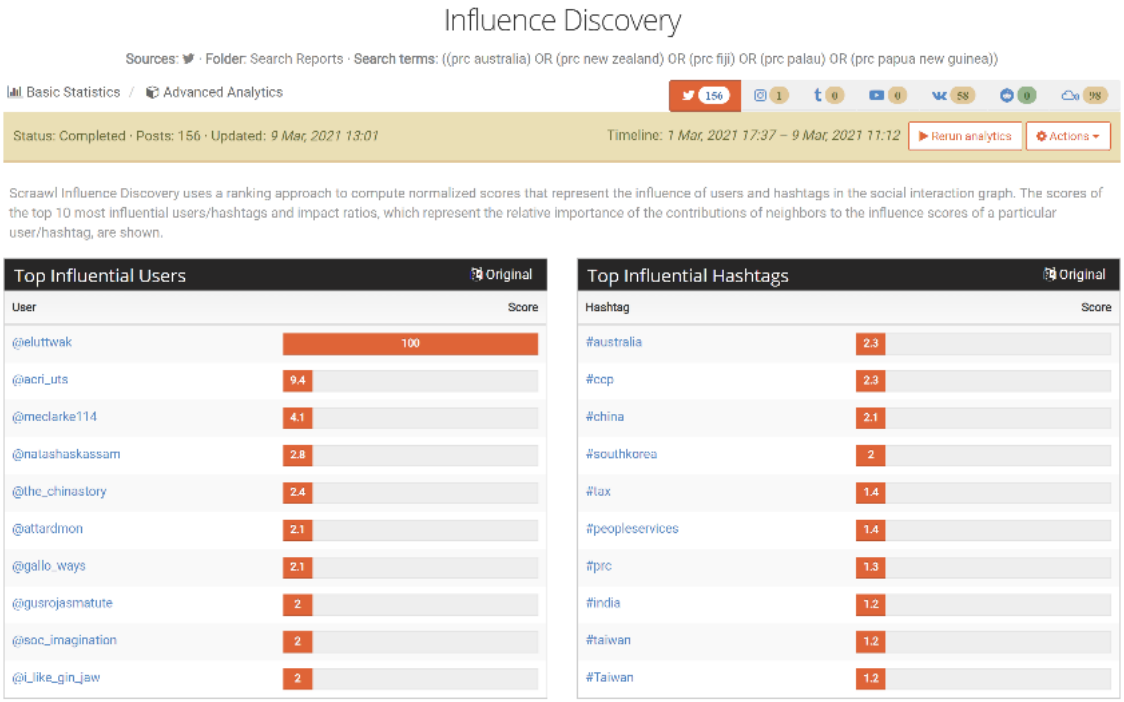



Figure 25. Keyword Search 2 Influence Discovery Metrics. Source: Scraawl (2021)

## Top Connected Users

| Label | Degree |
|---|---|
| @eluttwak | 81 |
| @tommy_cleary | 42 |
| @acri_uts | 23 |
| @meclarke114 | 8 |
| @elevtechlift | 7 |
| @j_laurenceson | 7 |
| @mediaactive | 6 |
| @thekidneydocto1 | 6 |
| @hudsoninstitute | 6 |
| @johnblaxland1 | 5 |

Figure 26. Top Connected users for Keyword Search 2. Source: Scraawl (2021)

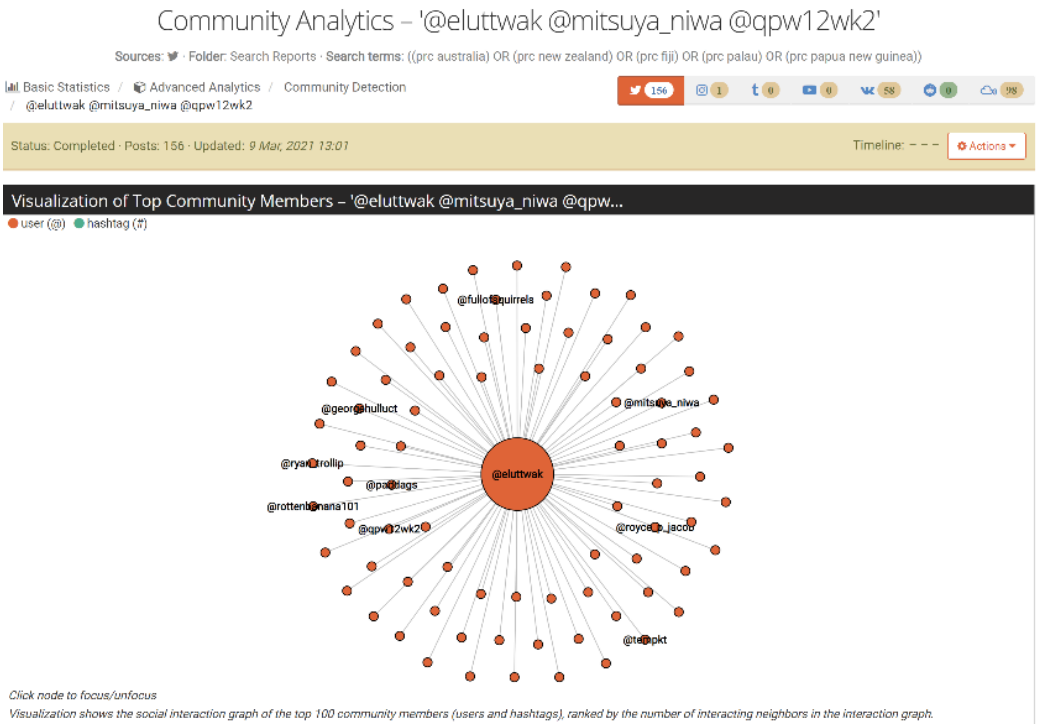



Figure 27. Social Graph for User @eluttwak. Source: Scraawl (2021)

### *f. Community Metrics and Detection*

The Community Detection visualization (Figure 28) shows the relative community strength of each community when compared to the others. The largest community contains 82 users and carries the most influence among these circles. The average community within this search contains eight members with 27 total communities discovered.

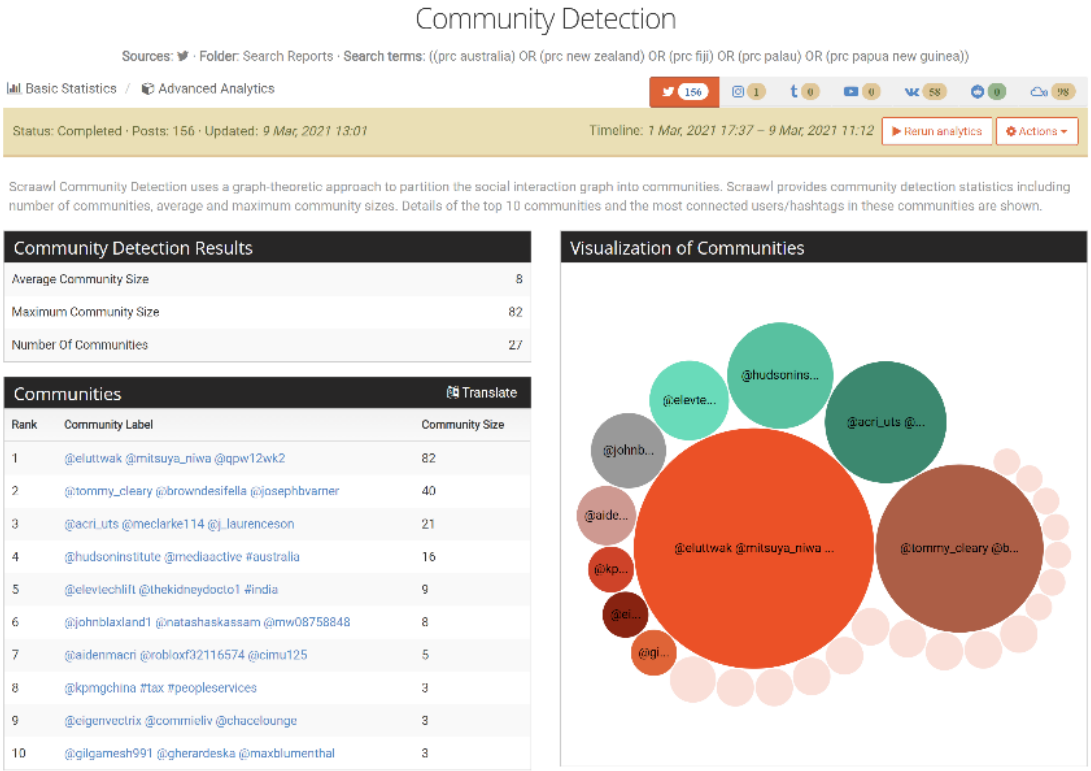



Figure 28. Keyword Search 2 Community Detection Visualization. Source: Scraawl (2021)

### 3. Keyword Search 3: ((pla australia) OR (pla new zealand) OR (pla fiji) OR (pla papua new guinea) OR (pla palau))

#### *a. Basic Statistics*

The results from the Multi-feed Search generated 126 matching posts over a seven-day period. There were no clear preferred users, and hashtags, mentions, or URLs among data of the same type. Top words included *palau, pla, social, and avul* and top hashtags included *#diainternacionaledeladona, #8m, # diadeladona, #8m2021.* Retweets and geographic data showed the clearest potential for salient information (Figure 29). Figure 30 gives a closer look at user statistics.

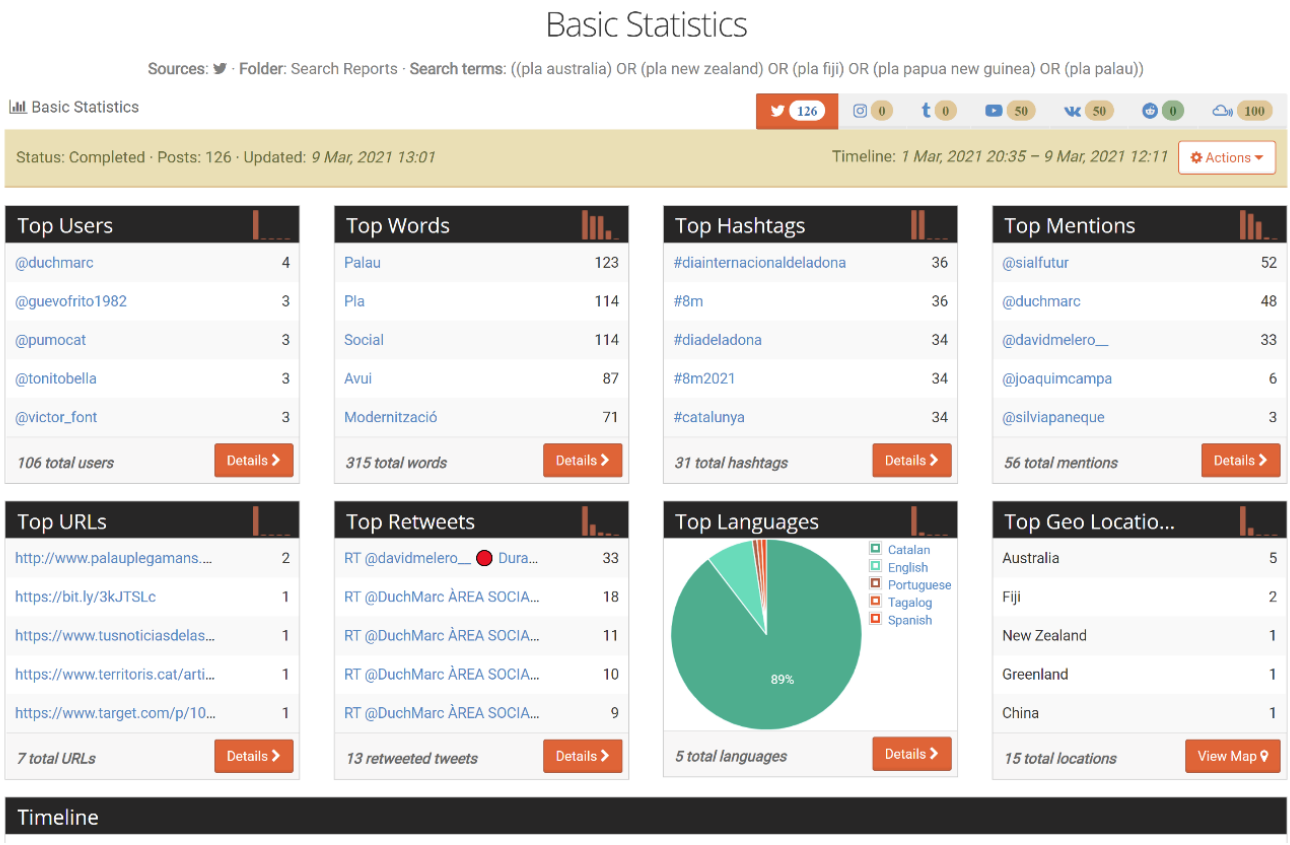



Figure 29. Keyword Search 3: Basic Statistics. Source: Scraawl (2021)

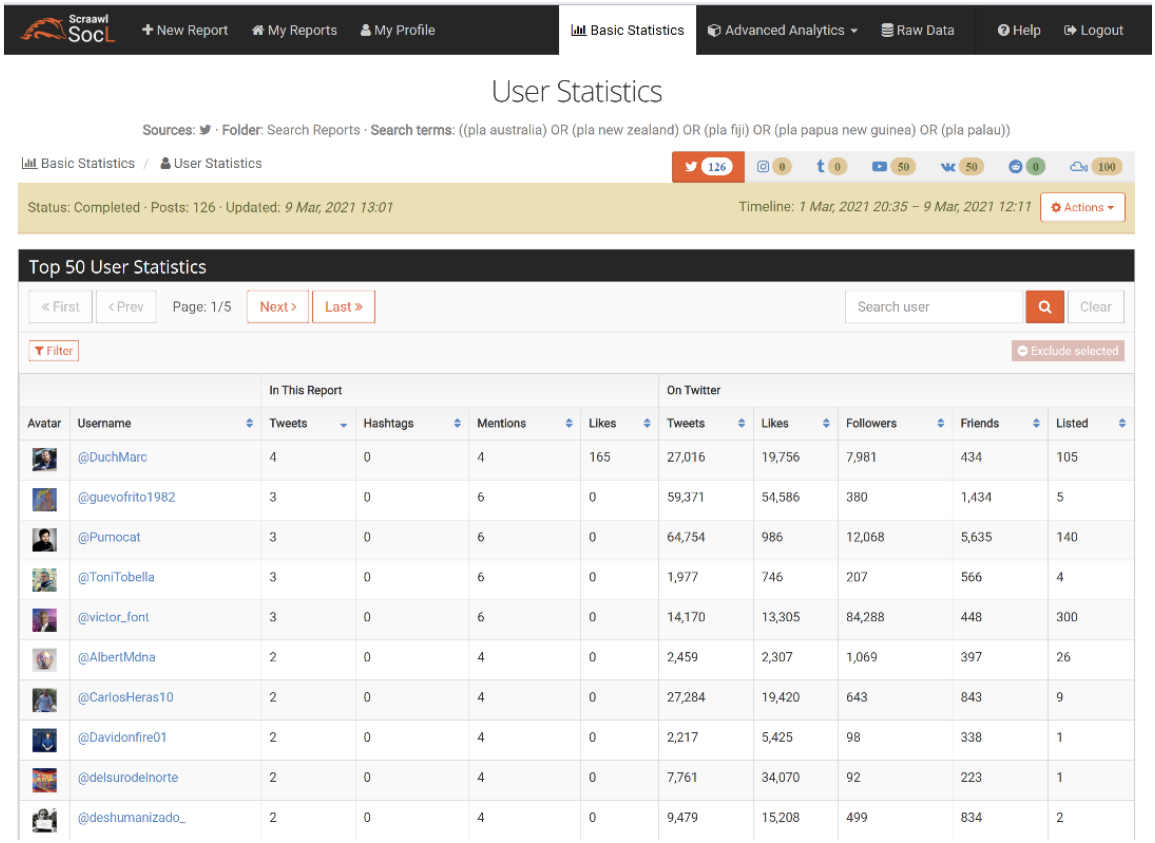



Figure 30. Keyword Search 3: User Statistics. Source: Scraawl (2021)

### *b. Mention Statistics*

The top three accounts (@sialfutur, @duchmarc, and @davidmelero_) comprise two-thirds of all mentions for this search. Two of those accounts belong to photojournalists. Ninety-four percent of individuals mentioned one of these individuals in this search (Figure 31).

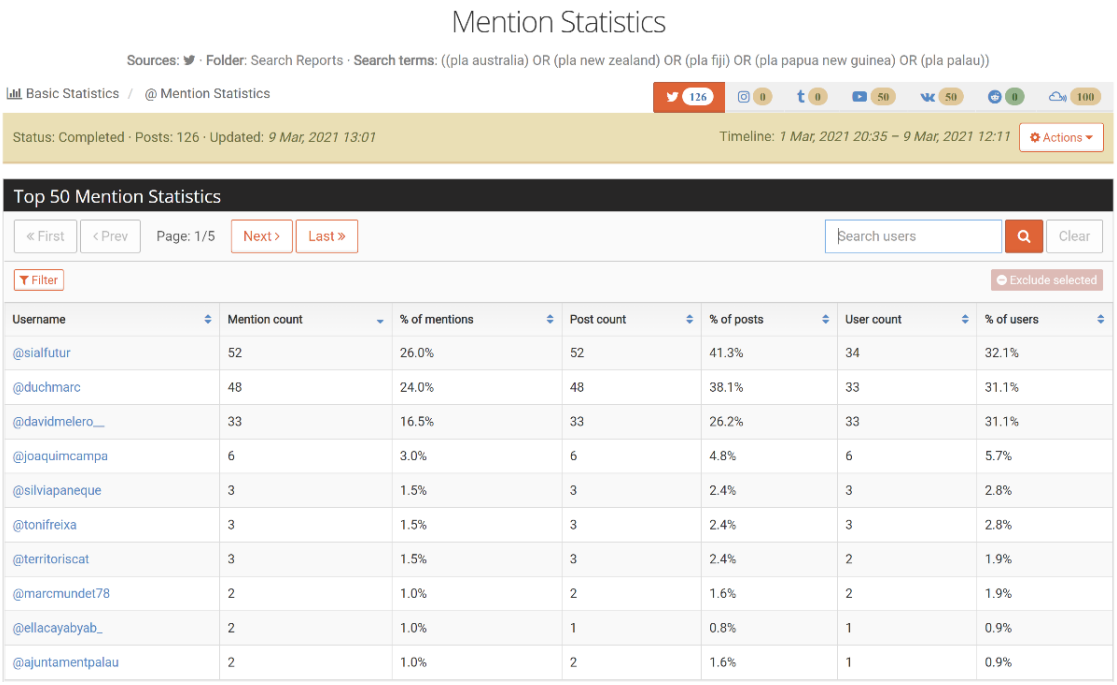



Figure 31. Keyword Search 3: Mention Statistics. Source: Scraawl (2021)

### *c. Retweet Statistics*

Most significant in the retweets is a story retweeted by user @davidmelero__ describing a tense interaction between the national police (Figure 32). The retweeting of this story displays solidarity with the demonstrators in a sign of support. The other prominent retweets are all the same with permutations on the tweet text, artificially inflating their impact.

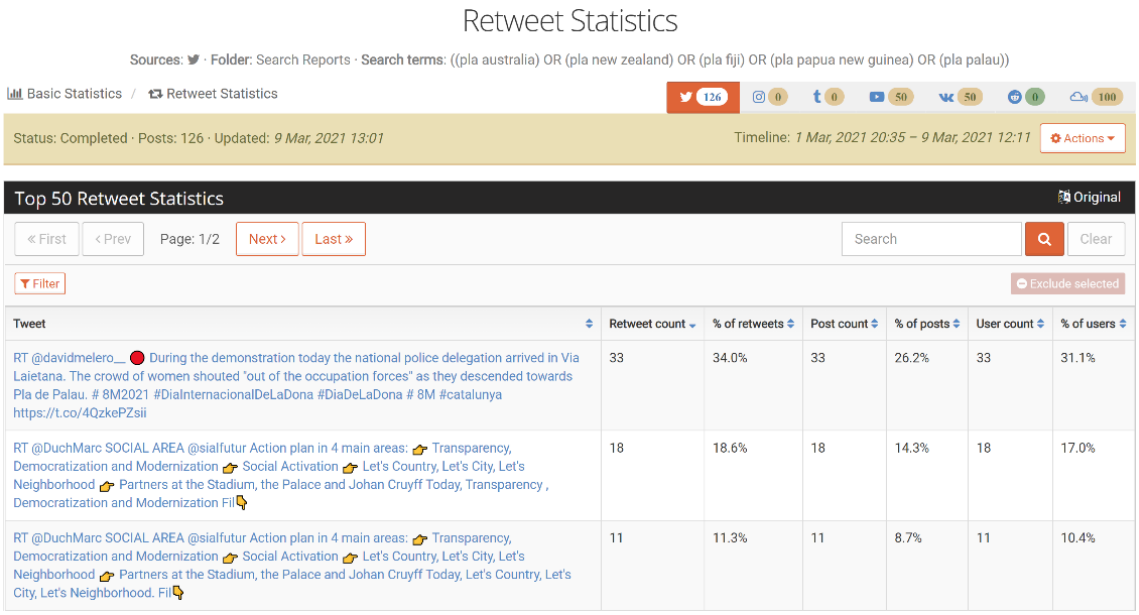



Figure 32. Keyword Search 3: Retweet Statistics. Source: Scraawl (2021)

### *d. Locations*

The geographically associated tweet data totals 89 tweets, 75 of which are geo-profiled and 14 are geo-referenced (Figure 33). The largest preponderance of tweets (48 tweets, geo-profiled) originated in Barcelona, Spain (Figure 34). This is unsurprising, though, as the top tweets during this time mentioned March 8th (International Women's Day) or Barcelona Futbal. User @sialfutur is running for president of the Barcelona Futbal club, boasting 93,000 followers. This demonstrates significant following and influence in this keyword search.

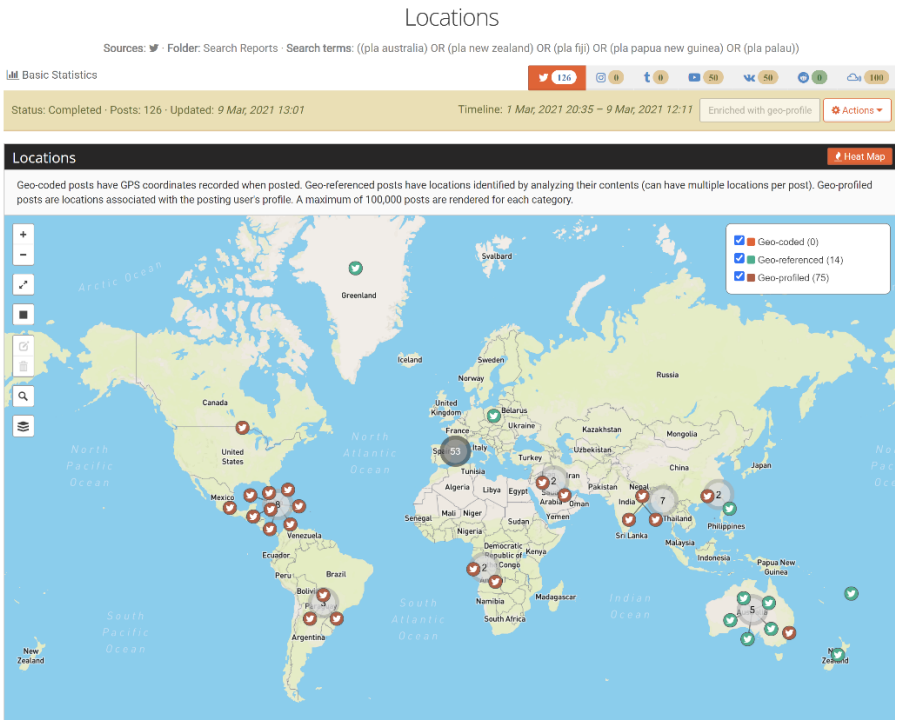



Figure 33. Keyword Search 3: Locations. Source: Scraawl (2021)

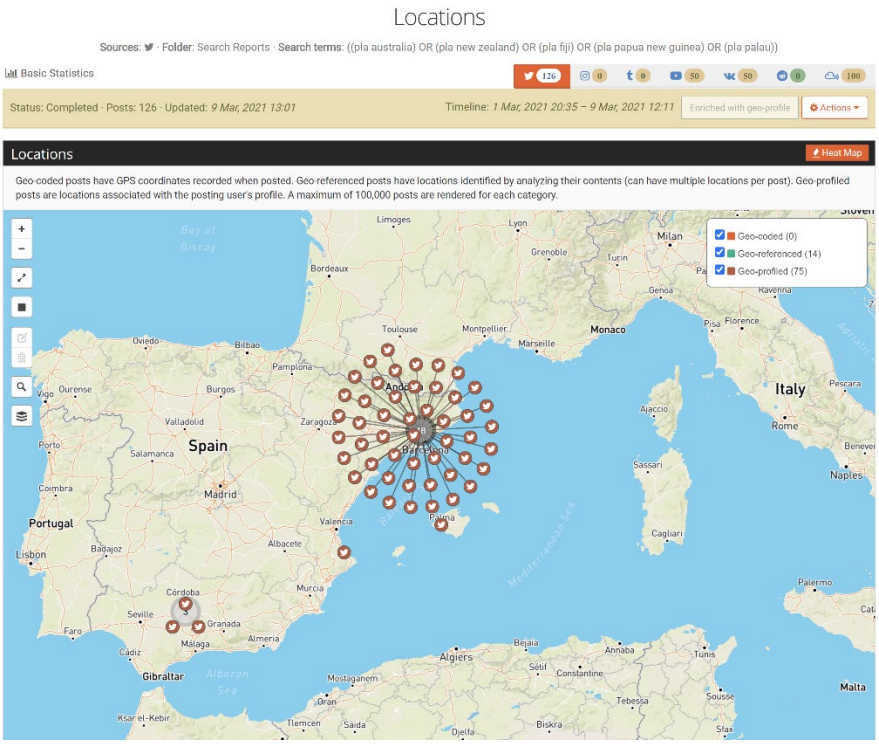



Figure 34. Keyword Search 3: Locations (Barcelona). Source Scraawl (2021)

### *e. Influence Discovery*

The Influence Discovery analytic shows users @sialfutur and @duchmarc as most influential in their community (Figures 35–37). This measured, again, via normalized values representing the interactions of users and hashtags (Intelligent Automation, Inc., 2020b).

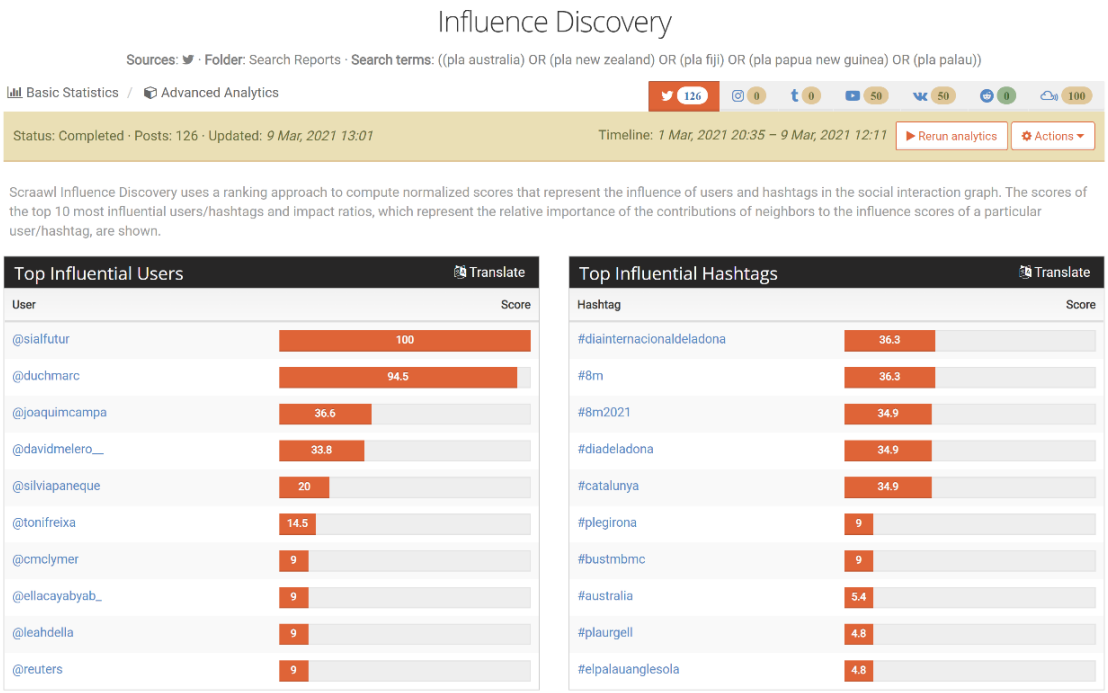



Figure 35. Keyword Search 3: Influence Discovery. Source. Scraawl (2021).


Figure 36. Keyword Search 3: Social Graph. Source: Scraawl (2021).

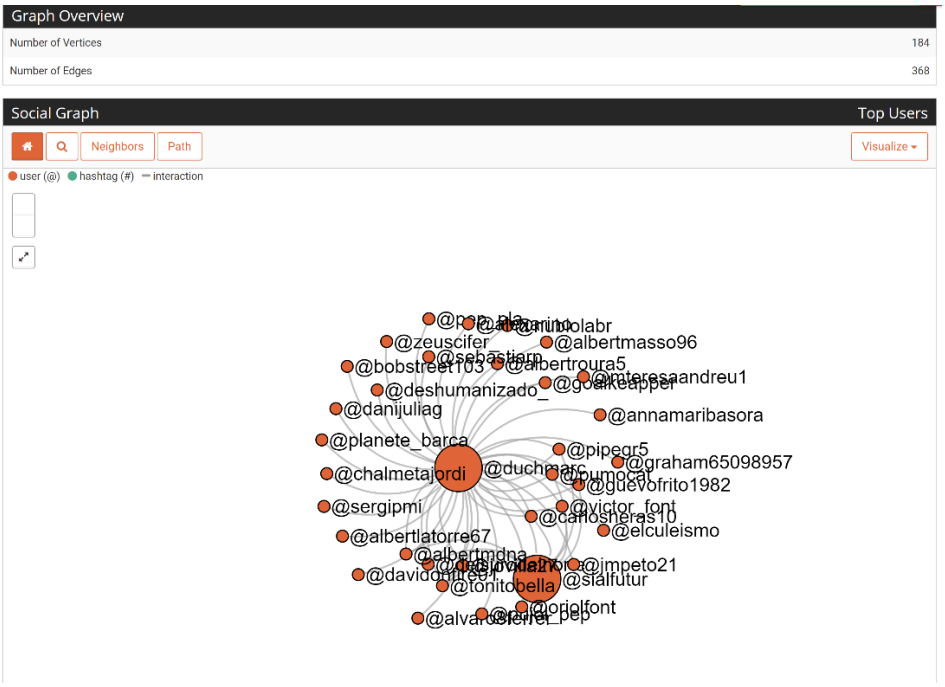



Figure 37. Keyword Search 3: Influencer's Social Graph. Source: Scraawl (2021)

The Top Connected User for this search is @davidmelero___ with a degree ranking of 38. Users @duchmarc and @sialfutur each ranked a degree of 34. The social graph includes 184 vertices and 368 edges. Of note, these communities are not all connected, but rather have individual components of centrality that do not interact with one another.

### *f. Community Metrics and Detection*

The largest community comprises 39 members, with the average community size of seven. There were 27 total communities discovered. Users @davidmelero__ and the hashtags #diainternacionaldeladona and #8m were included in the most prominent community (Figure 38).

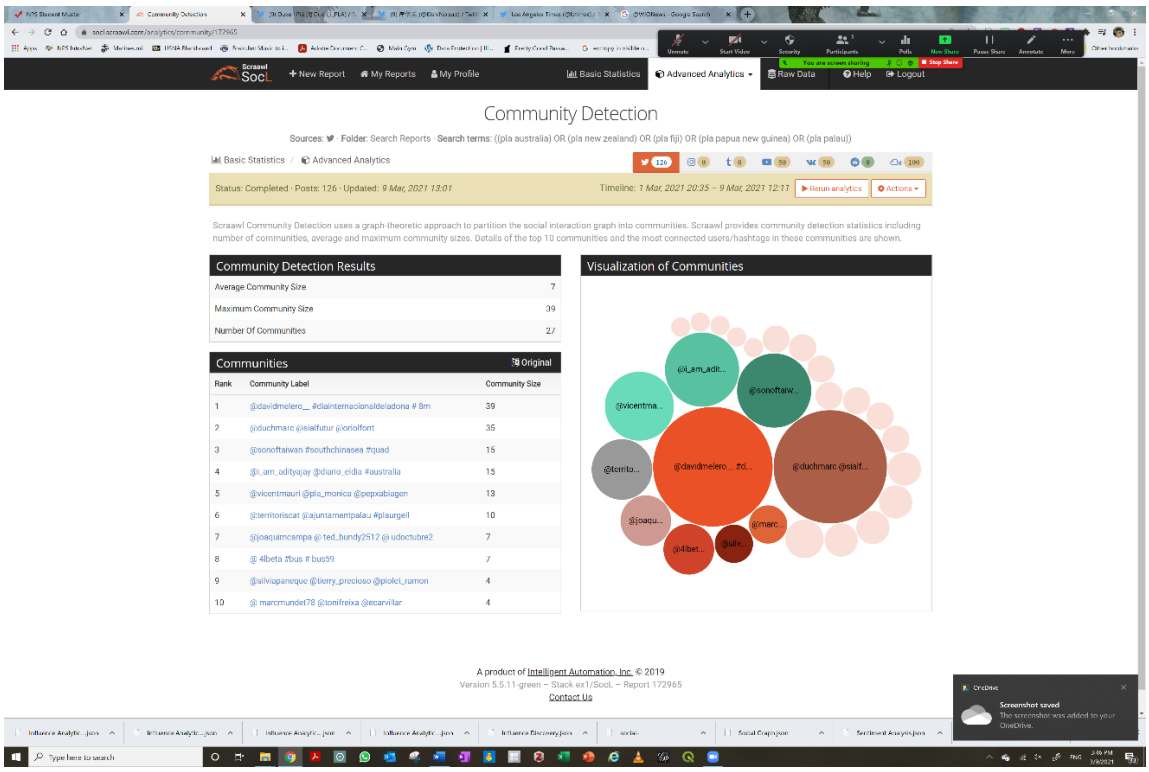



Figure 38. Keyword Search 3: Community Detection. Source: Scraawl (2021).

### 4. Keyword Search 4: ((us military australia) OR (us military fiji) OR (us military new zealand) OR (us military papua new guinea) OR (us military palau))

#### *a. Basic Statistics*

The results from the Multi-feed Search generated 345 matching posts over a seven-day period. There were no unusually exceptional users or hashtags. However, user @jaredferrie, the word *military*, and tweets originating in Australia stood out. A news story by the politically center news organization Reuters was shared in a clear majority (Figure 39).

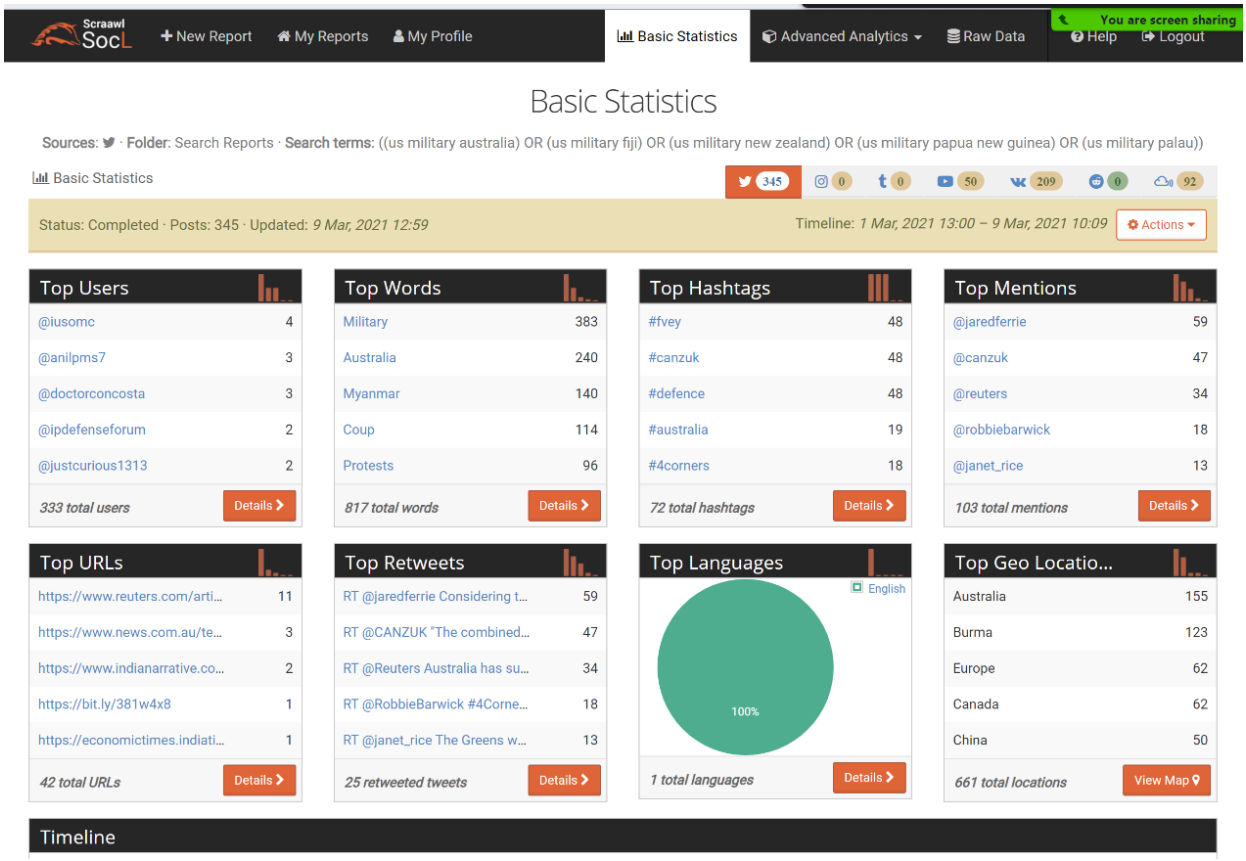
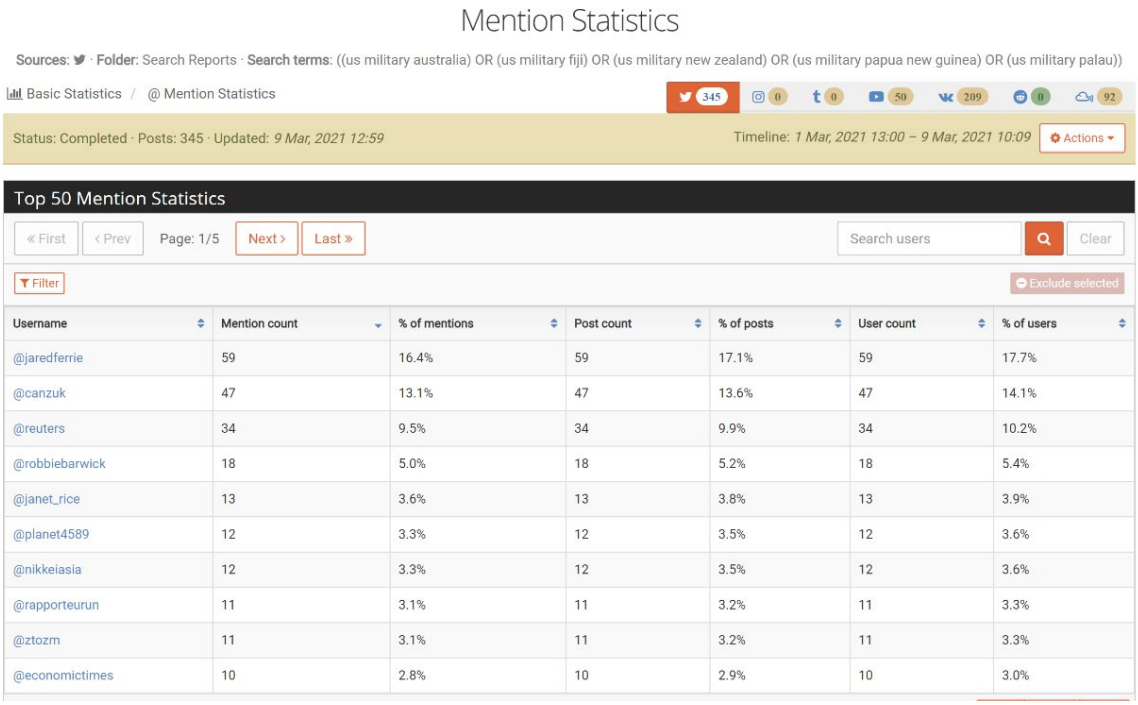



Figure 39. Keyword Search 4: Basic Statistics. Source: Scraawl (2021)

### *b. Mention Statistics*

User @jaredferrie carried 59 mentions (16.4%) of the total. Other top mentions were to defense fan @canzuk and @reuters, carrying 13.1% and 9.5% of mentions in this search, respectively (Figure 40).




| Username | Mention count | % of mentions | Post count | % of posts | User count | % of users |
|---|---|---|---|---|---|---|
| @jaredferrie | 59 | 16.4% | 59 | 17.1% | 59 | 17.7% |
| @canzuk | 47 | 13.1% | 47 | 13.6% | 47 | 14.1% |
| @reuters | 34 | 9.5% | 34 | 9.9% | 34 | 10.2% |
| @robbiebarwick | 18 | 5.0% | 18 | 5.2% | 18 | 5.4% |
| @janet_rice | 13 | 3.6% | 13 | 3.8% | 13 | 3.9% |
| @planet4589 | 12 | 3.3% | 12 | 3.5% | 12 | 3.6% |
| @nikkeiasia | 12 | 3.3% | 12 | 3.5% | 12 | 3.6% |
| @rapporteurun | 11 | 3.1% | 11 | 3.2% | 11 | 3.3% |
| @ztozm | 11 | 3.1% | 11 | 3.2% | 11 | 3.3% |
| @economictimes | 10 | 2.8% | 10 | 2.9% | 10 | 3.0% |

Figure 40. Keyword Search 4: Mention Statistics. Source: Scraawl (2021)

### *c. Retweet Statistics*

Highest retweets are attributed to user @jaredferrie with 23% of retweets covering 17% of users. No other significant retweet data emerged from this search (Figure 41).

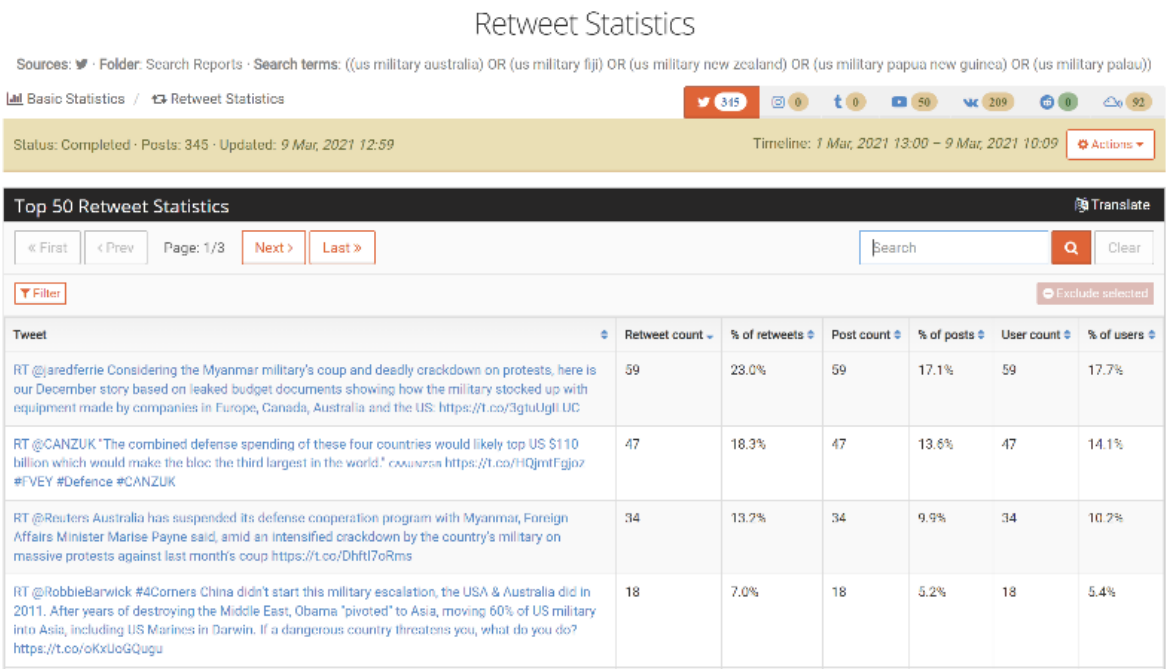



Figure 41. Keyword Search 4: Retweet Statistics. Source: Scraawl (2021)

### *d. Locations*

Location data shows 862 geographic associated data, with large sections of those tweets in the U.S., China, and Australia (Figure 42). This is much more clear indication of the competition for resources and influence in the region.

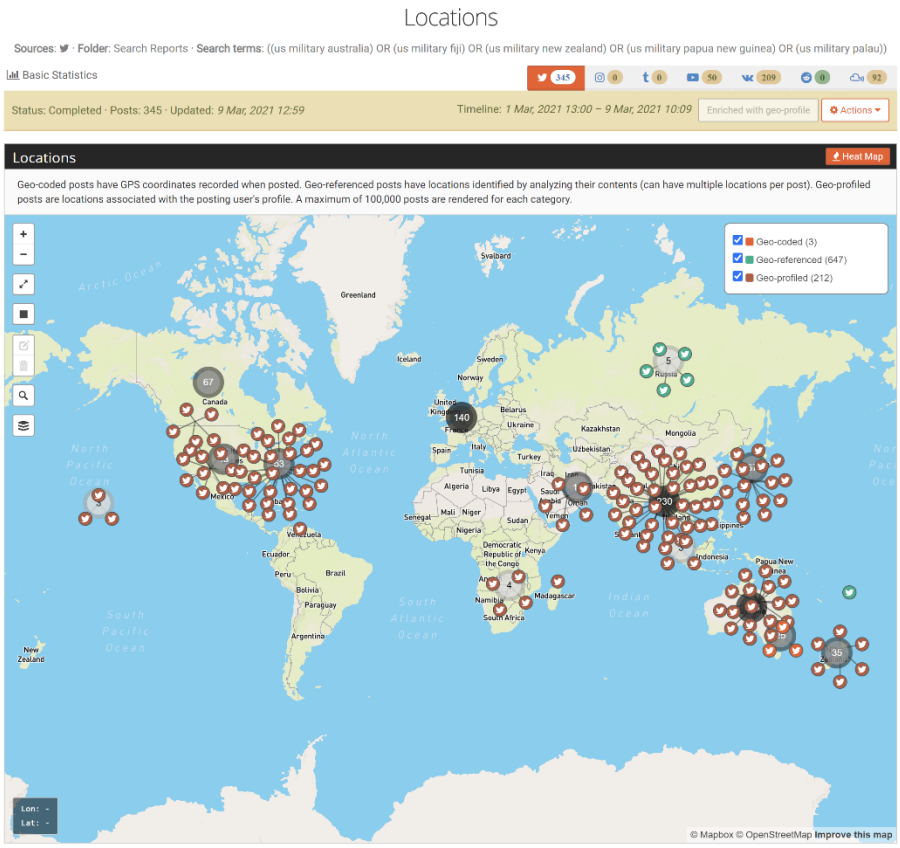



Figure 42. Keyword Search 4: Location Data. Source: Scraawl (2021)

### *e. Influence Discovery*

In this search, user @jaredferrie ranked first as Top Influential User with a score of 100/100 (Figures 43 and 44). This demonstrates his importance to his community neighbors. Users that ranked second a third were @Reuters (Influence Discovery score = 58) and @janet_rice (Influence Discovery score = 22.7), respectively.

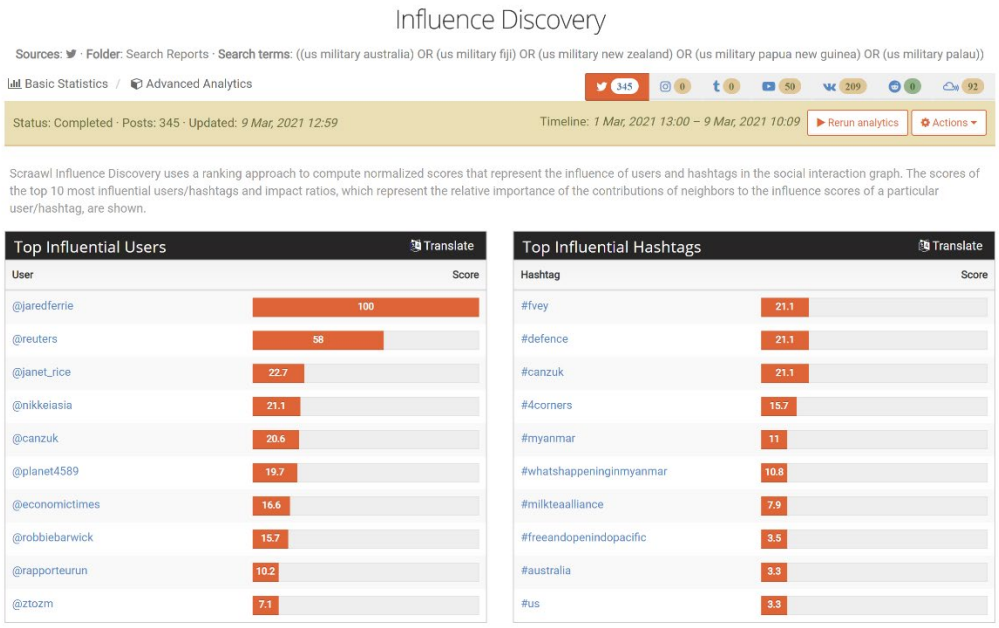



Figure 43. Keyword Search 4: Influence Discovery Scores. Source: Scraawl (2021).

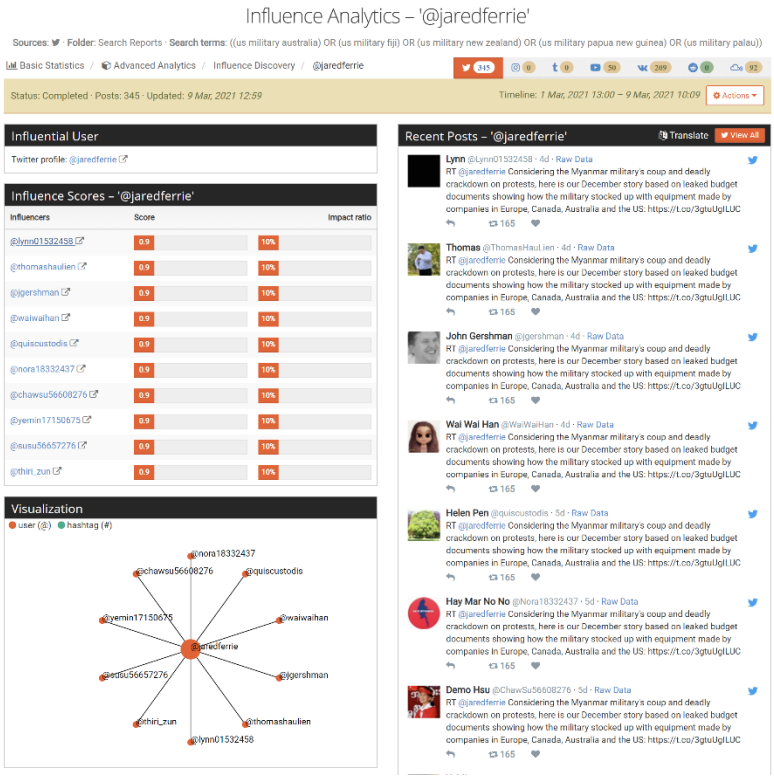



Figure 44. Keyword Search 4: Influence Discover Scores for User @jaredferrie

### *f. Community Metrics and Detection*

The Community Detection visualization shows that 70 communities were found in this search (Figure 45). The average community size was seven members and the largest, of which @jaredferrie belongs, boasted a staggering 60 members. The largest community label is named after the top influencers/hashtags in the community, thus users @lynn01532458 and @thomashaulien join @jaredferrie in Community 1.

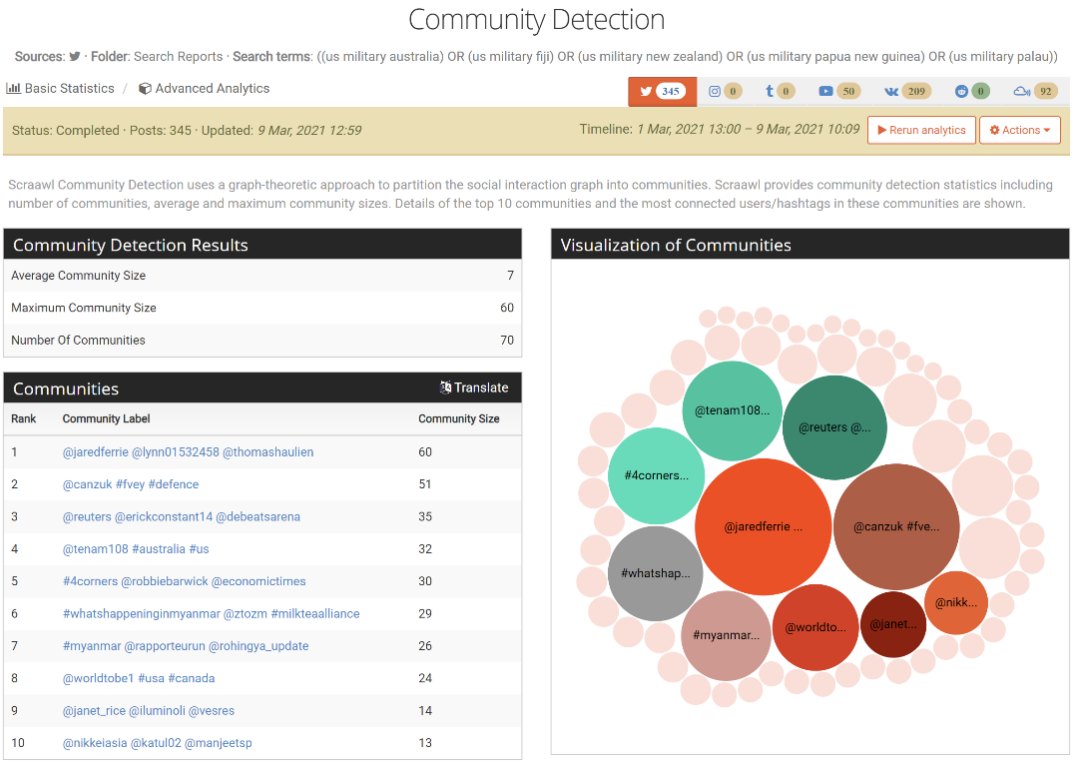



Figure 45. Keyword Search 4: Community Detection Visualization. Source: Scraawl (2021).

As is seen in his specific Community Analytics profile, User @jaredferrie scores so highly based on his degree (degree=59). This is measured in edges to not only all neighbors, but the highest interacting neighbors in his community (Figure 46).

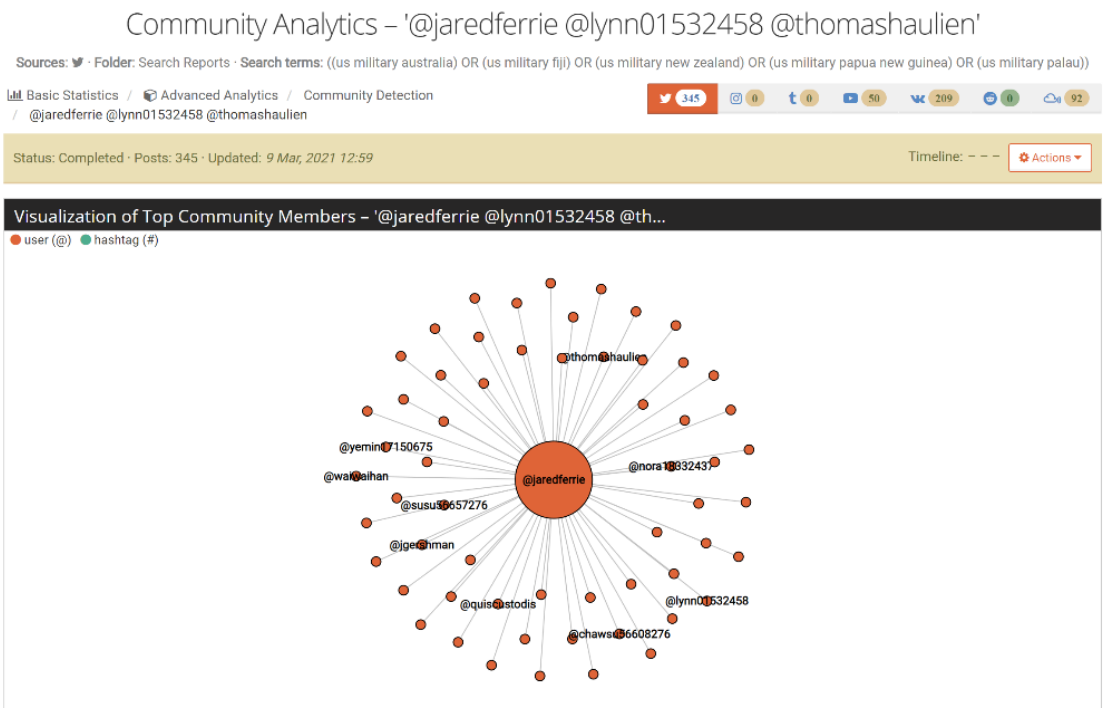



Figure 46. Community Analytics: User @jaredferrie. Source: Scraawl (2021)

**5. Account Monitoring Search 1: (fromsonoftaiwan OR @sonoftaiwan) OR (fromUSPacificFleet OR @USPacificFleet) OR (fromthejointstaff OR @thejointstaff) OR (fromINDOPACOM OR @INDOPACOM) OR (fromWIONews OR @WIONews) OR (from:PacificMarines OR @PacificMarines) OR (from:Japan_pac OR @Japan_pac) OR (from:CN_Australia OR @CN_Australia) OR (from:Global_Mil_Info OR @Global_Mil_Info)**

***a. Basic Statistics***

The Account Monitoring (AM) search is useful within Scraawl if there are several user accounts where interactions are to be analyzed for the purposed of determining community behavior This can be due to clustering, mutual degrees of interaction, likes, shares, follows, mentions, or retweets the same or similar data. Therefore, for the purposes of determining influence, the basic and advanced tools within the Scraawl suite will accomplish this.

The Account Monitoring feature of Scraawl will output the same reports generated from Multi-feed Search, Premium Search, and Premium Advanced Search. The differences

in the search results, however, are vast. There were 25,737 posts retrieved, In addition, there were greater degrees of centrality uncovered than previously thought. User @wionews was the top user throughout, with Top Mentions and Top Retweets attributed. Top words and locations centered around India (Figure 47).

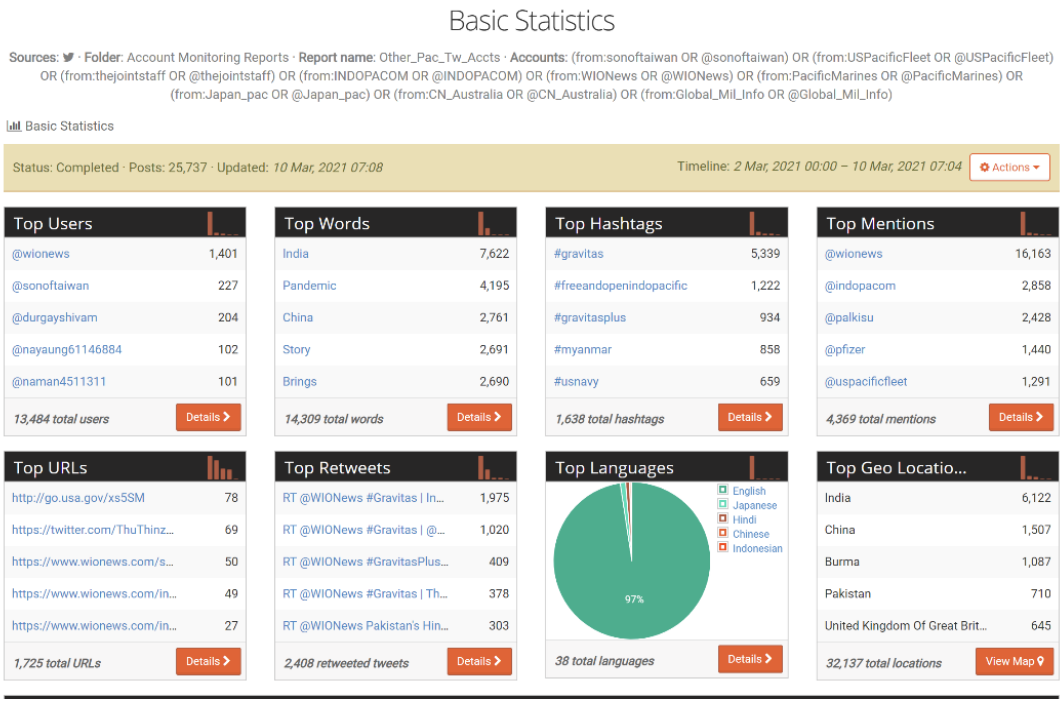



Figure 47. AM Search 1 Results. Source: Scraawl (2021)

### *b. Mention Statistics*

World Is One News (user @wionews, WION) is a New Delhi-based international news agency, serving content in English (World Is One News, 2021). There are 5.6 times as many mentions (16,163 mentions versus 2,858 mentions) to @wionews than to the DOD IndoPaCom page (Figure 48). This is consistent with other prominent search data.

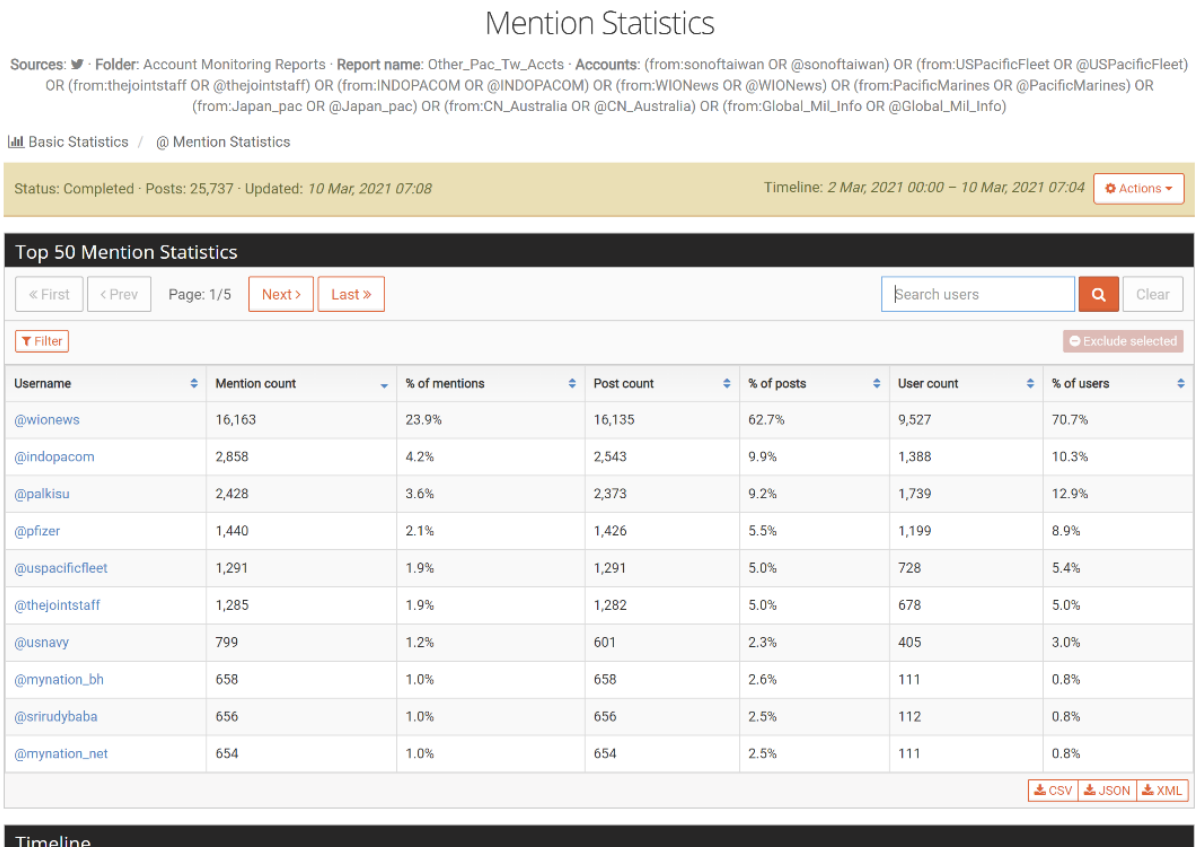



Figure 48. AM Search 1 Mention Data. Source: Scraawl (2021).

### *c. Retweet Statistics*

As the retweets show, a news story from WION related to India's successful response to the coronavirus pandemic resonates and is highly retweeted within India. This story was retweeted nearly twice as much as it is second-most popular tweet concerning vaccines (Figure 49).

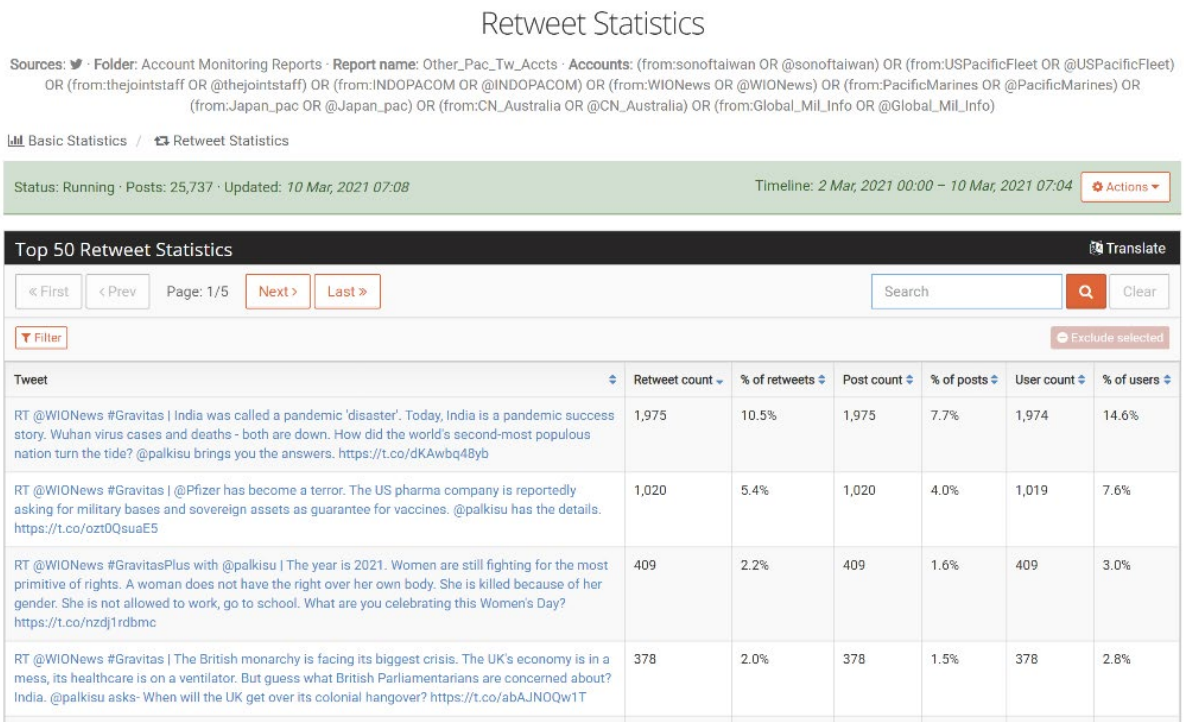



Figure 49. AM Search 1: Retweet Data. Source: Scraawl (2021).

### *d. Locations*

Geo-referenced tweets (tweets that reference a specific location) dominated the gathered data, as 60.9% of tweets were geo-referenced to India (Figure 50). Geo-profiled tweets (tweets with associated location data in their profiles) assumed 38.7%.

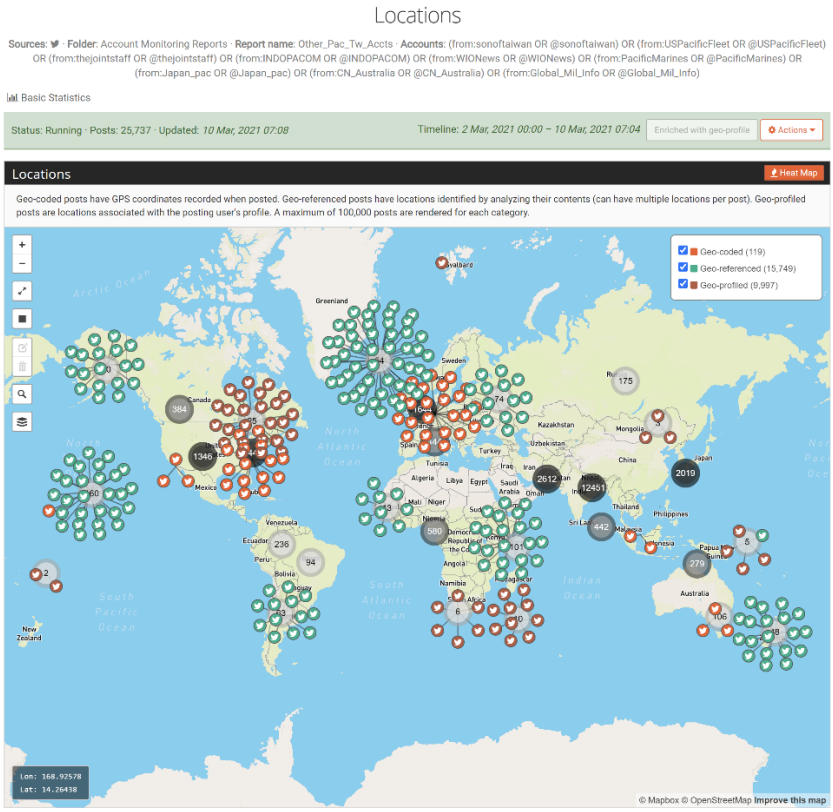



Figure 50. AM Search 1: Geo-associated Tweet Data. Source: Scraawl (2021)

### *e. Influence Discovery*

The user @wionews ranks 100% on Influence Discovery. This is consistent with the preference of other users in the community to retweet and share posts from @wionews (Figure 51).

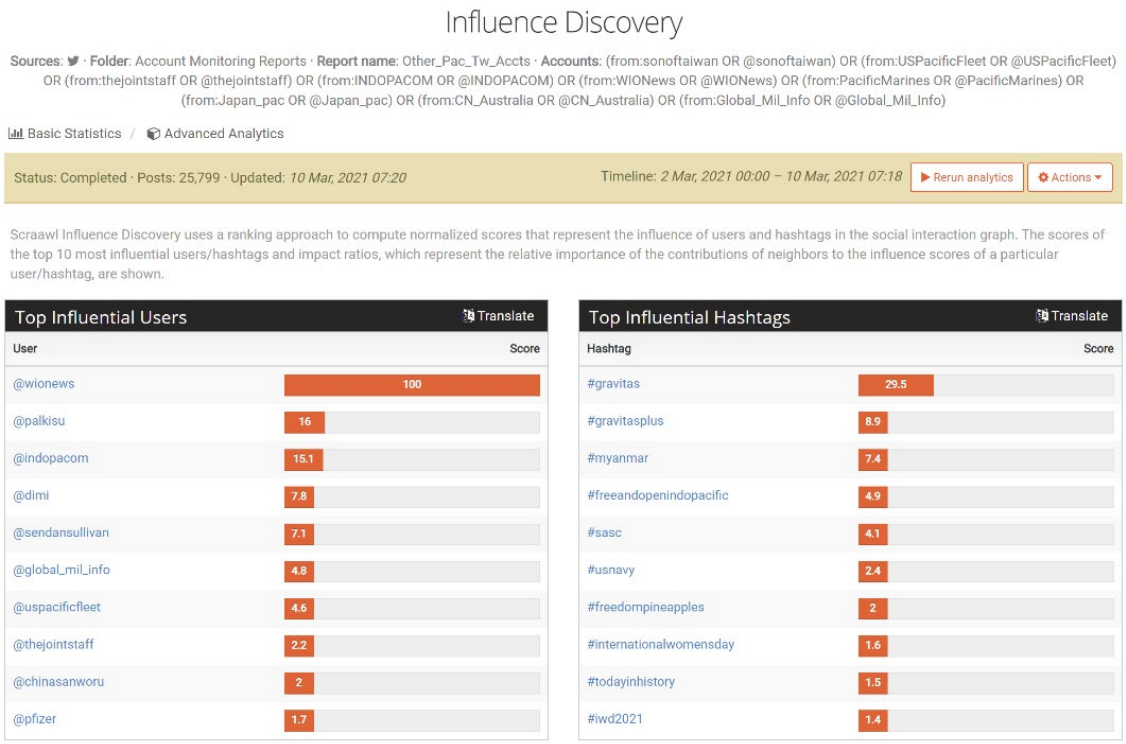



Figure 51. AM Search 1: Influence Discovery. Source: Scraawl (2021).

### *f. Community Metrics and Detection*

The AM Search 1 uncovered over 25,000 posts with 50 communities. Each of the linked communities is connected through a handful of users or hashtags. Figure 52 calls out the community clustered around user @wionews, While Figure 53 gives comparison to degree.

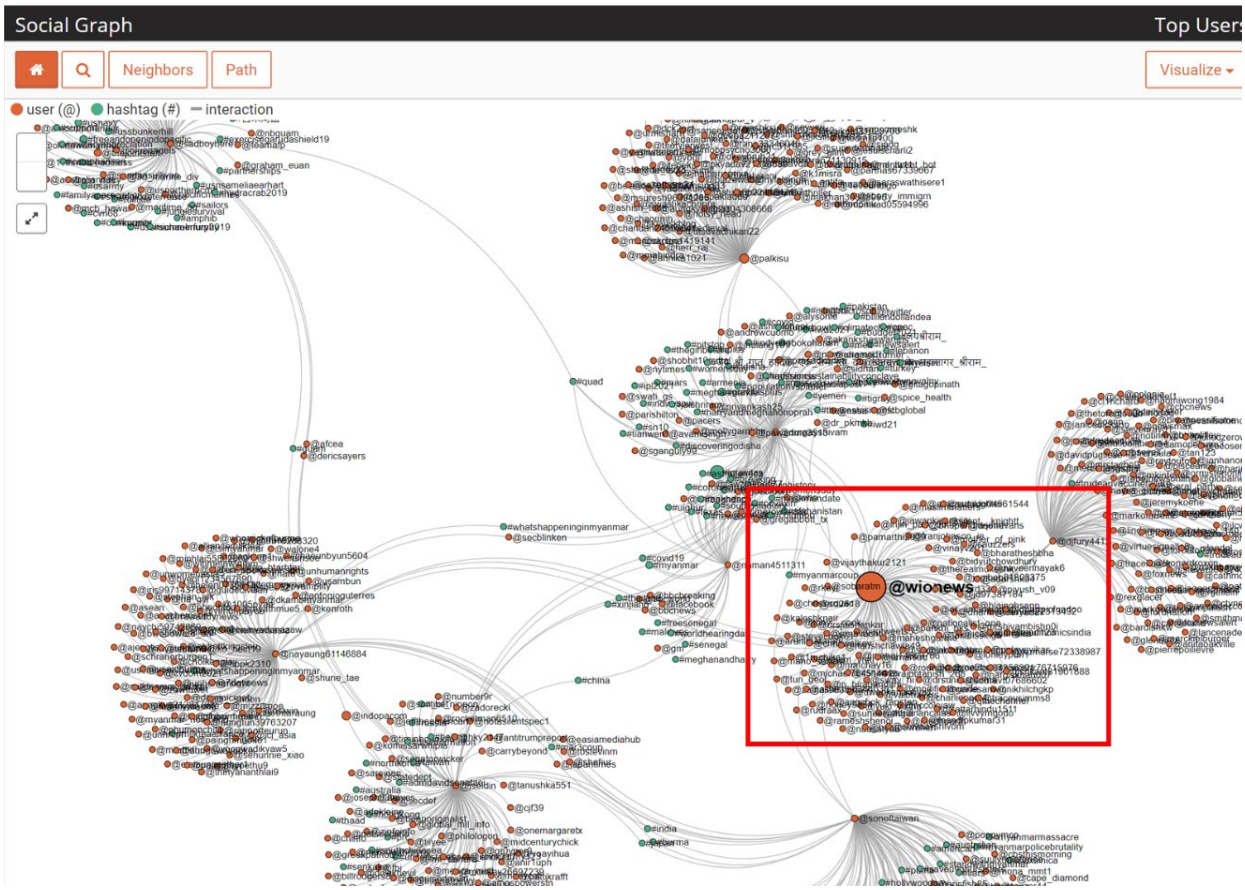



Figure 52. AM Search 1: User @wionews Social Graph.
Source: Scraawl (2021)

Top Connected Users

| Label | Degree |
|---|---|
| @wionews | 9,962 |
| @palkisu | 1,785 |
| @indopacom | 1,471 |
| @pfizer | 1,199 |
| @uspacificfleet | 763 |
| @thejointstaff | 678 |
| @usnavy | 431 |
| @sonoftaiwan | 376 |
| @dimi | 323 |
| @global_mil_info | 292 |

Figure 53. AM Search 1: User @wionews Influence by Degree. Source: Scraawl (2021).

### 6. Account Monitoring Search 2: (fromSinoDefence OR @SinoDefence) OR (fromzlj517 OR @zlj517) OR (fromCDF_Aust OR @CDF_Aust) OR (fromDeptDefence OR @DeptDefence) OR (fromRfmf_Media OR @Rfmf_Media) OR (fromADFinPNG OR @ @ADFinPNG) OR (from:CDF_PNGDF OR @CDF_PNGDF) OR (from:IPDefenseForum OR @IPDefenseFOrum) OR (from:NZDefenceForce OR @NZDefenceForce) OR (from:CDF_NZ OR @CDF_NZ)

#### *a. Basic Statistics*

The results from the Multi-feed Search generated 7,303 matching posts over a seven-day period (Figure 54). User @ipdefenseforum was the most active followed by the official spokesperson for the Chinese military, user @zlj517. Chinese-focused information dominated top words and location information this search.

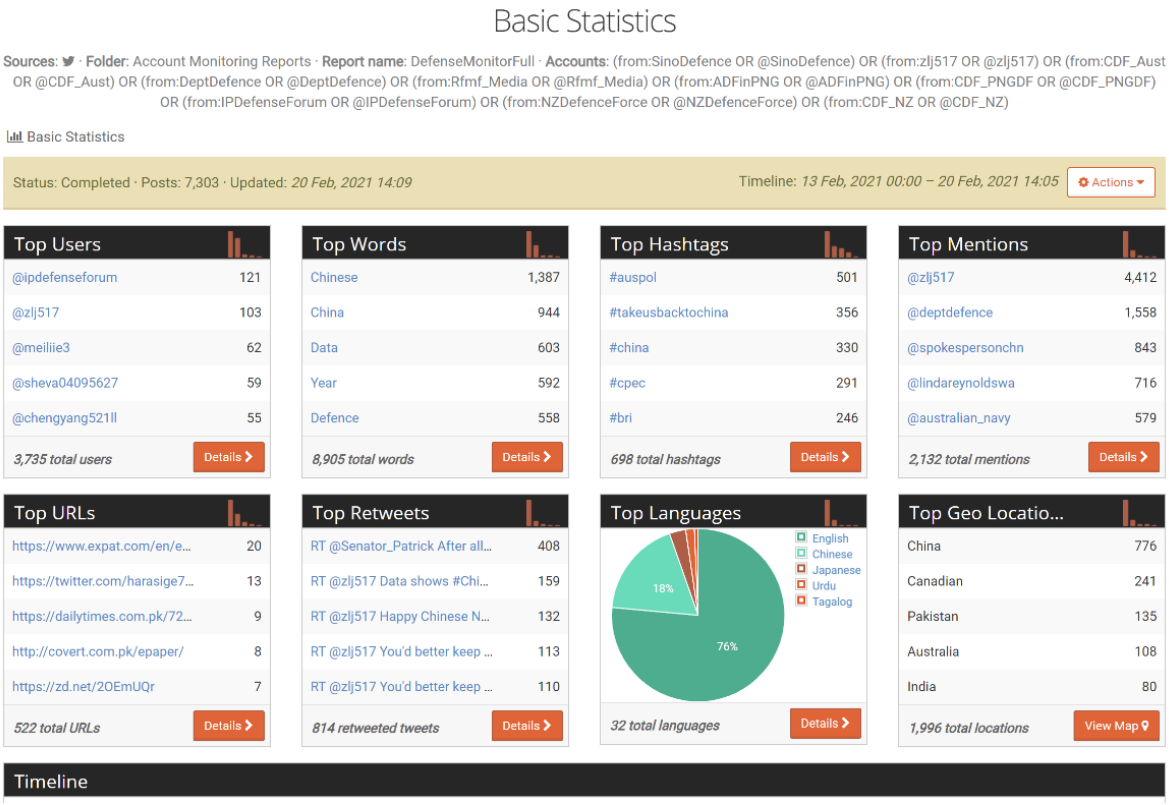



Figure 54. AM Search 2: Basic Statistics. Source: Scraawl (2021)

### *b. Mention Statistics*

Seventeen percent (17.2%) of mentions in this search (4,412 mentions) are attributed to the PLA account and 6.1% of mentions (1,558 mentions) attributed to Australia's defense department account. This is expected as Australia is China's main competitor in spreading influence in Oceania (Figure 55).

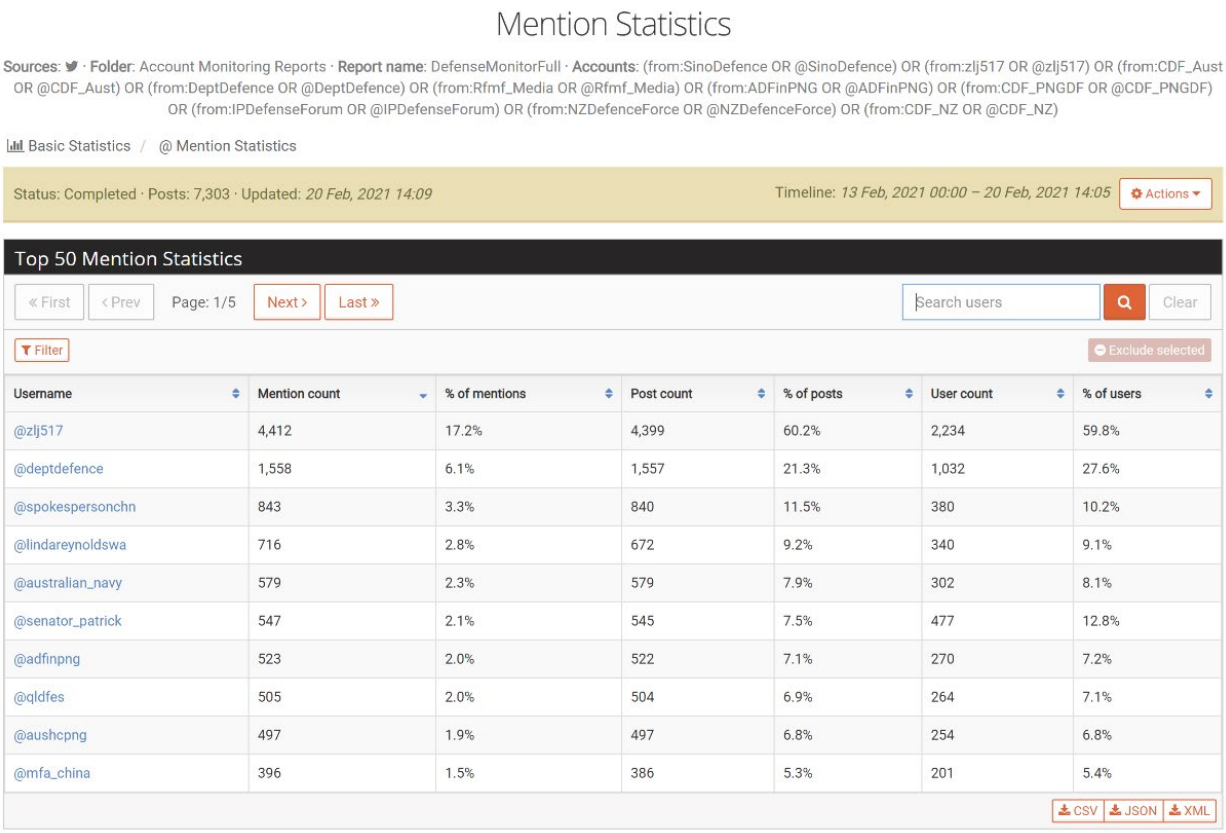



Figure 55. AM Search 2: Mention Statistics. Source: Scraawl (2021)

### *c. Retweet Statistics*

The top retweeted post centered on Chinese espionage from user @Senator_Patrick, an independent Senator for South Australia (Figure 56). His position within the political system suggests a high degree of trust, which accounts for high retweeting of his post.

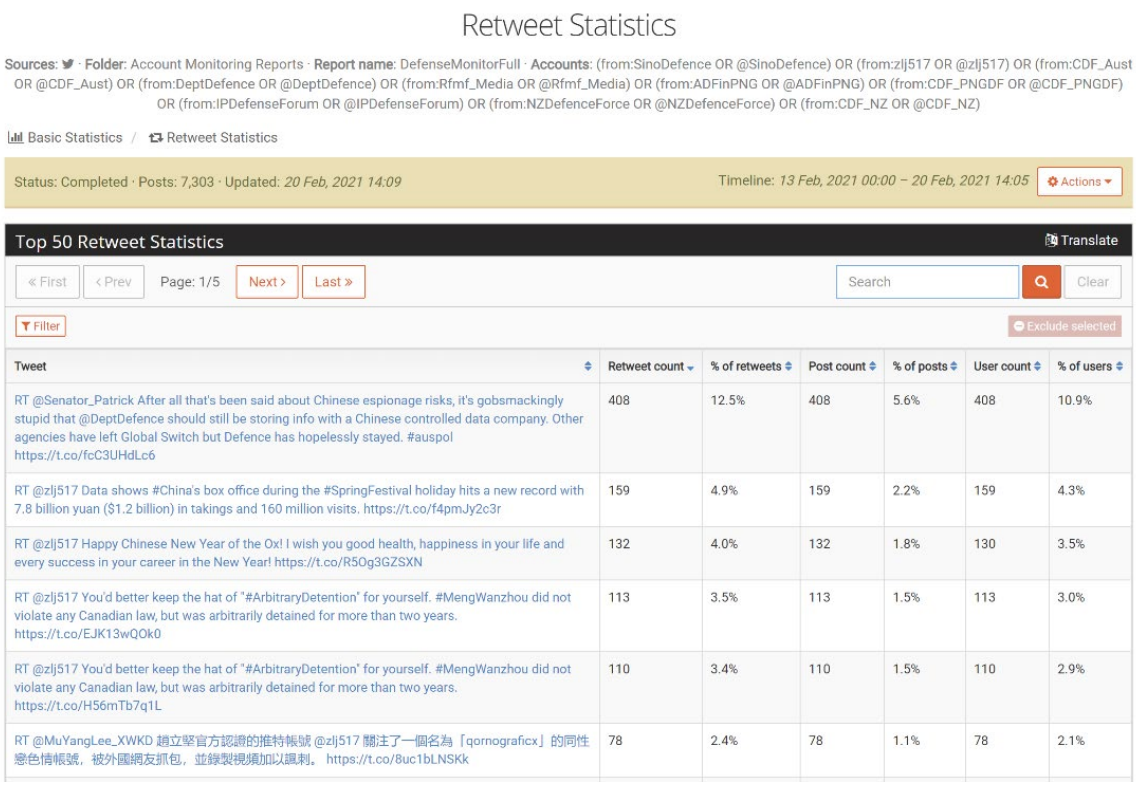



Figure 56. AM Search 2: Retweet Statistics. Source: Scraawl (2021)

### *d. Locations*

Geo-profiled tweets account for 67.8% of geographically associated data from this search (7,136 geo-profiled tweets / 10,523 all geo-associated data). This high proportion of tweet data originating in China is a clear indication that the Chinese prefer to initiate Twitter data about Chinese events over other agencies reporting about China (Figure 57). This is further shown in Figure 58 which displays the density of tweets via a heat map (Figure 58).

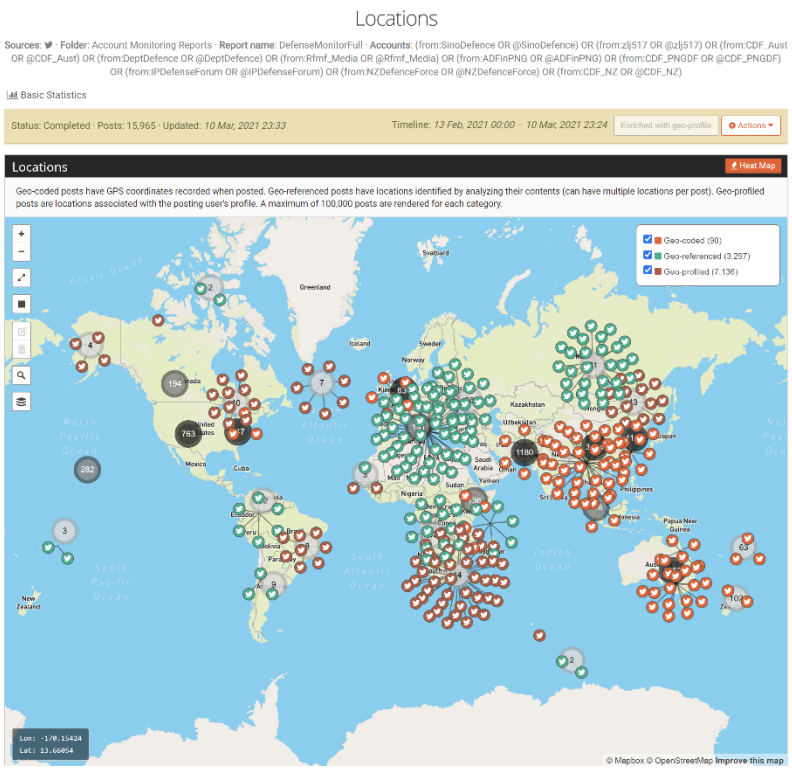



Figure 57. AM Search 2: Location Data. Source: Scraawl (2021).

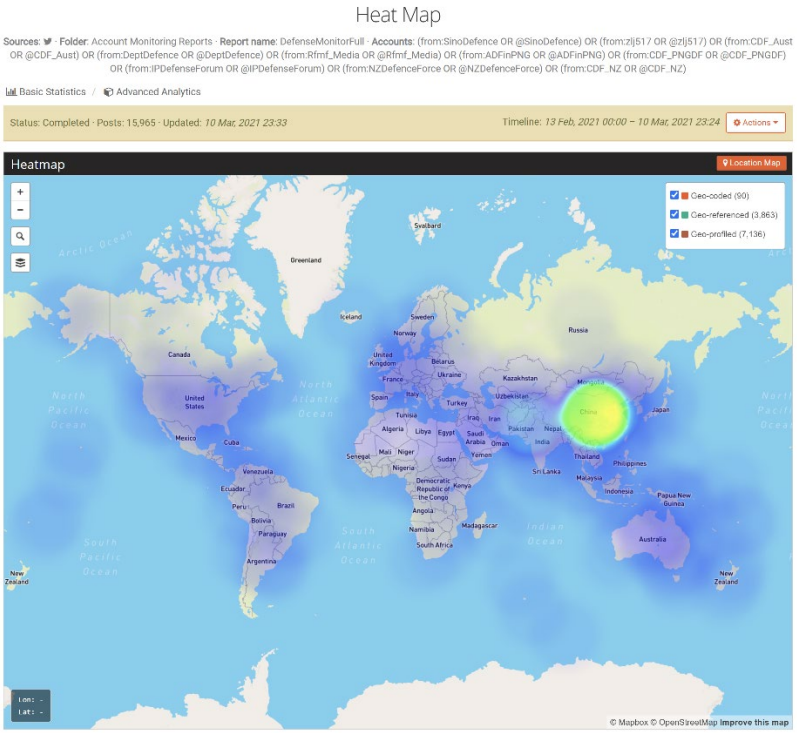



Figure 58. AM Search 2: Location Heat Map. Source: Scraawl (2021).

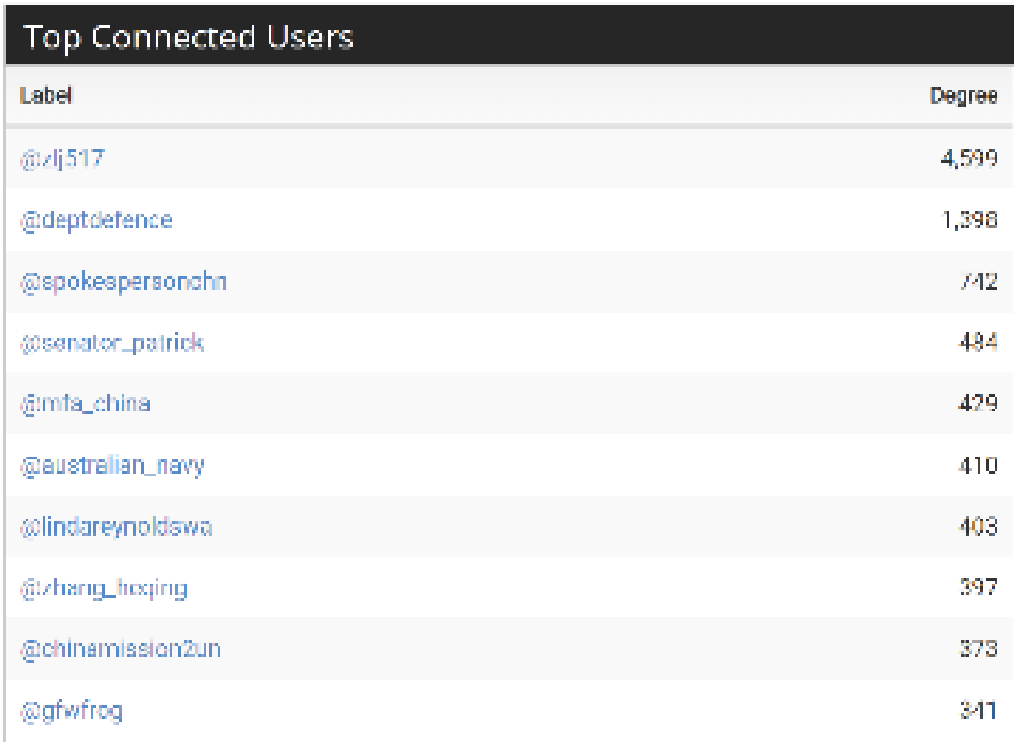
### *e. Influence Discovery*

User @zlj517 ranked 100% on the influence scale for this search topic (Figure 59).


Figure 59. AM Search 2: Influential Users Scores. Source: Scraawl (2021).

### *f. Community Metrics and Detection*

User @zlj517's degree of connectedness and the social graph for the closest vertices near them are shown in Figures 60 and 61. The number of meaningful connections to user @zlj517 via edge count is more than triple that of the Australian defense account @deptdefence.



Top Connected Users

| Label | Degree |
|---|---|
| @zlj517 | 4,599 |
| @deptdefence | 1,398 |
| @spokespersonchn | 742 |
| @senator_patrick | 484 |
| @mfa_china | 429 |
| @australian_navy | 410 |
| @lindareynoldswa | 403 |
| @zhang_hxjrng | 397 |
| @chinamission2un | 373 |
| @gfwfrog | 341 |

Figure 60. AM Search 2: Influential Users Scores by Degree. Source: Scraawl (2021).

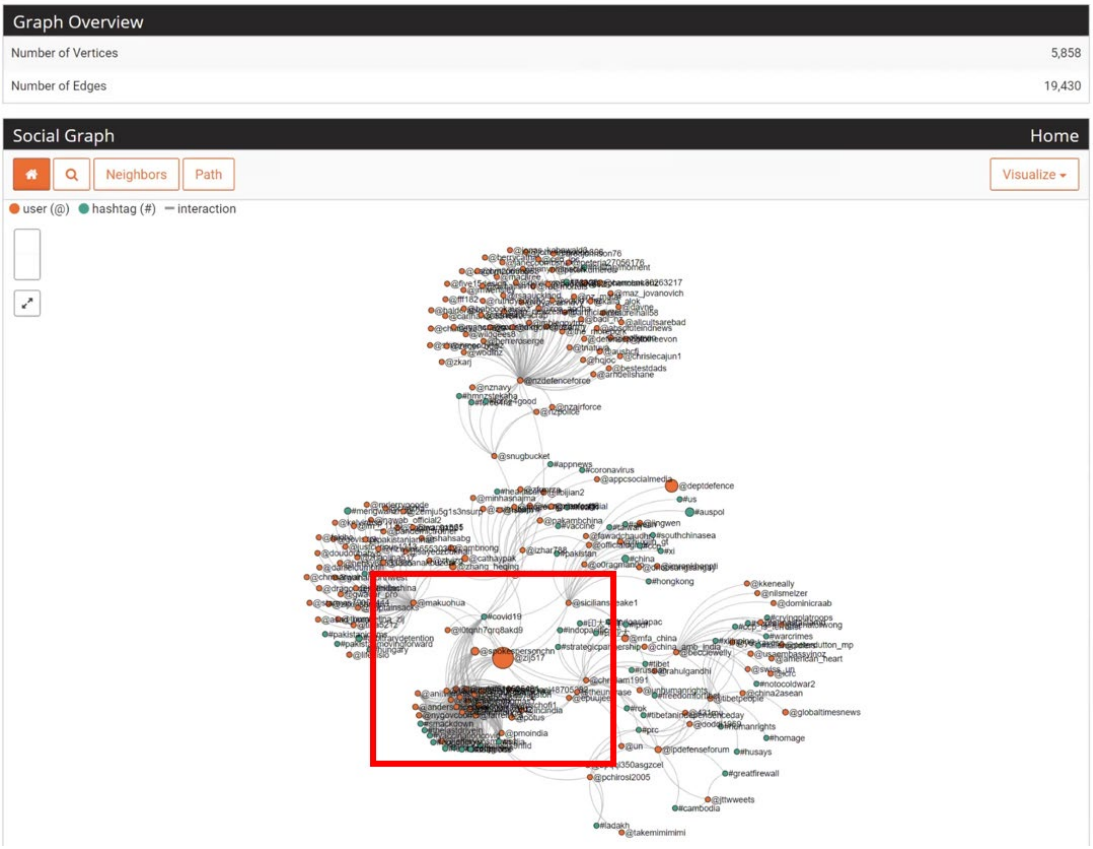



Figure 61. AM Search 2: Social Graph with User @zlj517 callout. Source: Scraawl (2021).

## B. ANALYSIS

### 1. Data Trends

As a result of these data, the following information trends can be derived from them and offered as generalities:

- The opinions and thoughts of users who have experience within the same field as the content shared tend to be followed more closely and shared more widely (Figures 9, 11, 20, 51).
- A user's influence ranking is closely correlated to their mention and retweet scores (Figures 48 and 51, 55 and 59).

- Degree rankling (via edge count) is normally closely related to high influence scores (Figures 55, 59, 60)
- A top user rankling (by high individual activity) does not imply high rankling elsewhere (mentions, retweets) (Figures 9, 13)
- Geo-referenced and geo-profiled data were more common than geo-coded tweets (Figures 12, 24, 33, 42, 50, 57).
- Users within similar communities of engagement are typically connected in more than one meaningful way (Figure 45).
- Users who reside in the same geography as the discovered information are mentioned and retweeted with favor over those who are not (Figure 56).
- Media outlets continue to carry prominent influence online (Figures 48, 49, 51).
- Data searches that are user-focused return more meaningful information than keyword-based searches (Keyword Searches 1–4 vs Account Monitoring Searches 1–2).
- Democratic countries favored geo-referenced tweets while non-democratic countries favored geo-profiled data. This suggests a strong desire by the non-democratic nations to control the narrative surrounding events within their borders (Figures 33 and 34, 57 and 58).

### 2. CARVER Results

As a primary result of the data, placed within the context of the operational vignette, the following CARVER matrix is offered in summary:

Table 10. Search Key Findings

| CARVER Key Findings | C | A | R | V | E | R |
|---|---|---|---|---|---|---|
| Keyword Search 1 | High influence shared by experts' reporting / commenting on potentially damaging stories | All information readily available via open sources | Pace of reporting suppresses damaging stories | Potentially damaging news stories difficult to deny | Various, political impacts | How are the nations able to evaluate sensitivity of reporting |
| Keyword Search 2 | Sensitive information provides tension between nations | All information readily available via open sources | Pace of reporting suppresses damaging stories | Information revelation can contain classified reporting | Political | Information recognizable as sensitive |
| Keyword Search 3 | Prominent information less critical, highly influential | All information readily available via open sources | Pace of reporting suppresses damaging stories | Reporting on futbal vulnerable, unlikely to be exploited | Medium impacts to population / media | Non-sensitive information |
| Keyword Search 4 | Sensitive information critical to international tensions | All information readily available via open sources | Pace of reporting suppresses damaging stories | Weapons reporting vulnerable to international propagation | Political, population, media effects | Information recognizable as sensitive |
| Account Monitoring 1 | Reporting in pandemic response critical to confidence in national leadership | All information readily available via open sources | Pace of reporting suppresses damaging stories | International reporting leaves stories vulnerable for exploitation | Effects across political, population, and media | Information recognizable as sensitive |
| Account Monitoring 2 | Critical information regarding Chinese espionage | All information readily available via open sources | Pace of reporting suppresses damaging stories | Information exploitable, but minimally | Potential damaging effects across political, population, and media | Information recognizable as sensitive |

Table 11. CARVER Results

| Target | Criticality | Access-sibility | Recover-ability | Vulner-ability | Effect | Recogniz-ability |
|---|---|---|---|---|---|---|
| Government of Red | 5 | 3 | 3 | 3 | 4 | 5 |
| Liberal Population | 5 | 5 | 3 | 5 | 5 | 5 |
| Conservative Population | 5 | 5 | 3 | 3 | 3 | 4 |
| Red Media | 5 | 5 | 3 | 4 | 4 | 5 |
| Blue / Green Media | 5 | 5 | 3 | 5 | 4 | 5 |

The Criticality of the information proved high for all data. The accessibility of the information would be ranked high except there are indications (based on geography of tweet data) that it is highly controlled from the national government level. Recoverability for damaging information is heavily contingent on the source and how widely distributed the information is. Vulnerability measures are closely tied to accessibility of the information within the Twitter ecosystem. Effects can vary based on what the information happens to be and Recognizability metrics are closely related to Criticality, as the data obtained seemed to be well-curated by those sharing.

In addition, it is with these six measures in mind that planners seeking to leverage influence should include the visualizations within Scraawl that act as aids in order to have smartly designed briefings with quality information. The inclusion of statistics related to top words, links, and hashtags and prominent mentions, retweets, and social graph data will ensure that influence information captured in Scraawl is properly analyzed to be classified as responsible Visual Analytics.

# V. CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

## A. CONCLUSIONS

When examining the research questions proposed in this thesis, we can make the following observations:

1. In what specific ways can information flow at the Marine Expeditionary Force Information Group (MIG) be enhanced?

- The MIG, when leveraging Scraawl, must seek to leverage the advanced analytics suite in order to find the most pertinent information and relevant visuals. This will ensure that information received and communicated is clear, engaging, and easily absorbed.

2. How can information pertinent to OIE be communicated more effectively?

- A major limitation of the software is the inability to run classified reports and elevate the classification of that information. The Marine Corps' information practitioners should seek to integrate Scraawl at the Secret / Top Secret level.

3. What are the relevant metrics and the current standards (MOEs / MOPs)?

- Relevant metrics from this thesis center around increase in influence by way of followership and acceptance of messaging. Methods of performance will vary depending on command and mission objectives. However, methods of effectiveness can take shape as any or all of the following: increase in retweets, like, follows, or mentions and a decrease in similar metrics for competitors.

4. How does ID enhance the above?

- Information design enhances the above by offering a systematic, repeatable process to understand and simplify complex information. In

addition, ID assists the cells of the ICC with the ability to produce information briefings that are clear, engaging, and easily absorbed,

## B. FUTURE RESEARCH

### 1. Alternative Application 1: Other Scraawl Tools

The Scraawl suite contains four primary modules which gives Scraawl users the ability to analyze publicly available data, pictures, video, and unstructured data. They are SocL ("social"), PixL ("pixel"), Txt ("text"), and TrndZ ("trends")(Intelligent Automation, Inc., 2020b). This thesis primarily utilized the Scraawl SocL module, but future work could leverage image, text, and raw data analysis in deriving credible information. There is much within Scraawl that can assist the MIG.

### 2. Alternative Application 2: Secure Internet Protocol Router for Scraawl (SIPR Scraawl)

This research project focused primarily on information that can be obtained open-source and via standard search methods on Twitter and other platforms. The military information practitioner, however, is routinely searching for meaning via information channels not accessible to the public. It is in these cases that a secure way of searching and discovering information that resides at a higher classification would be most beneficial.

### 3. Alternative Application 3: Enhanced Social Network Analysis

This research included the basic social network analysis techniques of analyzing vertices, edges, and degree. There are many more techniques that can provide richer analysis of social data, namely eigenvectors, betweenness, and closeness for undirected networks, and indegree, outdegree, input domain, proximity prestige, and hubs/authorities for directed networks.

In addition, topographical characteristics of networks were not considered. Some features of topology not considered were average path length, diameter, density, average degree, and centralization.

Furthermore, characteristics of subgroups, brokers and bridges are also germane to influence analyses.

### 4. Alternative Application 4: Other Software

In the study of social network analysis, there are many tools available that provide the analyses mentioned in the previous application section. While those measures are tangential in Scraawl, they are primary features found in some software. Two additional software products that can aid the analyst are Gephi (a tool for social network analysis and visualization) and Quantum Graphical Information System (QGIS) (a tool that aids in analysis of geospatial data via intuitive graphical user interface). Both products are capable of producing graphics that meet ID based on the relevant and intuitive nature of the visualizations created.

### 5. Alternative Application 5: Other MIG Tools

In pursuit of the MIG commander's information objectives, the ICC utilizes many software systems. Additional systems that can enhance information received in this thesis can include the following: Microsoft Power BI, Pulse, Open IO, Talk-Walker, Meltwater, Palantir, C2IE, Web-ISSA, and FadeMist.

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# LIST OF REFERENCES


Berger, D. (2020a). *CMC-38 force design 2030 report phase 1 and 2.* Headquarters Marine Corps. Retrieved from https://www.hqmc.marines.mil/Portals/142/Docs/CMC38%20Force%20Design%202030%20Report%20Phase%20I%20and%20II.pdf?ver=2020-03-26-121328-460

Berger, D. (2020b). The case for change: Meeting the principal challenges facing the corps. Marine Corps Gazette, 104(6). https://mca-marines.org/wp-content/uploads/The-Case-for-Change.pdf

Cordray III, R., & Romanych, M. J. (2005). Mapping the information environment. *IO Sphere,* Summer 2005, 7–10. https://www.quantico.marines.mil/Portals/147/Docs/MCIOC/IORecruiting/MappingtheInformationEnvironmentIOSphere Summer2005.pdf

Cunningham, D., Everton, S., & Murphy, P. (2016). *Understanding dark networks: A strategic framework for the use of social network analysis.* Rowman & Littlefield.

Department of Defense. (2018). Summary of the 2018 national defense strategy. https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

DOMO. (n.d.). Data never sleeps 6.0. https://web-assets.domo.com/blog/wp-content/uploads/2018/05/18_domo_data-never-sleeps-6verticals.pdf

Intelligent Automation, Inc. (2020a). *Scraawl community detection. Discovering communities in social networks*. https://classroom.scraawl.com/pluginfile.php/234/course/section/24/Scraawl-Community_Detection.pdf?time=1610747197106

Intelligent Automation, Inc. (2020b). *Scraawl influence discovery. Influence discovery in social Networks.* https://classroom.scraawl.com/pluginfile.php/234/course/section/24/Scraawl-Influence_Discovery.pdf?time=1610747181415

Joint Chiefs of Staff. (2012). Information operations (JP 3-13). https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_13.pdf

Keim, D., Mansmann, F., Stoffel, A., & Ziegler, H. (n.d.). *Visual analytics.* University of Konstanz, Germany. http://infovis.uni-konstanz.de

Labaj, L., & Bencie, L. (2018). *The CARVER target analysis and vulnerability assessment methodology: A practical guide to evaluating security vulnerabilities.* Security Management International.

Olsen, J. (2015). *Airpower reborn: The strategic concepts of John Warden and John Boyd.* Naval Institute Press. ProQuest.

Potts, D. (2003). *The big issue: command and combat in the information age.* DOD Command and Control Research Program.

Robins, G. (2015). Fundamental network concepts and ideas. In *Doing social network research: Network-based research design for social scientists*. SAGE Publications Ltd. https://doi.org/10.4135/9781473916753

United States Marine Corps. (2019, July 16). Commandant's planning guidance: 38th commandant of the marine corps (CMC CPG 2019). https://www.marines.mil/Portals/1/Publications/Commandant's%20Planning%20Guidance_2019.pdf?ver=2019-07-17-090732-937

World Is One News. (2021). Wion (world is one news). In Wikipedia. https://en.wikipedia.org/w/index.php?title=WION_(TV_channel)&oldid=1027839550

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