**Introduction**

Since Twitter launched in 2006, the amount of new users and total posts has grown precipitously. Twitter currently boasts more than 517 million total users, accounting for over 500 million tweets every day [5]. With several billion tweets posted each month, an enormous opportunity awaits emergency managers and analysts.

Despite the ability to associate tweets with geographic locations (via geotagging), fewer than 1\% of tweets use this feature [3], though in times of crisis up to 15\% of tweets may be geotagged [4].

Our work pairs the torrential stream of tweets with entity extraction and geocoding algorithms to determine what is being tweeted about, where tweets are referring to, and how topics vary across space and time.

**Enabling Analytics:** **SensePlace2**

SensePlace2 is a web-accessible geovalculics analytics tool that allows analysts to gain greater situational awareness about topics of interest. SensePlace2 collects, analyzes, and visualizes millions of tweets, which analysts can then explore through ad hoc queries and a rich set of user interactions [5].

**System Architecture**

![Diagram of System Architecture](image)

**Central Database and index (PostgreSQL + PostGIS and Lucene)**

- **Query Table**
- **Data Table**
- **Person Table**
- **Organization Table**
- **Other Entity Table**
- **Location Table**
- **Text Search Index**

- **Twitter Channel Search Daemon**
- **GATE / JANNIE Named Entity Extractor**
- **GeoNames**
- **Named Entity Extraction Daemons (7 Instances)**
- **Geocoding Daemon**
- **Lucene Text Indoor Daemon**

**Overview First, zoom and filter, then details on demand.**

Ben Shneiderman (1996)

**Spatiotemporal Comparisons**

To empower analysts even further, new methods are being explored to better depict spatial and temporal relationships intuitively and seamlessly. These include surface and isarithmic maps and other topological filters that allow comparison between individual queries and the rest of the database. Novel approaches to map symbology (below) will allow SensePlace2 to depict the number of connections between locations at a glance, revealing the spatial patterns that exist across terms without unnecessary foraging.

**The UI: Leveraging Multiple Coordinated Views**

The user interface of SensePlace2 employs Shneiderman’s Visual Information Seeking Mantra [6]. In this way, users are provided with an overview that can then be explored to reveal additional details as the analyst forages and interacts with data of interest. The multiple coordinated views of SensePlace2 include:

1. a temporal filter,
2. the tweet list,
3. the map view,
4. a place-tree hierarchy, and
5. a word cloud.

The screenshot above demonstrates a query on the term ‘malaria.’ The analyst has constrained the date range between 3/6/2012 and 1/30/2013. After selecting tweets on the map that mention Africa and Uganda, the associated tweets are highlighted and brought to the top of the tweet list. Notice the connections that are drawn when a single tweet contains multiple place mentions.

**References**


**Future Work and Next Steps**

A prototype UI on the left demonstrates some of our new ideas. An updated temporal filter has been designed to show results from both the current query as well as the entire database. A new base map style gives salience to the symbology, which includes an isarithmic surface. Adjustments across the UI provide consistency and organization.

**Volunteered Georeferencing Improvement**

SensePlace2 takes advantage of its web-based foundation to enable volunteered feedback on tweet georeferencing. The interface allows users to report and categorize georeferencing errors and this input is being fed back into refining the SensePlace2 georeferencing algorithms.