TREC INCIDENT STREAMS TRACK PROPOSAL

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Background

Internationally, civil protection, police forces and emergency response agencies are under increasing pressure to more quickly and effectively respond to emergency situations. Moreover, such emergencies are common and re-occurring. For example, 50,000 people per-year on average dieing during natural disasters internationally, meanwhile in the U.S. 80 deaths per-year are directly attributed to tornados alone. Moreover, even when lives are not at stake, slow or ineffective emergency response can result in increased property/livelihood damage.

The corner-stone that forms the basis of successful response actions is *situational awareness (SA)*. SA is derived from accurate knowledge of what is occurring at the current moment (the operational picture), which can be used to take effective action to remedy the situation, as well as take preventative steps to avoid further loss of life/damage. Response services rely on direct contact with local first-responders and emergency services to form an operational picture. This is then augmented with information from the public, passed to the incident commander by contact points such as emergency call-centre operators. However, depending on the disaster severity, travel distance to the affected area, the state of the local roads and communication infrastructure, it can take hours before accurate information becomes available

The mass adoption of mobile internet-enabled devices paired with wide-spread use of social media platforms for communication and coordination has created ways for the public on-the-ground to contact response services. Moreover, a recent study reported that 63% of people expect responders to answer calls for help on social media.

Proposal

In the U.S. under the National Incident Management System (NIMS) contact with the public is handled by Public Information Officers (PIOs) for each region, With the rise of social media PIO's are now expected to monitor those channels to answer questions from the public, as well as report requests for aid to the Incident Commander. However, PIOs do not have adequate tools or manpower to effectively monitor social media, due to the large volume of information posted on these platforms and the need to categorise, cross-reference and verify that information.

The TREC Incident Streams track (TREC-IS) is a new initiative designed to promote state-of-the-art research into tooling to better support response services harness social media during emergencies. In particular, it will develop a test collection and evaluation methodology for automatic and semi-automatic filtering approaches that aim to identify and categorize information and aid requests made on social media during crisis situations. This will support the advancement the technology readiness level (TRL) of current social media crisis monitoring solutions and better support social media monitoring by PIOs and other stakeholders in the future.

The aim of the TREC-IS task is to produce a series of curated feeds containing social media posts, where each feed corresponds to a particular type of information request, aid request, or report containing a particular type of information. These 'types' are defined based on existing hierarchical incident management information ontologies, such as MOAC (Management of a Crisis), For instance, for a flash flooding event, feeds might include, 'requests for food/water', 'reports of road blockages', and 'evacuation requests'. In this way, during an emergency, individual PIO's and other stakeholders can register to access to the subset of feeds within their domain of responsibility providing access to relevant social media content without the large costs of monitoring all social media content produced during an emergency.

Task Definition

Methodology: The task will follow a classical TREC evaluation methodology whereby a dataset will be provided before-hand to the participants containing a stream of social media posts from a past event. Where possible the post stream will be provided with all the necessary content included, however participants may need to perform additional work to resolve content/metatdata for individual posts depending on the terms and conditions of the data source. An ontology will also be provided, which represents the different information needs of the user. Each participant will develop a system that will process the post stream in time order, as if the event was occurring in real-time. As a system processes the stream, it will emit individual posts over time it identifies as matching one or more information types in the ontology, discarding the rest. Due to the time-critical nature of the task, decisions for each post must be made immediately, i.e. a system much chose to emit or discard a post immediately as it is processed. Emitted posts will be written to a 'run' file. A participating group will be allowed to submit a number of run files to TREC for evaluation by expert assessors. At the TREC conference, the performance of individual runs will be released for comparison across groups. Post-TREC, the assessments will be released to the community for reproducibility and for use by future researchers.
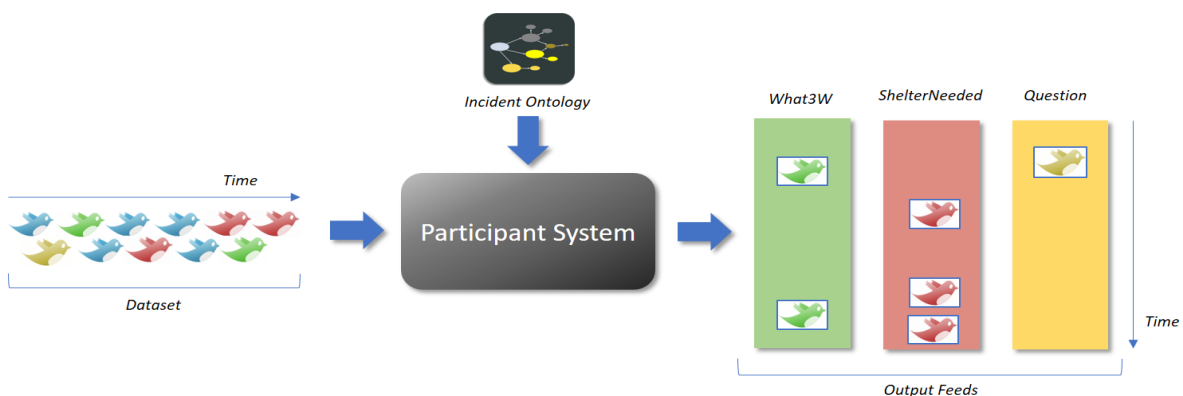
Input: Participating systems will ingest a stream of social media posts from a major platform in time order. It is anticipated that Twitter will be the primary social media data source for the first year of the track. However, access to other social media feeds for emergency management organisations, e.g. Facebook pages will also be considered (based on data availability). Each post will contain the following fields:

> ➢ ID: A unique string identifier for the post
> ➢ Content: This is a text string that contains the post message
> ➢ PostTimestamp: This is a long value that corresponds to the UNIX time the post was made.

Posts may also contain additional metadata about the post, author or source platform, depending on data source.

Additionally, participants will be provided with a structured ontology file containing the information needs that the participant system is to find related posts for. Each entry (information type) in the ontology will contain:

> ➢ ID: A unique string identifier for the information type
> ➢ Description: A free text description of what type of information would match this entry.
> ➢ Parent: The ID of the parent entry if one exists.

An example information type is shown below:

```
{
    "ID": "ShelterNeeded",
    "Description": "Records information regarding additional requests for shelter made by a
member of the public",
    "Parent": "Needs3W"
}
```

Output: Systems will output a subset of the social media posts that they have identified as matching one or more of the information types in JSON format. Each post should include the following fields:

> ➢ EventID: A unique identifier for the event being processed.
> ➢ ProcessingType: Either 'Automatic', 'Semi-Automatic' or 'Manual'. Automatic indicates that the post was selected based on a fully automatic process that only used data from before the event started to make the decision. 'Semi-Automatic' indicates that the post was selected based on a fusion of human effort and automatic classification, e.g. if the system used active learning and requested a human label for the post. 'Manual' should be used if a human decided to emit this post without input from an automatic system.
> ➢ ID, Content and PostTimestamp: Fields from the input post.
> ➢ InformationTypes: the information type(s) identified by the platform that the post matches. This should be a list of JSON objects containing ontology ids, e.g. 'ShelterNeeded' and confidence values on a 0-1 scale, where 1 is the highest confidence of a match and 0 is the lowest confidence of a match.

For example, an output post might look like:

```
{
        "EventID": "TREC-IS-E001",
        "ProcessingType": "Automatic",
        "ID": "56132414141345",
        "Content": "#nswfires NE of Mount Coramba, Type: Bush fire, Status: out of Control, Size 1ha"
        "PostTimestamp": 1459468800,
        "InformationTypes: [
                {
                        "OntologyID": "What3W",
                        "Confidence": 1.0
                },
                {
                        "OntologyID": "Where3W",
                        "Confidence": 0.7
                }
        ]
}
```

Evaluation

The aim of TREC_IS evaluation is to test the performance of a system in terms of its ability to identify relevant content for each of the ontology entries. To this end, the updates returned by each participant system will be pooled and assessed as matching one or more of the ontology entries (information types) by an expert. The task is inherently recall-focused, as missing information can have a very high cost (particularly in the case of aid requests). However, assessment resources will be limited. As such, after run submission, a subset of the ontology entries will be selected by the organisers. The pools of posts emitted by systems for these ontology entries will be completely assessed.

System performance will be reported in terms of classical filtering evaluation metrics per information type:

- ➢ Precision
- ➢ Recall
- ➢ Accuracy

Overall performance on the task is the average accuracy over all information types selected.