European Commission

3rd Workshop
"Social Media for Disaster Risk Management: Researchers meet Practitioners"

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Abstract

This report encapsulates the discussions and findings of the third Workshop on Social Media for Disaster Risk Management, which convened in June 2023. The workshop aimed to explore the evolving role of social media in enhancing disaster risk management practices by bridging the gap between researchers and practitioners. A diverse group of stakeholders, including policymakers, academics, technology experts, and emergency responders, engaged in rich dialogues to scrutinize the current capabilities, limitations, and future potential of social media tools in crisis situations.

The sessions highlighted innovative uses of social media data, emphasizing real-time data's critical role in improving response times and decision-making accuracy during disasters. Key topics included the integration of artificial intelligence to filter and analyse vast amounts of data, the challenges of data veracity, and the ethical considerations surrounding privacy and misinformation.

This workshop not only reinforced the importance of social media as a pivotal information resource during emergencies but also set the stage for further interdisciplinary collaborations aimed at developing more robust, reliable, and responsive disaster management tools. The conclusions drawn underscore the urgent need for standardized protocols and training to harness the full potential of social media, ensuring it becomes a cornerstone of disaster risk management strategies globally.

Foreword

In the face of the global challenge posed by Climate Change, the European Commission has prioritized the 'Green Deal' agenda. This emphasis underscores the intricate relationship between climate change and the increasing frequency, scope, and magnitude of Natural Hazards. As we navigate this evolving landscape, the essence of Disaster Risk Management becomes clear: to prevent, protect, and mitigate the impacts of these hazards. This commitment aligns with another foundational pillar of the European Commission, 'A Stronger EU in the World.'

At the Joint Research Centre, we are at the forefront of this mission, providing research, tools, and data to the Copernicus Emergency Management Services (EMS). Our contributions, ranging from advanced forecasting systems to monitoring tools, are bolstered by the invaluable insights from Earth Observation data. While the Copernicus EMS boasts an exemplary coordination network, we recognize the inherent uncertainties and the continuous quest for improvement. Despite their precision, traditional satellite maps sometimes fall short of the immediacy and specificity that crisis responders require. This is where the power of citizen-generated information comes into play, where citizen observations could be thought of as 'citizen sensors' data. Available around the clock and spanning the globe, this real-time data source offers many insights.

People produce vast amounts of data daily, turning social media into a potential global cognitive brain. This workshop is a testament to how social media can be harnessed for the greater good. At JRC, we find ourselves uniquely positioned at the nexus between researchers and crisis responders. This vantage point offers us a panoramic view of the challenges and opportunities on both sides. Our aim of this workshop is twofold: to foster a space where participants can bridge the linguistic and methodological divides between the research and practice communities, and to spotlight the shared goals and collaborative spirit underpinning social media use in disaster risk management.

Since the inception of this workshop series, co–organizers rightly put it during their opening remarks: "We created this event to bridge the gap between the tools, reliability, and even the language used by practitioners and researchers in disaster risk management. Our journey began with showcasing potential tools and understanding the needs of practitioners. Over the years, the discourse has evolved, centering on data utilization and sourcing. With this workshop, we hope to further these discussions, drawing from the insights of both researchers and practitioners."

In essence, this workshop is a clear call to unite efforts, making social media information as actionable and reliable as any other sensor or model. Together, we seek to curate best practices, case studies, and datasets to benefit the overall disaster risk management community.

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Executive summary

Policy context

The third iteration of this workshop aligns with the European Commission's ongoing efforts to integrate advanced digital solutions into disaster risk management frameworks. As social media continues to permeate all aspects of society, its potential to enhance the effectiveness of disaster response mechanisms has become increasingly apparent. This workshop supports the Commission's broader strategy to leverage innovative technologies for societal safety and resilience, aligning with the EU's Digital Strategy and the Green Deal's call for enhanced adaptation to climate change impacts.

Key conclusions

The workshop concluded that while social media platforms offer unprecedented real-time data, their utility is contingent on the development of robust analytical tools and protocols. Participants unanimously agreed on the necessity of establishing a standardized framework for the ethical and effective use of social media data in disaster situations. The need for ongoing training and the establishment of a dedicated role for social media analytics within disaster response teams were also emphasized.

Main findings

Key findings from the workshop include:

- **Data Utilization**: Social media can provide critical information faster than traditional data sources during emergencies.
- **Challenges of Scale**: The sheer volume of data available through social media presents significant analytical challenges.
- **Misinformation Risks**: The risk of misinformation remains a significant concern that requires systematic approaches to mitigate.
- **Integration with Traditional Systems**: Effective integration of social media data into established emergency management systems is crucial but remains underdeveloped.

Related and future JRC work

Building on the insights from this workshop, the community of researchers and practitioners in the field should:

- Develop pilot projects to test the integration of social media data into existing emergency response frameworks.
- Conduct a series of follow-up workshops to refine the guidelines and protocols for social media use in disaster management.
- Collaborate with EU member states to explore the development of national strategies that incorporate these new tools and methodologies.

Quick guide

For policymakers and practitioners interested in implementing the findings from this workshop, the following steps are recommended:

- **Review Existing Protocols**: Assess current disaster response frameworks to identify potential integration points for social media tools.
- **Develop Training Programs**: Establish training modules for emergency responders on the use of social media in disaster contexts.
- **Pilot Testing**: Implement pilot projects to test the effectiveness of social media integration and refine approaches based on real-world data.
- **Stakeholder Engagement**: Engage with technology providers, privacy advocates, and the public to ensure a balanced approach to social media use in emergencies.
- **Monitor and Evaluate**: Continuously monitor the effectiveness of social media tools and adjust strategies based on feedback and new developments in technology.

1. Introduction

The journey of understanding and integrating social media for Disaster Risk Management began with our **inaugural** workshop, "Social Media for Disaster Risk Management: Researchers Meet Practitioners", in November 2020. During this event, practitioners acknowledged the great potential of social media as a timely information source. However, they highlighted significant challenges, such as validating and integrating real-time social media information with authoritative sources and the potential pitfalls of misinformation and disinformation. A unanimous sentiment was the desire to continue these discussions, aiming to steer research and system development in directions that cater to the unique needs of emergency managers regardless of the geographical regions, language barriers, and types of disasters.

Our **second** workshop, in 2022, delved deeper, bringing more practitioners into the fold. Through their insights, we better understood how user-generated data is leveraged during crises. The discussions were instrumental in bridging the gap between practitioners and researchers, with a growing emphasis on a shared data framework and standardized procedures. A notable outcome was identifying a new breed of practitioners who championed using non-authoritative data, ensuring its validation and seamless integration into traditional sources of crisis datasets.

Building on the insights and feedback from our 2022 workshop, we aim to address several pressing challenges and questions in our 2023 edition:

- The predominant reliance on Twitter: Concerns related to coverage, scalability of tools, and data.

- The reliability of humans as sensors: Noise, methods, and data quality challenges.

- The scarcity of geotagged information: Issues related to coverage and methods.

Issues surfaced during panel discussions:

- A pervasive lack of skills and resources.

- The overwhelming volume and noise of information.

- The challenges posed by heterogeneous data.

- The validation of training data and the transition to semi-operational tools.

Insights from the 2022 Workshop

Technological solutions, as showcased by presenters, offer promising avenues. The panels also highlighted improvements in precision. Using social media from community or clustered networks offers a way to expand beyond platforms like Twitter. However, this raises questions about accountability, privacy-preserving data collection, and the role of digital practitioners like VOST or CERT.

Extending data sources and refining geocoding can enhance coverage. However, this requires the development of a robust data model.

Detailed datasets like CrisisMMD or CrisisLex could be pivotal for training. The need for more diverse data was evident, with users expressing interest in alternatives to platforms like TREC Timeline, especially if practitioners like VOST/CERT are involved. A pressing question is the potential addition or production of metadata.

Third workshop : 2023

The third workshop held in 2023 marked a significant evolution in our approach. Spanning two days, it provided participants with a hands-on experience, simulating an emergency response exercise in the ECML crisis room at JRC. This immersive experience brought together a diverse group of responders, data experts, and researchers, each bringing unique geographical, policy, and governance perspectives.

During **Day 1**, the presentations primarily revolved around the practical applications of social media data in real-world crisis scenarios. Presenters showcased various case studies, highlighting the benefits and challenges of integrating user-generated content into disaster response strategies. The emphasis was on the real needs of crisis responders and the tools available to meet those needs. Day 1 closed with a panel discussion about the barriers and tools for enhancing crisis response using non-authoritative data. The panelists, representing diverse expertise, engaged in a robust dialogue about the potential and pitfalls of relying on social media and other non-traditional data sources during emergencies.

Day 2 shifted the focus to the academic and research side of the equation. Researchers presented their findings on extending social media sources, especially concerning recent policy changes on platforms like Twitter. They also discussed the potential of leveraging advanced AI models, like chatGPT, for analyzing user-generated content. The day's panel discussion centered on the technical challenges and solutions in harnessing non-authoritative data for crisis management. The panelists, including esteemed researchers and practitioners, shared insights on the evolving landscape of disaster risk management in the age of social media.

Together, the presentations and panels from both days painted a comprehensive picture of the current state of social media's role in disaster risk management, highlighting its immense potential and the challenges ahead

2. In-Person Morning Sessions: Simulation Exercise

The morning sessions of the workshop were designed to be an immersive, hands-on experience, simulating the real-time challenges and decision-making processes during a crisis event. The event in focus was the "Türkiye EQ 2023", which happened in Türkiye in February 2023.

Objective and Approach

The primary objective of these sessions was to explore how social media data could be harnessed to complement traditional risk data, thereby enhancing the quality and timeliness of information available to decision-makers during a crisis.

Participants, a mix of responders, data experts, and researchers, were provided with a structured format of reports generated during actual past events. While the titles of these reports were retained, the analysis within them was concealed. This approach was adopted to set a benchmark for the participants, challenging them to recreate the study based on the data.

List of Participants (in alphabetical order):

Bakken Rolf, ACAPS Syria/Turkiye Project Manager

Castillo Carlos, Universitat Pompeu Fabra, Spain

Fernandez-Marquez Luis, Universite' de Geneve, Switzerland

Gomes Jorge, VOST Portugal, Portugal

Hugues Amanda, Brigham Young University, United States

Imran Mohammed, QCRI, Qatar

Lorini Valerio, European Parliament, Luxembourg (DG-JRC during the Workshop)

Panizio Emanuele, Arcadia SIT, Italy

Peterson Steve, Montgomery County CERT, United States

Purohit Hemant, George Mason University, USA

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Souza Diego, CEMADEN, Brasil

Collaborative Crisis Reporting: Exercise: Simulation of a Near Real Time Impact Assessment and Situational Awareness with ONLY Social Media Data

Under the guidance of experts with firsthand experience responding to similar events, participants collaborated to fill in the report. The aim was to make the report as accurate and comprehensive as if the event unfolded in real-time. This exercise was not just about data analysis; it was about understanding the nuances of a crisis, the importance of timely information, and the collaborative spirit required in such situations.

Technologists among the participants had a unique role. They were provided with a corpus of social media data collected during the event. This data set served a dual purpose:

1. It allowed technologists to pre-process this data using their mostly Artificial Intelligence tools, in real-time during the event.

2. It served as a rich source of real-time information, enabling participants to simulate a live crisis response.

Data

Practitioners

Rolf Bakken set up the scene and described needs in terms of situational awareness (usually in the immediate aftermath of an event happens) and impact assessment (when first response starts to deploy). He presented the data needs according to his experience in the frameworks of international humanitarian support. He provided technologists with a clear set of categories in terms of infrastructures and services.

Marzia Santini presented the reports done by JRC (during the event in February) to be used as Validation.

JRC Collected Dataset

Valerio Lorini presented social media data collected: Tweets from Twitter using districts in Turkyie + related words filtered by keywords for infrastructure and other categories

Other datasets

Data from Critech: Daily maps, shake maps, Infrastructures (roads, bridges, hospitals)

Researchers

Researchers could present their system they could use for the data analysis

- Text summaries AI generated by Fedor V. from UPF
- Interactive AIDR tool displaying missing people reports and shelter requests (text); damages (images) by Imran from QCRI
- Valerio Lorini presented JRC & VOST social media analysis performed in February in real time. They also extracted images of impacts to geocode**.** They relied on the platform SMDRM, able to leverage AI models to annotate relevan text and images during crisis.
- CitizenHelper, an interactive tool showing messages and their locations for serviceable requests/calls for help (e.g., urgent rescue, power/electricity), offering help (e.g., Shelter setup), relevant messages with code-mixing or involving multiple languages, with various

filters like by verified sources, resource types such as medical, etc., presented by Hemant from GMU

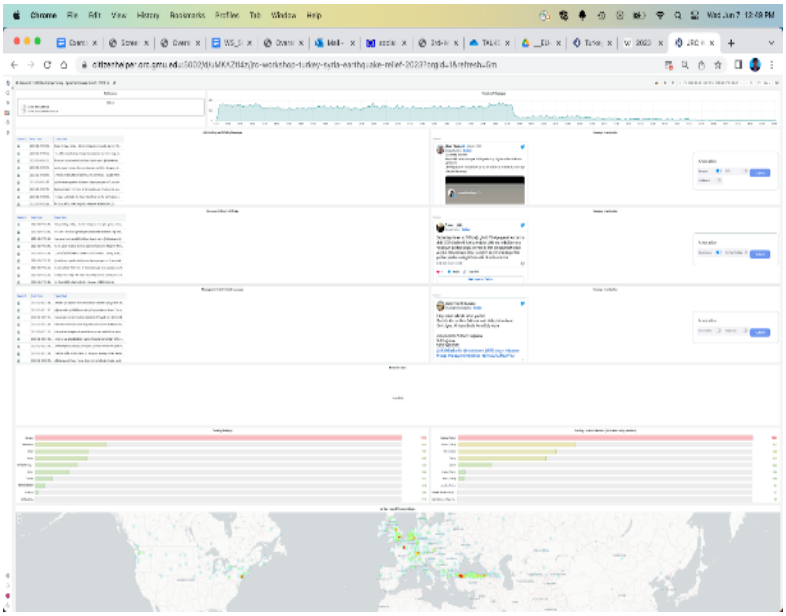


Figure 1 CitizenHelper Dashboard: JRC data collection screenshot

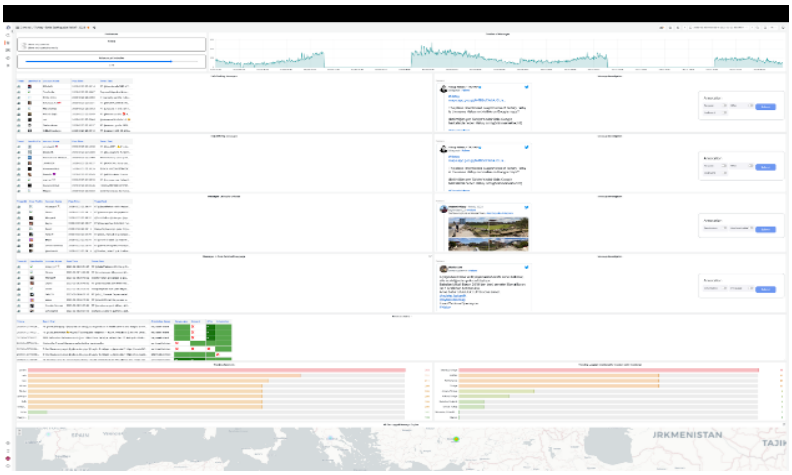


Figure 2 Citizenhelper Own data collection screenshot

Goals

Identify areas impacted by the Earthquake. Compare with Report and check correlation with Critech automatic and CEMS Mapping requests

1. **Collaborative Map**
    1. INFRASTRUCTURE - Describes infrastructural damages and needs, categorised according to:
        1. Dams, power-plants and industries
        2. Airports
        3. Seaports
        4. Roads and bridges
        5. Communications
        6. Governmental buildings

7. Electricity grid
8. Heritage
9. Environmental

2. SHELTER
    1. Describes situation for IDPs, camps, make-shift shelters, host-population, etc.

b. Collaborative Report

1. **SUMMARY** - Provides a summary of the situation with total figures
2. **DISTRICT FIGURES** - Broken down figures for the various districts (dead, injured, missing, IDPs, and electricity and water)
3. **INFRASTRUCTURE** - Describes infrastructural damages and needs
4. **SHELTER** - Describes situation for IDPs, camps, make-shift shelters, host-population, etc.
5. **HEALTH** - Describes situation related to health needs, hospitals, etc.
6. **WASH** - Describes situation for drinking water and sanitation and hygiene issues
7. **FOOD** - Describes situation for food security

c. **Identify Requests from bottom (people in distress)**

Participants should also try to geocode impacts to identify AOIs and Impacts and confront them with the daily maps generated by Copernicus Emergency Management Services.

Methodology

Researchers and Practitioners worked together to define what to search in data (i.e. Taxonomy, which images, which areas)
Practitioners could help with manual tasks and/or validation and/or writing report

Deliverable

- A draft report to compare with the pre-filled authoritative reports
- Participants presented new datasets on the videowall each with a different color. The generated data overlap with existing data. Participants discussed the type of maps generated with social media (i.e., impacts map, health map, req for help, infrastructures, etc.)

Structure of the Exercise

Data Collection Phase: Start by collecting tweets mentioning the earthquake. You can use the Twitter API to collect tweets based on specific keywords and hashtags. Given the earthquake's location, you should look for English and Turkish tweets.
Data Annotation Phase: Participants will be given a sample of tweets and asked to annotate them for relevance to the earthquake, specific impact details, and location information. They can also be asked to identify whether an image attached to the tweet is relevant.
Data Analysis Phase: Here, participants will use the annotated tweets to understand the situation on the ground, identify key areas of concern, and propose potential data analysis for reporting purposes.

Recommended Analysis

1. **Relevance Analysis**: Analyzing the relevance of the tweets can give an insight into the overall impacts on people/infrastructure/services.
2. **Topic Modelling**: This can help identify key themes emerging from the tweets and can help to highlight key areas of concern.

3. **Geographical Analysis**: Using the location data from the tweets, map the most affected areas

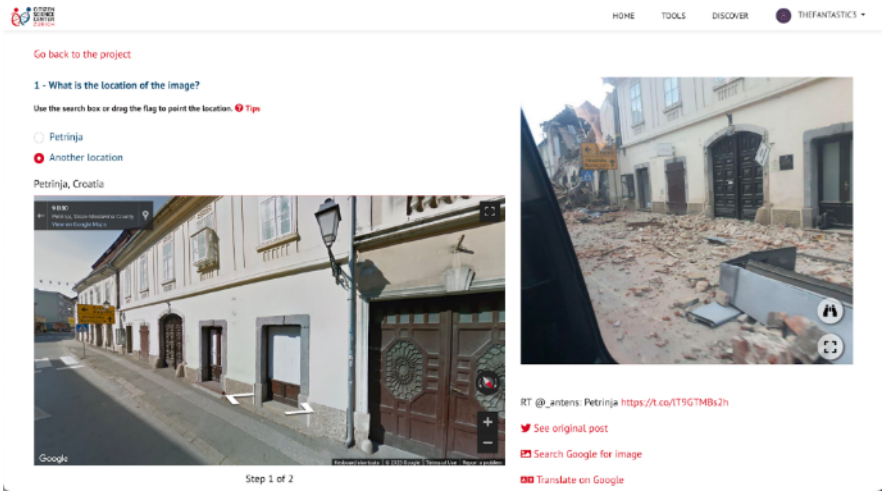


Figure 3 Web application provided by Citizen Science Lab of ETH in Zurich for image geocoding support

1. **Temporal Analysis**: Identify when the number of tweets increased, stayed constant, or decreased to understand the different phases of the disaster

Taxonomy

A taxonomy for this exercise could include:

- Relevance: Whether the tweet is relevant to the earthquake or not.
- Impact: Does the tweet mention specific impacts (e.g., infrastructure damage, casualties, displaced people)?
- Need: Does the tweet mention specific needs (e.g., need for medical help, food, shelter)?
- Location: Does the tweet mention a specific location?
- Sentiment: What sentiment does the tweet convey (e.g., positive, negative, neutral)?
- Image: Is there an image attached, and is it relevant?

Keywords

Typical keywords (their Turkish equivalents have been used too) for the exercise:

- Earthquake
- Turkey
- Damage
- Casualties
- Displaced
- Aid
- Help
- Shelter
- Food
- Water
- Medical
- Emergency

In the context of an earthquake or any other disaster, keywords associated with **requests for direct help** can be varied and situation-specific. However, commonly used phrases and words may include:

1. "Help" / "Need help"
2. "Emergency"

3. "Trapped"
4. "Stuck"
5. "Injured"
6. "Lost"
7. "Missing"
8. "Displaced"
9. "Hungry" / "Thirsty"
10. "No food" / "No water"
11. "Need Shelter"
12. "Need medical aid" / "Need doctor" / "Need medicine"
13. "No power" / "No electricity"
14. "No signal" / "No phone"
15. "Evacuate" / "Evacuation"
16. "Rescue"
17. "Safety" / "Unsafe"
18. "Stranded"

Retrospective Analysis

The session from 12:00 to 13:00 was dedicated to introspection. Participants engaged in a retrospective analysis, discussing the challenges, the tools' effectiveness, and the accuracy of data-driven decisions' accuracy. One key aim were identified during this session: The need to establish a **universal set of requirements for data and tools**, ensuring uniform processing of social media and other non-authoritative data sources across various event types and geographical areas.

Results of the exercise

After comparing the maps generated by Participants' tools with the AOI generated for Copernicus EMS and they partially overlap. There is a potential to use social media data to confirm/complement AOIs

Overall it seems that many information found from social media (and media) could complement with images and numbers some estimations done in official reports based on static data. for instance, the fire at Iskenderum port was not caught in our reports.

More roads closure could be identified

Request for shelters and direct help map could be gathered and provided within limited time if service providers could agree on a sort of 'service agreement'.

Here's an excerpt of the Report generated with AI tools

"A major **earthquake registering 7.8 on the Richter scale**, followed by a **gas pipeline explosion** in **Hatay** and a **fire** at the **port** of **Iskenderun**, has led to a significant humanitarian crisis in Turkey. Current reports show **1,500 fatalities, 2,383 injured**, and numerous individuals missing. The number of Internally Displaced Persons (IDPs) is not yet confirmed but presumed to be high. Basic services like electricity and water are severely disrupted, with water reportedly available in Gaziantep.

Text extracted from tweets

Several devastating earthquakes have struck Turkey and Syria, resulting in significant loss of life, injuries, and extensive damage to infrastructure and buildings [1][2][3][4]. Unofficial accounts report that at least **3,000 people** have died in two devastating earthquakes in Türkiye and Syria, with numbers expected to rise even further. [5] Multiple organizations called for aid to help the areas affected by the 7.7 magnitude earthquake in Maraş, killing at least 912 in Türkiye and hundreds in Syria [6] Two massive earthquakes kill more than 1,800 people in Turkey and Syria; death toll expected to rise; Early morning 7.8-magnitude quake was followed by second 7.6-magnitude; Turkey faces worst disaster since **1939**, Pres. Erdogan says [7]"

3. Afternoon Session: Panels and Discussions

The full set of slides from the presentations are available at the link provided on the DRMKC of the JRC initiative about Social Media for Disaster Risk Management[1]

Day1

Prof Hemant Purohit - George Mason University

Prof. Hemant Purohit is a faculty member and lead for humanitarian at George Mason University in the Washington DC metro region. His research interest lies in technology for social good, primarily focusing on social computing and leveraging various forms of crowdsourced data using AI methods to create effective tools for decision-makers.

Prof. Hemant Purohit discussed the activities and findings of the SMDRM Task Force. The presentation emphasized the importance of bridging the gap between researchers and practitioners and highlighted the perceived value of using social media for disaster risk management.

The SMDRM Task Force was envisioned to bridge the gap between researchers and practitioners. The aim was to converge the expertise of both groups, allowing practitioners to communicate their information needs and operational requirements. At the same time, researchers could fine-tune their research interests to assist practitioners better. The task force has been organizing workshops, conducting surveys to understand the information needs of emergency management practitioners, and hosting focus groups for a more detailed analysis of tool design. The goal is to understand better the perceived value of social media analytics tools and the barriers to their use.

Preliminary results from the SMDRM survey indicated that participants perceived a high value in using non-authoritative data sources, such as social media, for situational awareness. This data can provide insights into disaster extent and magnitude, impacts on infrastructure and services, and more. However, the perceived value varied depending on the specific type of information.

The survey also highlighted the perceived value of using social media for public communication. The majority of participants found it valuable for coordination and timely information dissemination.

Practitioners used various tools to achieve their goals with social media, indicating diverse needs and preferences.

Rolf Bakken – Project Manager ACAPS' Syria/Turkiye EQ Analysis Team

Rolf Bakken, the Project Manager of ACAPS' Syria/Türkiye Earthquake Analysis Team, shared his experiences and insights on using social media in disaster response.

He highlighted the transformative role of social media in disaster response. From providing real-time updates to helping create accurate disaster maps, social media platforms have become indispensable for disaster management teams worldwide.

Background

[1] https://drmkc.jrc.ec.europa.eu/initiatives-services/social-media-driven-disaster-risk-management#3rd-workshop-social-media-for-disaster-risk-management-researchers-meet-practitioners

He began by reflecting on the 2010 Haiti earthquake, a major disaster where over 200,000 people were killed. He mentioned that before 2010, disaster response teams would deploy to the field, gather all the necessary information on-site, process it, and then share their findings with the rest of the world. Advent of Social Media: The 2010 Haiti earthquake marked the beginning of the use of social media in disaster response. Teams on the ground realized that affected populations were sharing information on platforms like Twitter. This was a new phenomenon, and the teams were initially unaware of how to process this influx of data.

Social Media Opportunities

One of the challenges faced during the Haiti earthquake was the sheer volume of data coming from social media. The teams on the ground had limited internet capacity and needed to be equipped to process the vast amounts of data being shared online.

Despite the challenges, Bakken emphasized the value of user-generated data. For instance, during a specific event in Turkey, people sent messages about their needs directly on Twitter. This real-time information was invaluable for response teams.

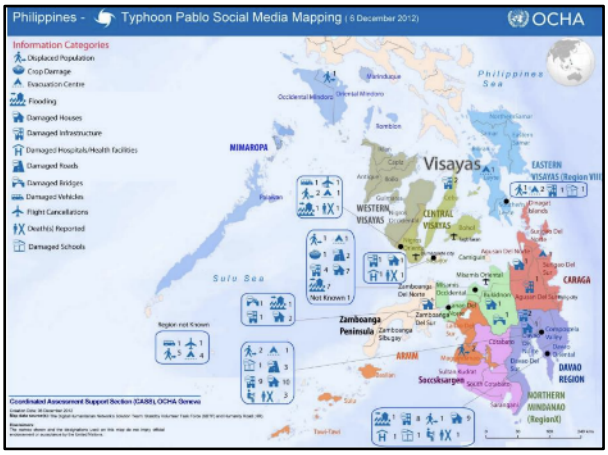


Figure 4 Slides from Bakken Presentation

Luigi Spagnolo – European Commission DG-JRC – SM for Public Health

Background

Public health institutions at both international and national levels are working together on an ICT system for information monitoring and gathering. The primary focus is on rapid risk assessment with two main principles in mind:

1. Human health, animal health, and environmental health are interconnected.

2. All our surroundings can impact human health or the environment.

EIOS System

The Epidemic Intelligence from Open Source (EIOS) system's key features include:

- Media Monitoring: The system monitors media from over 20 selected sources. So far, it has collected 90 million articles, 76% gathered since the beginning of the COVID pandemic. These articles come from various sources, including social media and official online sources.

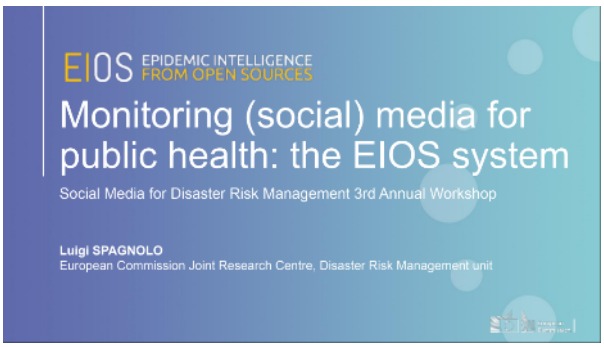
- Collaboration and Knowledge Management: The system aims to bring various teams and organizations together for collaborative information monitoring.

- Contextual Information: This provides a more profound understanding based on the context. For instance, if there's a signal of an emerging disease in a specific area, the risk might be determined based on contextual mobility indicators or the type of seasonality.

The system's components are collaboration and knowledge management, aiming to bring various teams and organizations together for collaborative information monitoring. There's also a focus on contextual information that helps understand the situation based on the context.

The system is a community of communities. Each community has its space within the system but can exchange information. Various UN agencies, NGOs, and WHO Member States, including some from the EU, use the system. One of the significant adopters is Brazil, using it at the subnational level.

Regarding social media in this context, the system gathers information from selected sources related to public health or disaster risk management. These sources include public health or disaster risk management authorities, NGOs, news agencies, etc. The system used to gather information from Twitter but has been suspended for now. They also collect data from Facebook and might include Telegram in the future.



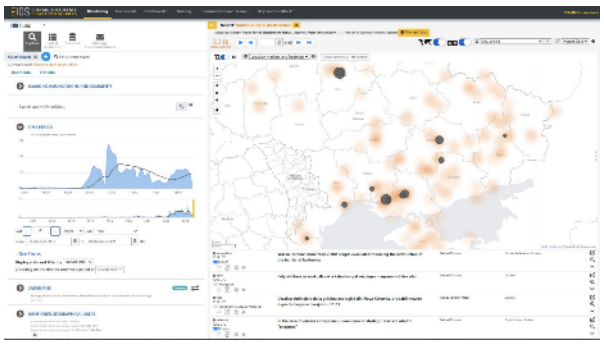


Figure 5 Slides from Spagnolo Presentation

Carlos Castillo – Universitat Pompeu Fabra & ICREA

Carlos Castillo, a distinguished professor from the Universitat Pompeu Fabra, opened his presentation by focusing on applying generative models, particularly in emergencies.

Generative Pre-trained Transformer

Castillo introduced the audience to the Generative Pre-trained Transformer (GPT) concept. He explained that GPT stands for Generative Pre-trained Transformer, which might sound technical but has practical applications.

At its core, GPT and its variants are deep neural networks designed to transform one text into another. These models have a wide range of applications. They can be used for machine translation, transforming one language into another. They can also be employed for question answering, where a model provides answers based on the information it has been trained on. Another significant application is summarization, where the model condenses large volumes of text into shorter, more digestible summaries.

Application in Emergencies

- Real-time Summarization: In emergencies, the rapid influx of information can overwhelm decision-makers. Here, GPT-like models can be invaluable. They can quickly summarize vast amounts of data, providing concise and relevant information to those coordinating response efforts.

Castillo mentioned the potential of using models like GPT during emergencies to extract and summarize critical information from social media platforms, news outlets, and other sources. This real-time summarization can aid in faster decision-making and more effective response strategies.

Challenges & Future Directions

While the potential of these models is immense, Castillo also touched upon the challenges. One primary concern is the reliability of the generated summaries. Ensuring that the summarized information is accurate and omits no critical details is paramount.

Castillo emphasized the importance of collaboration between AI researchers and emergency response practitioners. Researchers can more effectively refine and tailor these models by understanding practitioners' specific needs and challenges.

Castillo concluded by expressing optimism about the future of AI in emergency response. He highlighted the need for continued research, collaboration, and real-world testing to harness the full potential of generative models in this domain.

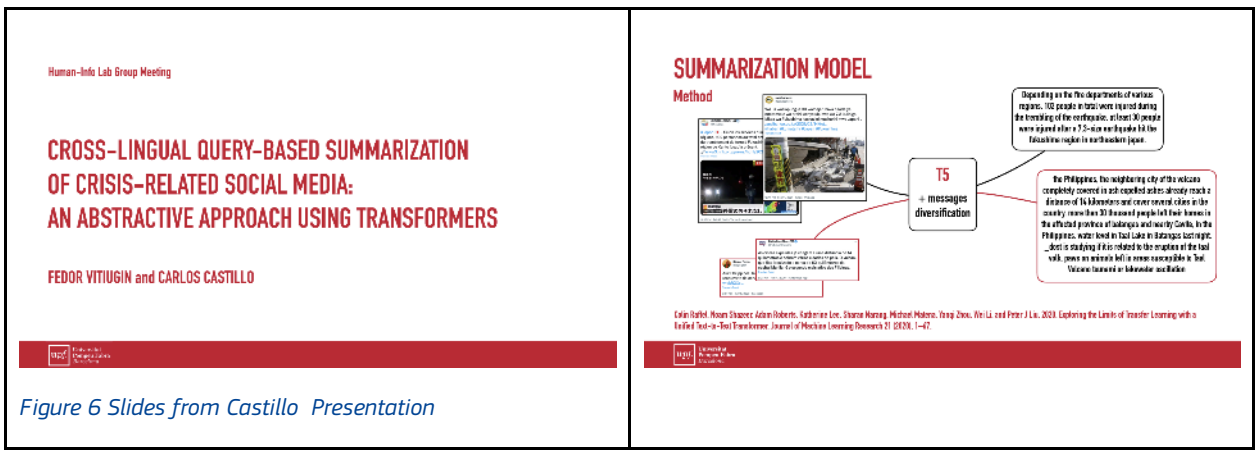


Figure 6 Slides from Castillo Presentation

Jens Linge - European Commission DG-JRC - SM and Misinformation

Jens Linge's presentation revolved around data mining and text analysis to combat misinformation and disinformation, particularly in the context of the European Union.

Introduction & Background

Jens Linge is a scientific researcher at the Joint Research Centre of the European Commission, specializing in text and data mining.

The team was initially formed in anticipation of the 2019 elections and is preparing for the upcoming European Parliament elections in 2024. The COVID-19 pandemic shifted their focus to a more operational role, creating daily and weekly briefs shared across the European Commission.

Methods & Tools

The team uses Natural Language Processing, Machine Learning, and AI to extract essential information from large volumes of text. They have developed methods and tools, such as Unter Base and Code, to combat disinformation narratives. Manual annotation of articles is used to build training sets for machine learning algorithms.

Data Sources

They process approximately 400,000 items daily from the Europe Media Monitor, covering over 70 languages. They also monitor the official websites of health ministries and public health agencies. They primarily focus on Twitter and Telegram for social media, using the Twitter enterprise API and retrieval software.

Misinformation Analysis

JRC researchers have identified over 1.1 million COVID-19 items labeled as containing misinformation narratives. Manual annotation was done on over 33,000 items to train machine learning classifiers. They can detect long-term trends in misinformation and compare narratives among EU member states.

Collaboration & Feedback

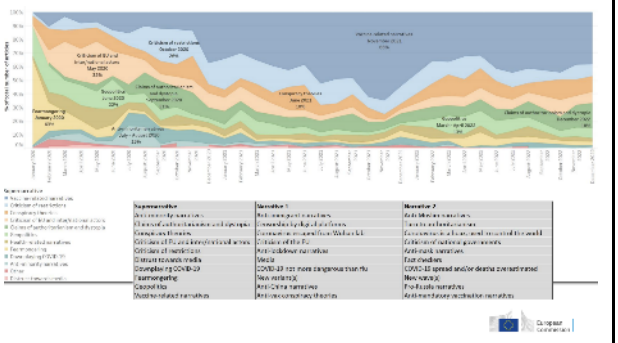
Their data is shared with various EU bodies, including the European Parliament and the European External Action Service. They are open to collaboration and feedback, especially regarding narratives they might miss.

Challenges & Insights

The team observed that many practitioners have multiple roles, which can pose challenges in designing tools to meet their diverse information needs.

This presentation highlighted the importance of using advanced data analysis techniques to combat the spread of misinformation, especially in the age of social media and rapid information dissemination.

Figure 7 Slides from Linge Presentation



Panel Discussion: Barriers and Tools for Enhancing Crisis Response Using Non-Authoritative Data

Moderator: Amanda Hughes, Brigham Young University

Participants:

- Jorge Gomes – VOST PT and coordinator VOST EU

- Karine Zoghby - Consultant for DRM

- Lorini Valerio – European Commission DG-JRC, SMDRM Operational use of SM

Key Points

The panel began with a brief introduction and setting the context for the discussion. The focus was on the challenges and opportunities of using non-authoritative data in crisis response.

Karine Zoghby discussed establishing a national early warning platform system in Lebanon. The system collects data from various sources, including satellite imagery, and disseminates early warning messages about hazards.

She emphasized the importance of sharing this data with national Disaster Risk Management units, ministries, and local actors.

Jorge Gomes' Perspective highlighted the role of VOST (Virtual Operations Support Teams) in crisis management. VOST teams play a crucial role in gathering and verifying information from social media during emergencies. He stressed the importance of collaboration between VOST teams and official emergency services.

A significant insight from the survey was that many practitioners indicated they play multiple roles during crisis management. This assortment of functions, according to Gomes, presents challenges in utilizing and adapting social media tools effectively.

Lorini Valerio presented the Social Media for Disaster Risk Management (SMDRM) project's efforts in operationalizing the use of social media for disaster risk management. He highlighted the importance of integrating social media data with traditional data sources for a more comprehensive

understanding of crises. He also stressed the need for standardized protocols and guidelines for using non-authoritative data.

Panelists agreed on a suggestion to advocate for a new role within the practitioner command structure, specifically an "Information Technical Specialist" or "Data Analyst." This role would focus on processing and analyzing vast AI-filtered data from social media and other sources during a crisis.

One of the primary barriers discussed was adapting to the rapid influx of information from social media. Panelists emphasized the need for tools to filter and present relevant data in real-time effectively.

The panel concluded with a discussion on the way forward, emphasizing the need for collaboration between researchers and practitioners. There was a call for more research into developing tools to harness social media data's power for crisis response effectively.

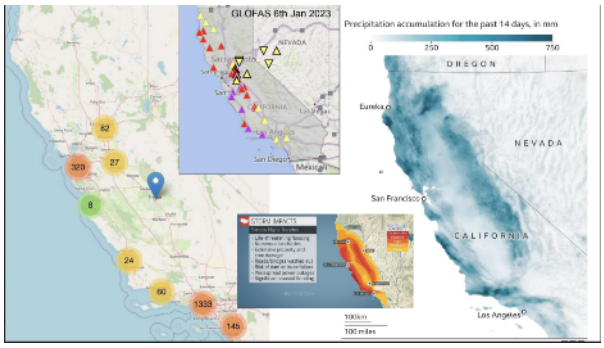


Figure 8 Slides from the panel discussion

Day2

Lucia Castro Herrera - University of Agder

Lucia Castro Herrera is a multidisciplinary researcher in her final year of PhD at the University of Agder. Her project explores support information systems (such as social media) in the public sector for crisis management.

Background

Diversity and inclusion are important values when it comes to crisis and disaster response. The Sustainable Development Goals (SDGs), the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction 2015–2030 indicate that vulnerable populations should be included in disaster risk management strategies and actions to foster resilient communities. How can we leverage social media to listen to the concerns of the population at risk or affected by disasters if social media analytics are providing us with a generalized picture of the conversations happening during crises? Current social media listening strategies might leave underrepresented communities in the background, as concerns, sentiment, and needs are perceived as homogenous.

Herrera presented findings from a study of public service organizations that are listening to their communities through social media. She highlighted the need for segmentation in social media strategies. She also provided attributes that can be considered when practicing social media listening to better serve communities in their entirety.

Diego Souza - CEMADEN Brazil

Diego Souza represents CEMADEN, responsible for producing alerts for landslides and floods across Brazil. The presentation focused on the flow of information, the challenges of obtaining data from vulnerable communities and integrating various data sources to improve disaster response.

Background

CEMADEN produces alerts for landslides and floods across Brazil. These alerts are sent to the national civil defense in the capital, disseminating them to local and regional civil defense units. The center receives information from national and international universities and collaborations.

Dr Souza highlighted three significant disasters in Brazil:

December 2021: Floods in the south of Bahia state during Christmas night, affecting over 800,000 people.

February 2022: Disasters in the mountain region of Rio de Janeiro resulted in over 2,200 deaths due to flash floods and landslides.

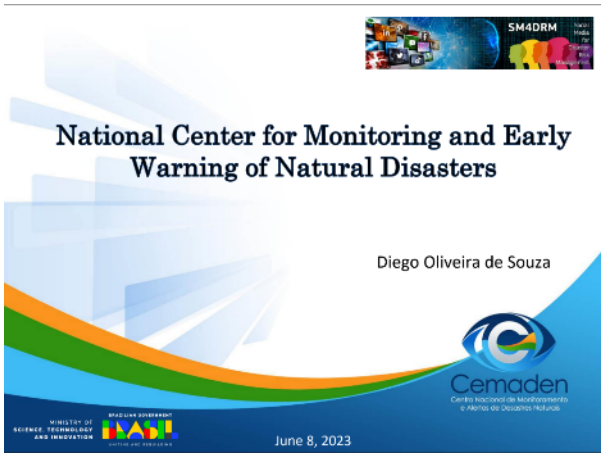
Carnival parties in São Paulo: Record-breaking rainfall in a short duration, affecting over 12,000 people.

Diverse Sources

CEMADEN has developed a database to collect, store, and analyze information about floods and landslides. This data comes from news sources, civil defense, social media, and direct reports from citizens. However, many communities affected by disasters must familiarize themselves with platforms like Twitter. To address this, CEMADEN has been working directly with communities, especially schools, to educate them about risks and gather information.

CEMADEN has initiated collaborative mapping projects where community members identify risk areas. This grassroots approach ensures that local knowledge is incorporated into disaster preparedness and response strategies.

In collaboration with the JRC and the University of Warwick, CEMADEN has been analyzing social media data to identify flood extents and validate them against reports from civil defense. Diego Souza's presentation emphasized integrating various data sources, including social media, to improve disaster response. By collaborating with communities and leveraging technology, CEMADEN aims to enhance its alert systems and provide timely information during crises.



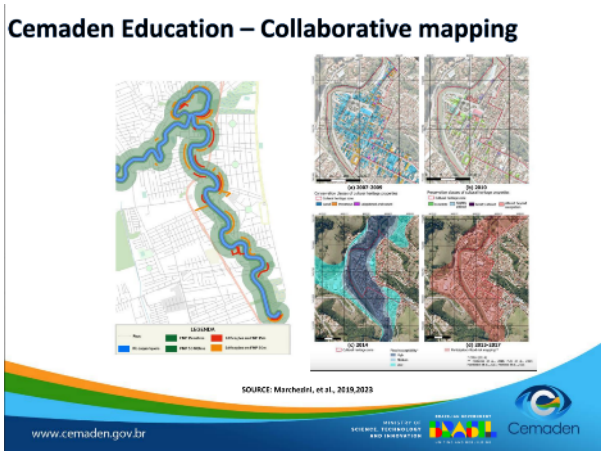


Figure 9 Slides from Souza Presentation

Amanda Hughes - Brigham Young University

Prof. Hughes discussed the challenges and opportunities of using social media and AI for disaster risk management. Dr. Hughes's research specializes in participatory theory and information communication technologies. It combines heavy social theory with heavy computation.

Background

They are currently working on AI and Two-Way Risk Communication. They focus on understanding if the public is listening to official reports from first responders or if it is interested in the engagement with official alerts, especially in specific areas.

Dr. Hughes explored unsupervised classification, which doesn't require training data, and highlighted its benefits and challenges, especially regarding interpretability and situational awareness.

Dr. Hughes emphasized the importance of understanding local sentiments during crises. She highlighted the challenges and potential solutions in using AI and machine learning to analyse and interpret this data.

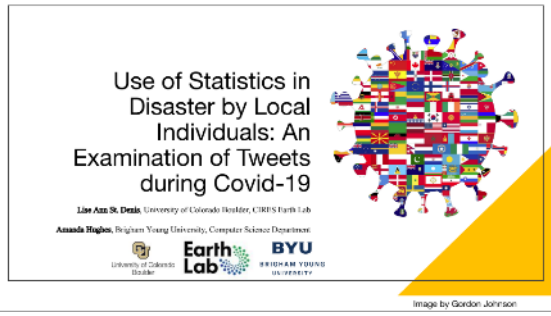


Figure 10Slides from Hughes Presentation

Renee Sieber - McGill University

Renee Sieber is an associate professor at the Department of Geographies. Renee has previously participated in the workshop and is known for her work in public participation GIS (Geographic Information Systems). She focuses on AI and Two-Way Weather Risk Communication, specifically interested in whether official reports from first responders and entities like Environment Canada are being heeded.

Background

Traditional supervised classifications might not capture routine crises like snow or ice. Snow and ice can be impactful without causing injuries or significant infrastructure damage. The categories currently used by the research community are useful for crisis managers but might be less beneficial for the affected public.

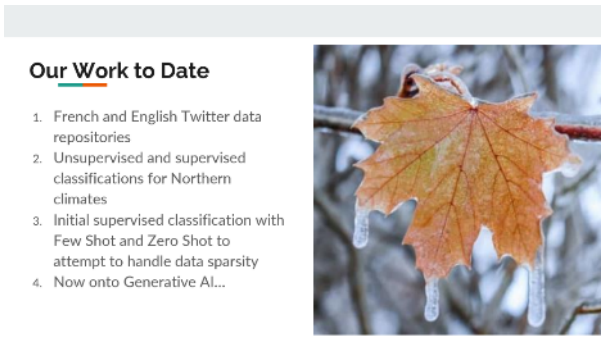
Canada has a significant infrastructure to handle routine events like snow. They use various equipment, from plows to front loaders, to manage snowfall, which could be an impactful situation for the public.

Automated AI classification

They have tried unsupervised classification, which doesn't require training data. However, it needs to be more interpretable and more situationally aware. Fortunately, access to Twitter data has become more affordable.

They have recently employed GPT-4 for classification. Generative AI can be viewed as a conversational agent capable of summarizing, categorizing, and formatting results. They've used it to format responses as JSON objects, effectively creating a database. The AI system obtained can identify tweets about responses to Canadian weather events that describe actions taken to address the aftermath.

Figure 11 Slides from Sieber Presentation



Dr. Muhammad Imran - Qatar Computing Research Institute

Introduction

Dr. Imran discussed a recent work combining remote and social sensing data sources to assess flood exposure damage and understand population needs.

Context

He referenced a significant flooding disaster in Pakistan in August 2022, which affected approximately one-third of the country and impacted around 33 million people. The flood presented various challenges, especially in remote areas where the government needed help understanding and responding to the diverse needs of the affected population.

Methodology

The team worked on a system that integrates remote sensing, social sensing, and geospatial data called "Flood Insights."

This system is in its final stages of development and was recently published at a web conference in 2023.

The methodology consists of three pipelines:

1. Satellite and geospatial data processing.
2. Social media text processing.
3. Social media image processing.

While he didn't delve into the specifics of each AI component, he mentioned that more details are available in their published work.

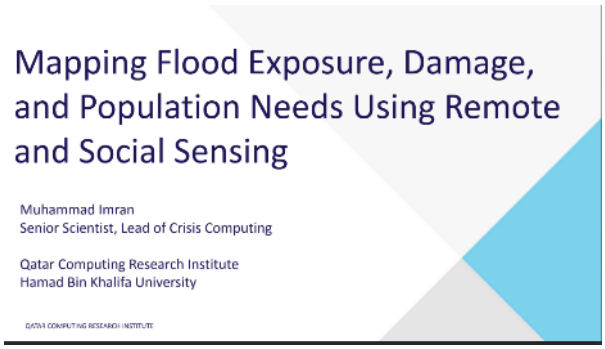
Results

Dr. Imran emphasized the results obtained at the intersection of these non-traditional data sources and the potential opportunities they present. Remote sensing data provides a bird's eye view of situations, allowing for mapping of flood extents and understanding of other disasters. They used

satellite imagery, including Synthetic Aperture Radar Data, and collected around 1600 images from all over Pakistan. Geospatial data from World Pop was used to understand population density, age, gender, etc., for all districts. Social media data, primarily from Twitter, was used, with a collection of 9.4 million Twitter messages and around 400,000 images during the activation period. The remote sensing data allowed them to map flood extents and understand the exposed population to flooding.

Conclusion

Dr. Imran's presentation highlighted the importance of integrating various data sources to comprehensively understand disaster impacts and needs. Combining remote sensing, social media insights, and geospatial data offers a promising approach to enhance disaster response and management.



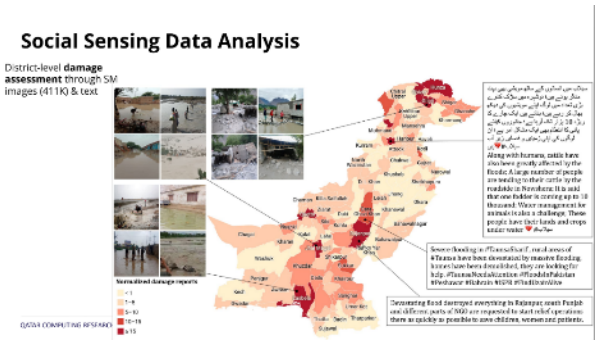


Figure 12Slides from Imran Presentation

3.2.6 Dr. Jayr Alencar Pereira - Qatar Computing Research Institute

Dr. Pereira is a researcher at NeuralMind.ai, holding a PhD in Artificial Intelligence from Centro de Informática, Universidade Federal de Pernambuco, Brazil.

Social Media Processing

Social media platforms, especially Twitter, are a rich source of real-time information during disasters. Jayr's team collects data from Twitter using specific keywords related to floods and landslides. This data helps in understanding the immediate impact of a disaster and aids in response coordination.

Challenges

Brazil has a diverse linguistic landscape. While Portuguese is the official language, there are variations in dialects and colloquial terms across regions. This diversity can make capturing all relevant data using a fixed set of keywords challenging.

During a disaster, there's often an influx of tweets and posts. Filtering out the noise and identifying genuine, actionable information is a significant challenge.

Many communities affected by disasters in Brazil do not regularly use platforms like Twitter. This gap means that while Twitter provides a snapshot, it might not capture a situation's full extent or nuances.

Solutions

The team often resorts to manual searches to overcome the limitations of automated keyword searches. This approach helps in capturing localized information that automated systems might miss.

By engaging with local communities and educating them about the importance of sharing information on social media during disasters, the team aims to get a more comprehensive view of the situation.

Visconde Tool

Visconde is designed to aggregate and analyse vast amounts of information from various documents. In the context of disaster management, this tool can be invaluable in quickly extracting relevant data from a multitude of sources.

Functionalities:

- Search Engine Integration: Visconde combines the capabilities of a search engine with the power of GPT-3. When asked a question, the tool first uses the search engine to identify relevant documents.

- Information Aggregation with GPT-3: Once the relevant documents are identified, GPT-3 extract and aggregate the necessary information. This process ensures the user gets a comprehensive answer without sifting through multiple sources.

Application in Disaster Management

In the aftermath of a disaster, time is of the essence. Visconde can quickly provide insights by analyzing multiple reports, news articles, and other documents, aiding decision-makers in formulating a response strategy. Often, information about a disaster is scattered across various platforms and sources. Visconte is a one-stop solution to consolidate this data, making it easier for responders to get a holistic view of the situation.

In summary, combining social media processing and tools like Visconte offers a powerful solution for disaster management. While social media provides real-time insights, Visconte ensures that decision-makers can access consolidated and analysed information from multiple sources.

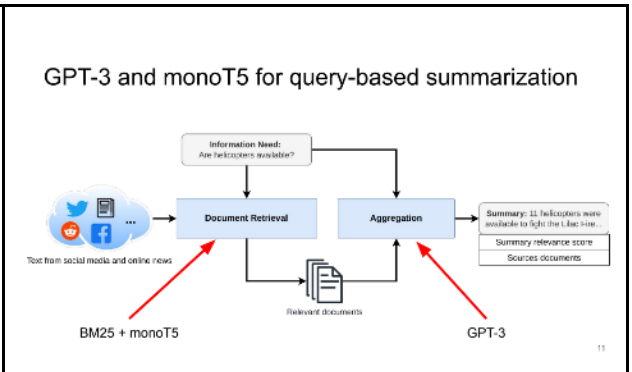


Figure 13 Slides from Alencar Pereira Presentation

Panel Discussion: Barriers and Tools for Enhancing Crisis Response Using Non-Authoritative Data

Moderator: Jorge Gomes – VOST PT and coordinator VOST EU

Panelists:

- Dr. Jose Luis Fernandez-Marquez - University of Geneva

- Dr. Hemant Purohit – George Mason University

- Brindisi Chan - FEMA

- Steve Peterson – CERT Montgomery County

Discussion Highlights:

Jose Luis Fernandez-Marquez introduced a platform that leverages the power of crowdsourcing to allocate and verify images from social media during crises. This platform aims to ensure that the most relevant and accurate images are prioritized for emergency responders. He stressed the significance of integrating participatory methods with advanced technologies. By involving the public, the accuracy and relevance of data can be enhanced.

Dr. Marquez showcased a European initiative that aims to harness social media and crowdsourced data to aid national statistical offices in monitoring Sustainable Development Goals (SDGs). The project has shown promising results in providing real-time insights.

Dr. Hemant Purohit addressed the importance of human supervision in AI. He talked about the evolving role of humans in guiding AI models. As AI advances, the human role might transition from merely labeling data to actively correcting and refining AI outputs. It is essential to comprehend how AI models think and reason. This understanding can refine the models and align them with human reasoning. Even sophisticated models like GPT-4 have limitations. Prompt engineering can help, but there's a need for mechanisms that can effectively communicate human reasoning to these models.

Brindisi Chan brought attention to the work of FEMA, which has been instrumental in social listening and analytics. She discussed how the rapid progress in technology doesn't diminish the human role but instead shifts it. Humans are essential in guiding, refining, and interpreting the outputs of AI models.

General Discussion Points

The panelists agreed on the crucial role of human-AI synergy, especially in crisis management. While AI can process vast amounts of data, human intuition and understanding are irreplaceable.

The inherent biases in AI models were a concern. The panelists discussed human intervention's importance in identifying, correcting, and guiding these models to ensure fairness and accuracy.

The potential of crowdsourcing in enhancing crisis response was a recurring theme. Real-time and ground-level insights can be obtained by involving the public, which can be invaluable during emergencies.

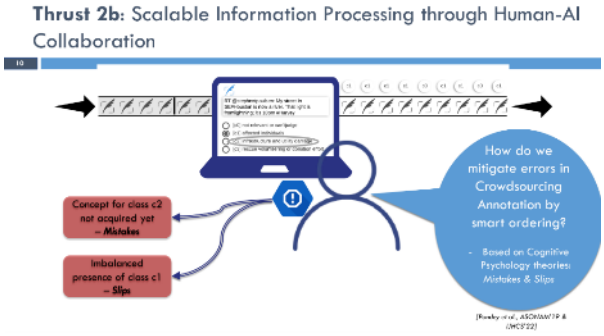


Figure 14 Slides from the panel discussion

4. Conclusions

The organizing committee expressed gratitude for hosting the workshop in person after two online attempts. They reflected on the progress made since the workshop's inception and noted the evolution of discussions and the community's growth.

Achievements

The workshop highlighted the real-world applications of tools and data derived from social media. Several panelists mentioned the collaboration between authoritative agencies and researchers, with real examples from the presentations.

Future discussions

Generative artificial intelligence is here to stay. Participants acknowledged the early stages of its application and the importance of understanding and defining its boundaries. As a "Homework for the Future," organizers encouraged attendees to assess the impact of information extracted from social media during actual events. They suggested following up on reports generated during crises to understand their real-world implications.

From the workshop panels and presentations, it emerged how disaster response practitioners are increasingly aware of OSINT data harnessed from social media. Practitioners from emergency management communities presented several cases for which social media and AI have been deployed successfully for impact assessment. The SMDRM task force showcased preliminary results from their 2022 Survey and related focus group research. As in many other ICT fields, several researchers showed their test of Large Language Models (LLMs) for Disaster Management, especially for summarization and text classification.
Generative AI will play a significant role in our research (text and image analysis, text production, image production, data augmentation, validation, etc.) In 2021, the workshop called for more research in practice and more practitioners in research. Therefore, we were delighted that several initiatives successfully supported real-time disaster response.

List of abbreviations and definitions

Abbreviations	Definitions
ACAPS	Analysis Capacities Project
AI	Artificial Intelligence
API	Application Programming Interface
CC BY	Creative Commons Attribution
CEMADEN	National Center for Monitoring and Early Warning of Natural Disasters (Brazil)
CERT	Community Emergency Response Team
DG-JRC	Directorate-General Joint Research Centre
DRM	Disaster Risk Management
DRMKC	Disaster Risk Management Knowledge Centre
EMS	Emergency Management Services
EU	European Union
FEMA	Federal Emergency Management Agency (US)
GPT	Generative Pre-trained Transformer
ICREA	Catalan Institution for Research and Advanced Studies (Institució Catalana de Recerca i Estudis Avançats)
ICREA	Catalan Institution for Research and Advanced Studies (Institució Catalana de Recerca i Estudis Avançats)
ICT	Information and Communication Technology
JRC	Joint Research Centre
NGO	Non-Governmental Organization

Abbreviations	Definitions
PDF	Portable Document Format
QCRI	Qatar Computing Research Institute
SDGs	Sustainable Development Goals
SM	Social Media
UN	United Nations
VOST	Virtual Operations Support Teams

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Annexes

Annex 1. Report on earthquake impacts in Turkey derived from social media data in the 24h (day 1: Feb 6th, 2023)

Report on earthquake impacts in Turkey derived from social media data in the 24h (day 1: Feb 6th, 2023)

SUMMARY - Provides a summary of the situation with total figures

Summary from social media

A major **earthquake registering 7.8 on the Richter scale**, followed by a **gas pipeline explosion** in **Hatay** and a **fire** at the **port** of **Iskenderun**, has led to a significant humanitarian crisis in Turkey. Current reports show **1,500 fatalities, 2,383 injured**, and numerous individuals missing. The number of Internally Displaced Persons (IDPs) is not yet confirmed but presumed to be high. Basic services like electricity and water are severely disrupted, with water reportedly available in Gaziantep.

Text extracted from tweets

Several devastating earthquakes have struck Turkey and Syria, resulting in significant loss of life, injuries, and extensive damage to infrastructure and buildings [1][2][3][4]. Unofficial accounts report that at least **3,000 people** have died in two devastating earthquakes in Türkiye and Syria, with numbers expected to rise even further. [5] Multiple organizations called for aid to help the areas affected by the 7.7 magnitude earthquake in Maraş, killing at least 912 in Türkiye and hundreds in Syria [6] Two massive earthquakes kill more than 1,800 people in Turkey and Syria; death toll expected to rise; Early morning 7.8-magnitude quake was followed by second 7.6-magnitude; Turkey faces worst disaster since **1939**, Pres. Erdogan says [7]

- [1] Twitter: http://twitter.com/anyuser/status/1622647085383155727
- [2] Twitter: http://twitter.com/anyuser/status/1622725288638443521

- [3] Twitter: http://twitter.com/anyuser/status/1622645030388105232
- [4] Twitter: http://twitter.com/anyuser/status/1622704104815337472
- [5] Twitter: https://twitter.com/BreakfastNews/status/1622704104815337472
- [6] Twitter: https://twitter.com/bianet_eng/status/1622643533080596480
- [7] Twitter: https://twitter.com/NBCNews/status/1622594735654182913

DISTRICT FIGURES - Broken down figures for the various districts (dead, injured, missing, IDPs, and electricity and water)

Summary from social media

As the details of each district are not explicitly provided in the given text, an estimation can't be made. The most severely affected areas include **Gaziantep, Kahramanmaraş, Hatay, Antakya, Adıyaman, and İskenderun** among others.

INFRASTRUCTURE DAMAGE- Describes infrastructural damages and needs.

Summary from social media

Dams, Power-plants, and Industries: Information on these not available in the given text.

Airports: **Hatay** International Airport and **Gaziantep** Airport are reported destroyed.

Seaports: Part of the port of **Iskenderun** has collapsed due to the earthquake, causing a **large fire**.

Roads and Bridges: Significant destruction to roads and bridges reported across multiple locations, making access to affected areas difficult.

Communications: Specific information on the state of communication infrastructure not available. However, references to social media indicate some level of connectivity.

Governmental Buildings: A police house in Kahramanmaraş and several other unspecified government buildings have been destroyed.

Electricity Grid: Power is disrupted across affected areas. Specific damage to the electricity grid not detailed.

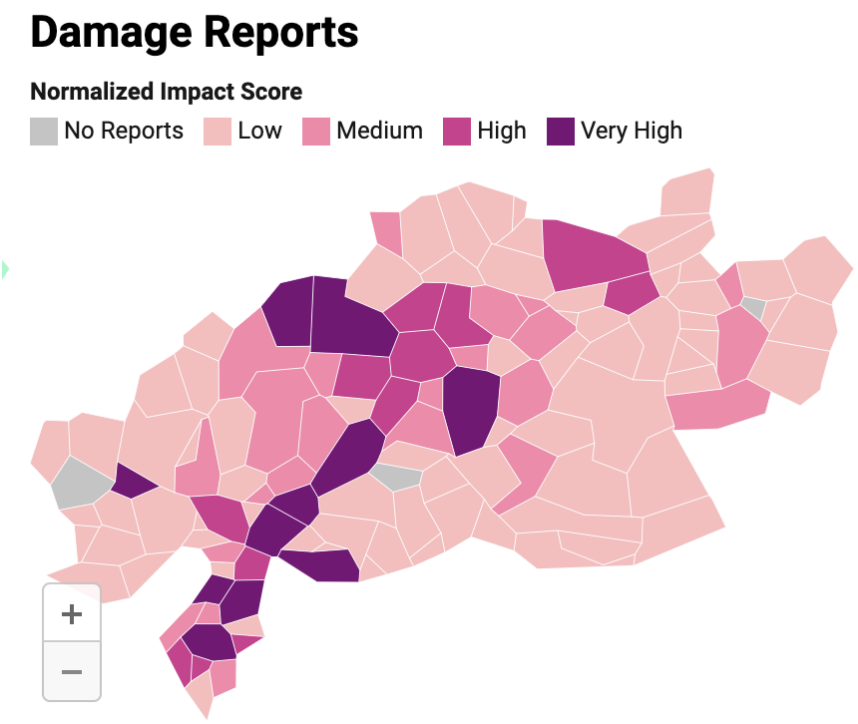
Heritage: **Gaziantep Castle**, a UNESCO World Heritage site, has collapsed. Further damage to cultural heritage sites is feared.

Environmental: No direct environmental impact specified beyond the broader earthquake impact.

Text extracted from tweets:

Severe damage inflicted on electricity, natural gas infrastructure, and major port after powerful earthquake struck southern Türkiye [1] Update on Türkiye's #earthquakes: at least 1,762 killed; at least **5,606 buildings** destroyed; 6,445 rescued so far from the rubble; rescue mission continues to the night amid cold, rainy weather. For more: http://xhtxs.cn/Eo1 [2] I have friends who say that there is no electricity and there is a lot of debris in Iskenderun, Hatay, please someone reach Iskenderun [3]

District-level mapping of damage reports/images shared on Twitter (Source: AIDR/QCRI)



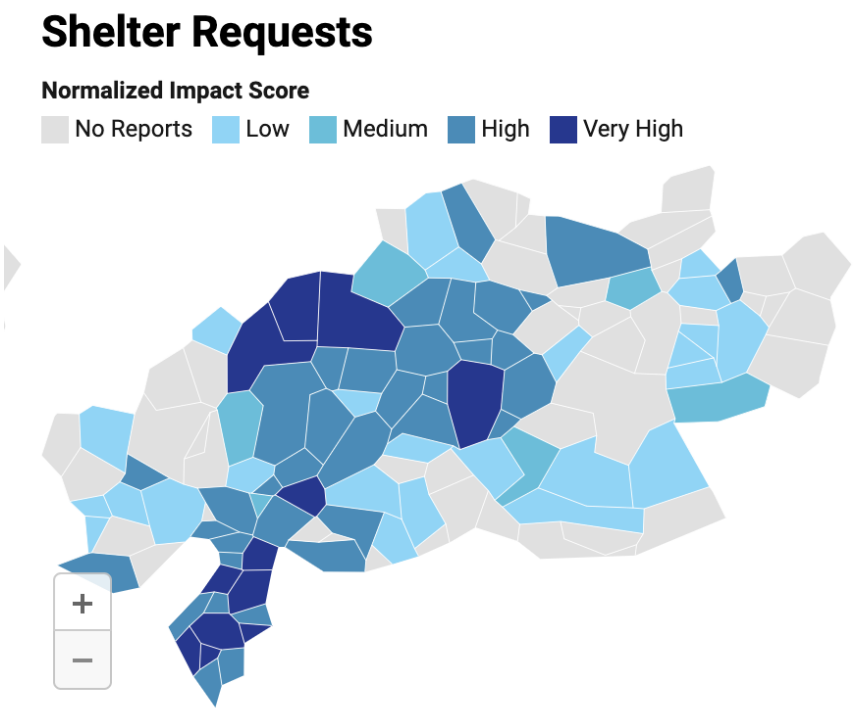
- [1] Twitter: https://twitter.com/DailySabah/status/1622641277597515782
- [2] Twitter: https://twitter.com/XHNews/status/1622696064179662848
- [3] Twitter: https://twitter.com/avceymn/status/1622671032371879936

SHELTER - Describes the situation for IDPs, camps, make-shift shelters, host-population, etc.

Summary form social media

The reports suggest that a significant number of buildings, including residential areas, have collapsed. Temporary shelters and camps are needed urgently, and help is sought for those under the rubble. Information about current IDPs, camps, or host populations is not specified.

District-level shelter requests posted on Twitter (Source: AIDR/QCRI)



HEALTH - Describes situation related to health needs, hospitals, etc.

Summary from social media

Several **hospitals** and healthcare facilities have been reported destroyed, including those in **Antakya**, **Hatay**, **Kahramanmaraş**, **Iskenderum,** and more, disrupting healthcare services. Immediate medical assistance is needed for the injured and those trapped under the rubble.

Text extracted from tweets:

My friend's brother and nephew were at the old State Hospital in Iskenderun. They're under the rubble. No news [1] 13 Healthcare Workers Under Ruin, Intensive Care Part of the Hospital Collapsed in Iskenderun, Work Continues to Rescue a Nurse.. #iskenderun #hatay #deprem #PrayForTurkey #enkazaltındayım #enkaz #earthquake #earthquakeinturkey #turkey #TurkeyEarthquake [2] @YellowredrePort Hatay İskenderun Merkez Md Park Private Hospital is said to have been demolished by my cousin Alper... [3]

- [1] https://twitter.com/aygs19051905/status/1622692714826371088
- [2] https://twitter.com/i/web/status/1622646925966049333
- [3] https://t.co/8dgllcwuck

WASH - Describes situation for drinking water and sanitation and hygiene issues

Summary from social media

Water seems to be available in Gaziantep, but the situation in other areas remains unknown. Given the widespread infrastructure damage, the impact on sanitation facilities is unspecified but likely severe. Ensuring access to clean water and sanitation facilities will be an immediate need to prevent disease outbreaks.

Text extracted from tweets:

Various requests for water in social media: #osmaniye please set up an AFAD tent in the central district, there is no electricity, no water, no heating, it is raining a lot, we cannot enter the houses, we cannot go to the assembly center, we are very cold, at least a glass of water and a tea [1]

- [1] Twitter: https://twitter.com/iisilnur/status/1622619132817448960

FOOD - Describes situation for food security

Summary from social media

There's no specific mention of food security in the given text. However, given the extensive infrastructure damage and number of displaced persons, food distribution will likely be a significant issue, and emergency food aid will be required.

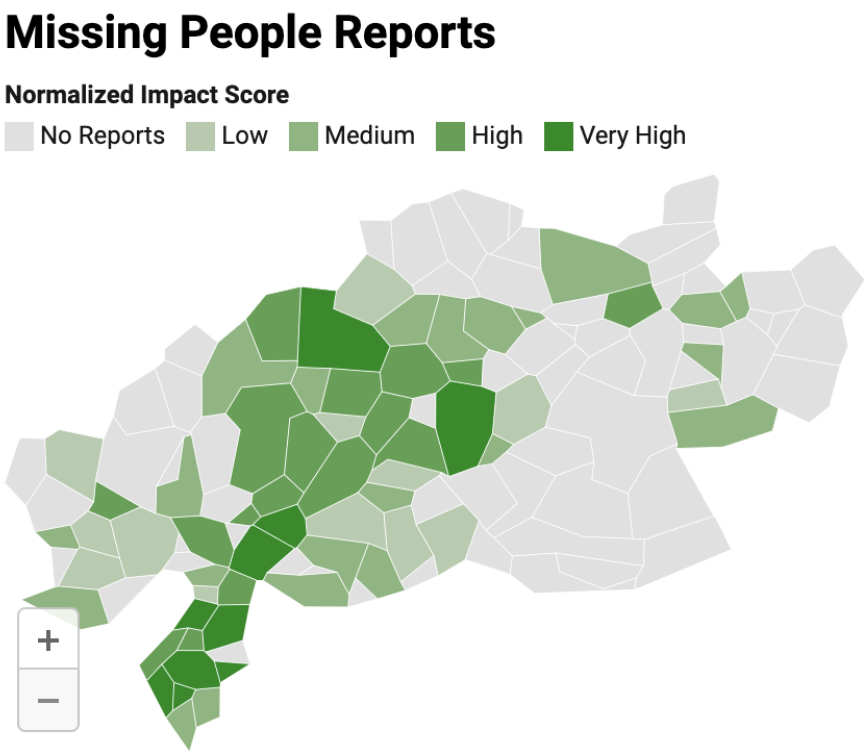
Text extracted from tweets

Various requests for food in social media: The gym in Mustafa Kemal Neighborhood needs WATER and FOOD assistance. Help!!! [1] Hatay / Iskenderun is waiting for food aid [2] We can't get gas etc. Our basic needs such as bread and water are very limited. We need help, buildings are collapsing all at once [3]

- [1] Twitter: https://twitter.com/Mertdmirtas/status/1622681971691323393
- [2] Twitter: https://twitter.com/EmirTugay1905/status/1622674907061526548
- [3] Twitter: https://twitter.com/elllllllla_/status/1622615064065806339

MISSING PEOPLE - Describes situation regarding missing people reports

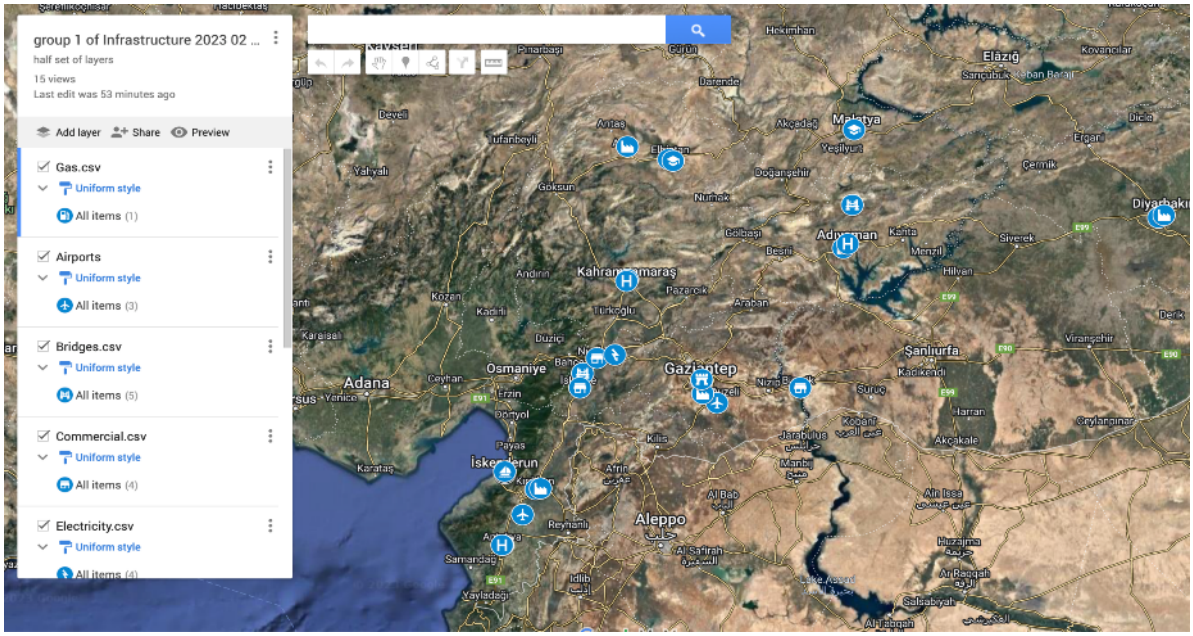
District-level mapping of missing people reports from Twitter (Source: AIDR/QCRI)



Maps from social media

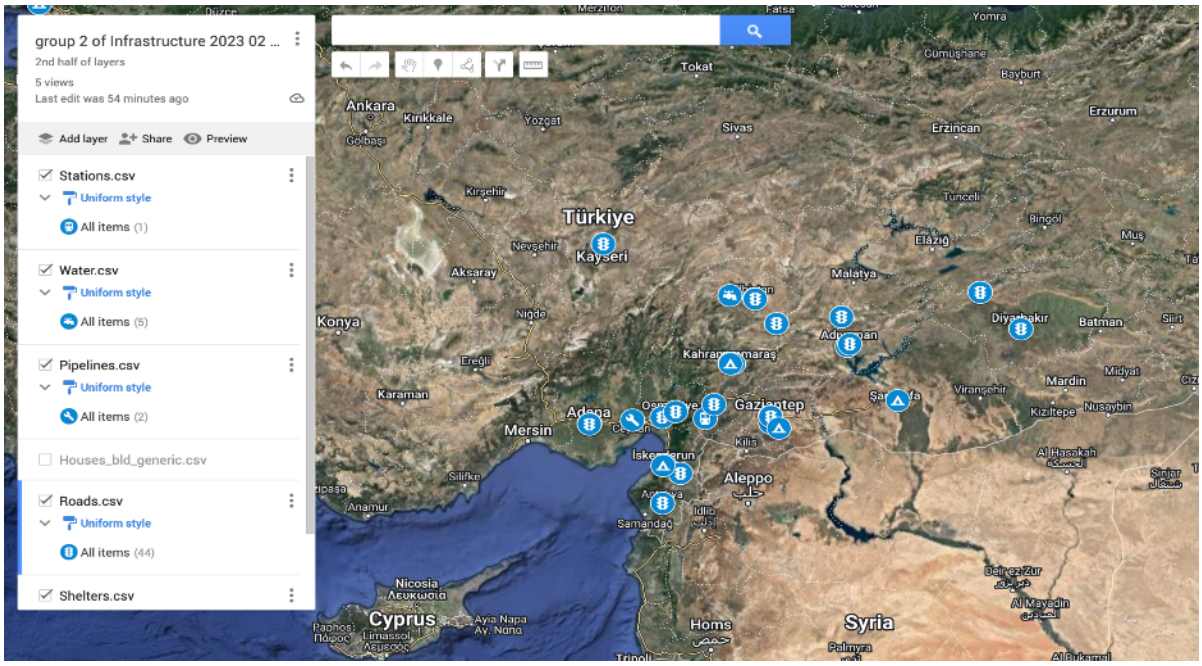
Infrastructures 1

Link to the map online

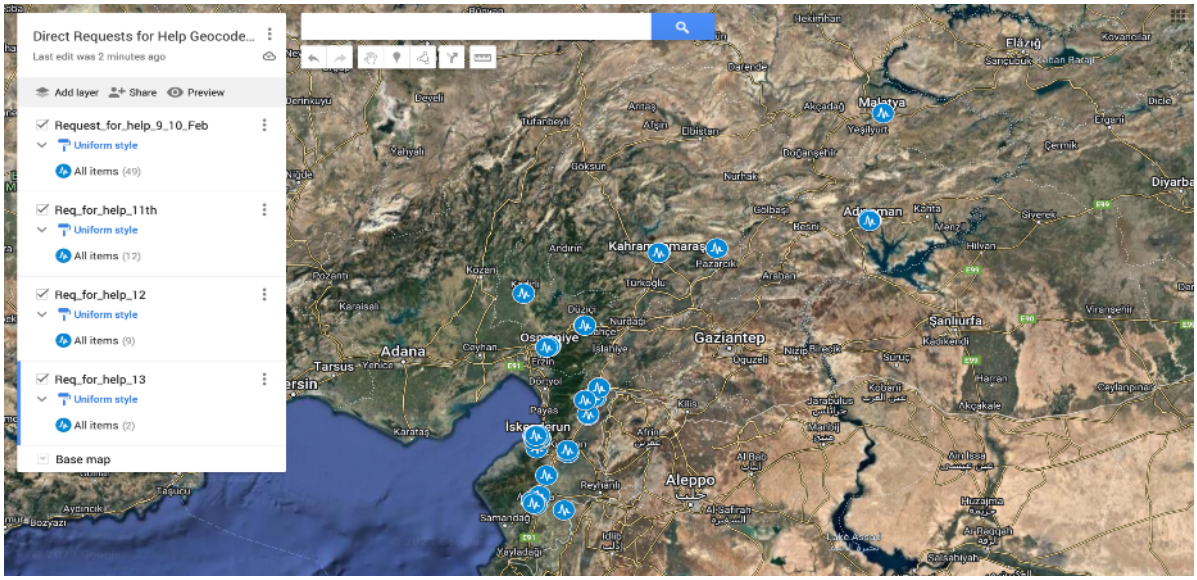


Infrastructure 2

Link to the map online



Request for Direct Help (from day 3)



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