

A Web Application to Map Disaster Impacts from Text

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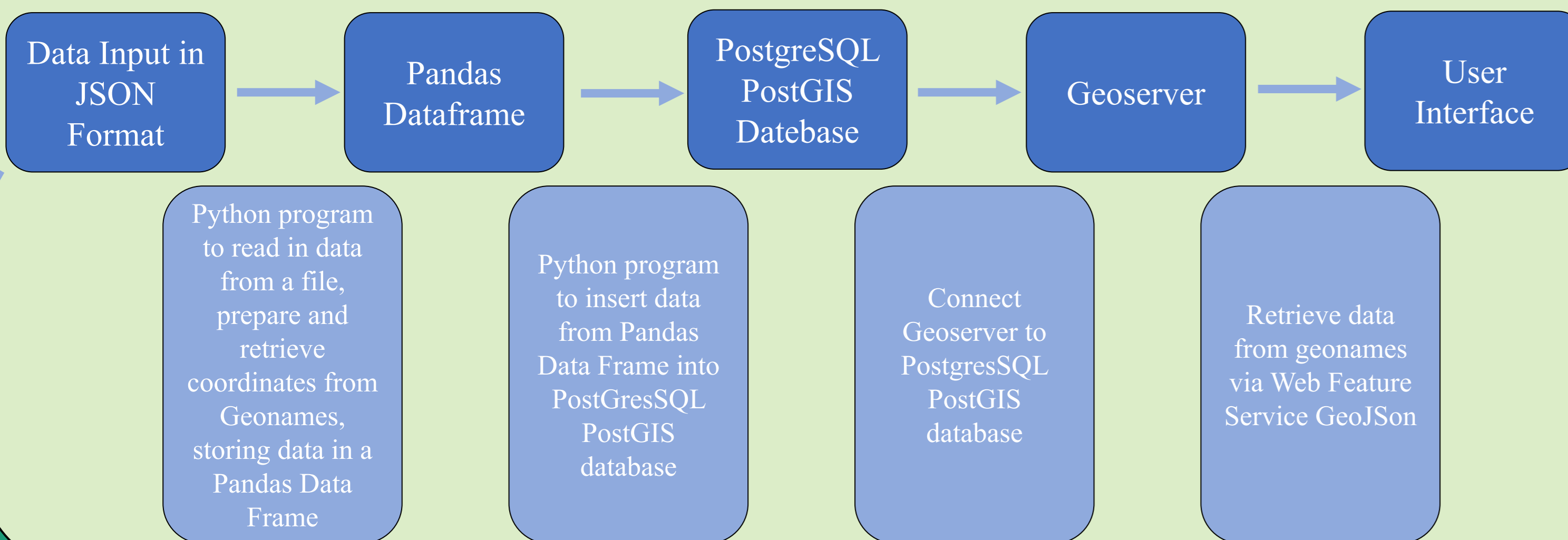
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Introduction

Social media enables users to connect and share information, news, and content with a large network of people. It contains a wealth of knowledge, being updated constantly in real-time. Following a natural disaster, people turn to social media to share information regarding the damage and injuries sustained.

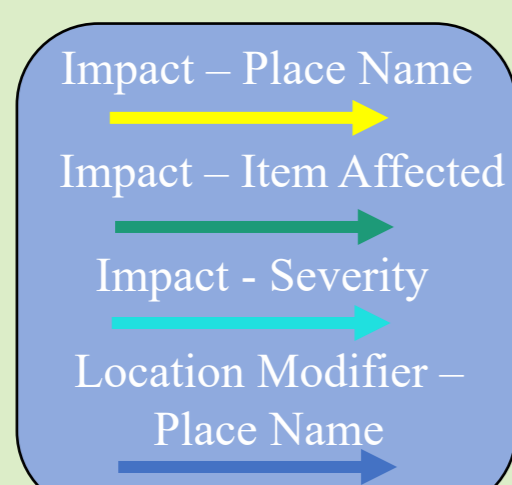
Unlike previous work, we are developing an application to map fine-grained, individual impacts that are automatically extracted from tweets, along with an accurate and informative open-source mapping interface. We present a description of the method we are using to georeference, map and display the information from the tweets and display them as well as the application's functionality.

Pipeline



Input Data

- Relations between entities including severity, impact, item affected, location modifiers and locations are extracted from tweets using NER [1]
- Relation annotation was separated into 4 categories: impact-place, item-impact, impact, severity and location modifier-location. [2]

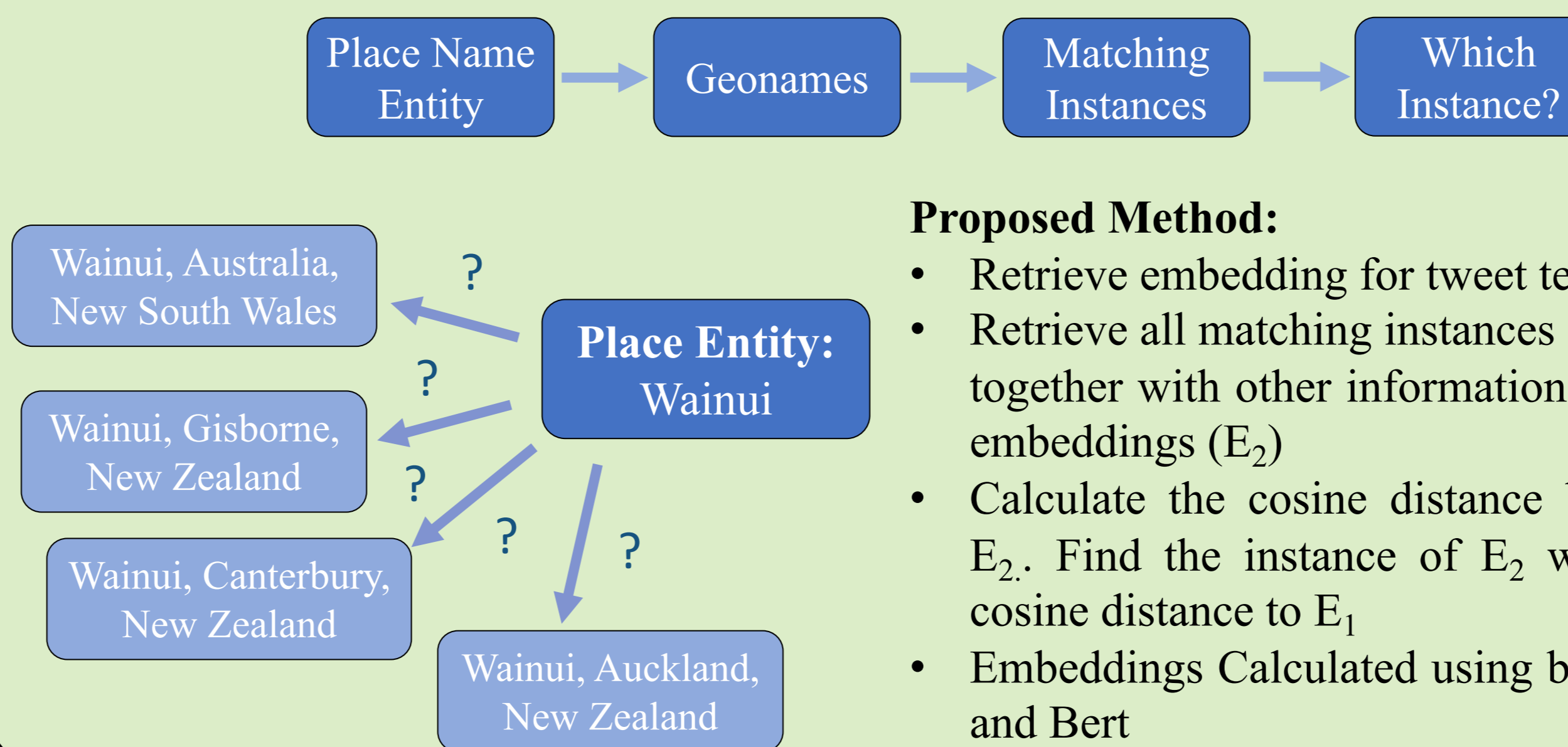


Coordinate Retrieval

- Retrieve first instance from Geonames [3], (a place name data base) local database stored in PostgreSQL [4] using queries, matching the place name extracted using NER from the text
- This is a temporary solution whilst we work on the place name disambiguation
- Convert coordinates to point geometries and stored in a GeoPandas Dataframe

Place Name Disambiguation

The task of correctly identifying a place from a set of places sharing a common name. [7]



Proposed Method:

- Retrieve embedding for tweet text (E_1)
- Retrieve all matching instances from GeoNames together with other information and retrieve the embeddings (E_2)
- Calculate the cosine distance between E_1 and E_2 . Find the instance of E_2 with the shortest cosine distance to E_1
- Embeddings Calculated using both Open AI [6] and Bert

References:

[1] Francis, S., Stock, K., Hameed, S.N., Yandamuri, H., Li, D., Prasanna, R., Liberatore, F., Jones, C.B., Hudson-Doyle, E., Medagoda, N., Mowll, R., Tregoweth, A., Treadgold, G. and Waterreus, A. (2022), Annotating and Extracting Disaster Impacts from Social Media with Named Entity Recognition. Poster presented at ISCRAM Asia Pacific, 7-9 November, Melbourne.
 [2] Wijegunaratna, K., Stock, A., Francis, S., Jones, C.B., Prasanna, R. and Hudson-Doyle, E. (2022), Relation extraction to identify locations of disaster impacts from social media text. Poster presented at ISCRAM Asia Pacific, 7-9 November, Melbourne.
 [3] 'GeoNames'. <https://www.geonames.org/>
 [4] P. G. D. Group, 'PostgreSQL', *PostgreSQL*. <https://www.postgresql.org/>

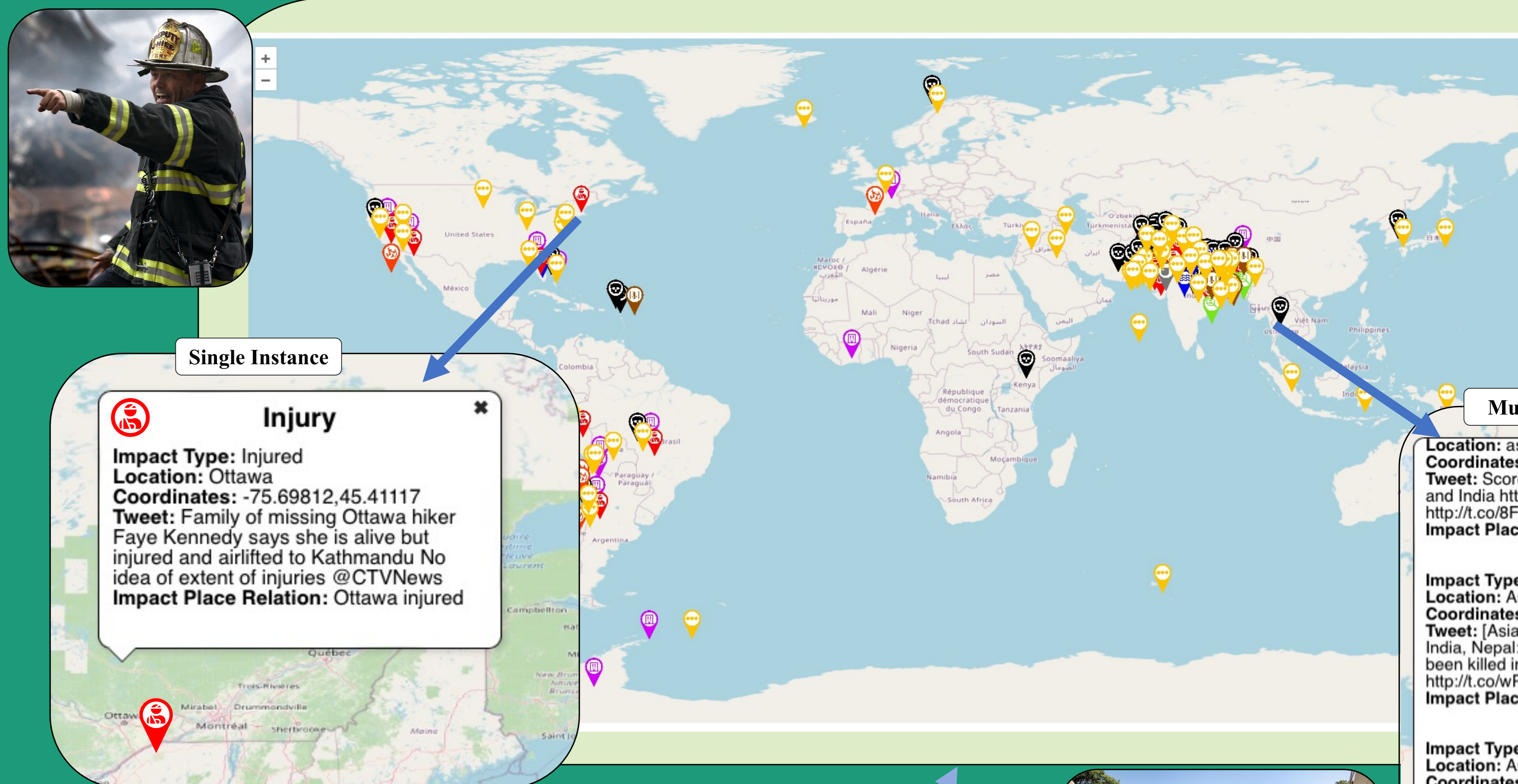
[5] 'OpenLayers - Welcome'. <https://openlayers.org/>

[6] 'GeoServer'. <https://geoserver.org/>

[7] Y. Ju, B. Adams, K. Janowicz, Y. Hu, B. Yan, and G. McKenzie, "Things and Strings: Improving Place Name Disambiguation from Short Texts by Combining Entity Co-Occurrence with Topic Modeling", in *Knowledge Engineering and Knowledge Management*, E. Blomqvist, P. Ciancarini, F. Poggi, and F. Vitali, Eds., in Lecture Notes in Computer Science, vol. 10024. Cham: Springer International Publishing, 2016, pp. 353-367. doi: 10.1007/978-3-319-49004-5_23.

[8] 'OpenAI API'. <https://openai.com/blog/openai-api>

[9] R. Liao, P. P. Das, C. B. Jones, N. Aflaki, and K. Stock, "Predicting Distance and Direction from Text Locality Descriptions for Biological Specimen Collections," in *15th International Conference on Spatial Information Theory (COSIT 2022)*, Dagstuhl, Germany, 2022, vol. 240, p. 4:1-4:15. doi: 10.4230/LIPIcs.COSIT.2022.4.



Display Impacts

- Damage
- Death
- Fire
- Flood
- Injury
- Missing
- Terrorism
- Trapped
- Other

Mapping Interface

- Openlayers [5] connects from Javascript Application to Geoserver [6] (a geographical data server), retrieving GeoJSON data and creates a vector layer on the map
- Icons are allocated based on the previous definition of the impact type

Place Name Disambiguation Challenges

- Restrictions on number of calls to Open AI Api [8]
- Open AI Api [8] is very slow to retrieve embeddings
- Retrieving GeoNames instances is slow
- Work in progress – unsure as to how well our method will work

Future Work

- Refine geolocations of tweets on the map by incorporating location modifiers creating models for specific spatial terms using similar approach to [9] but applying the latest deep learning methods
- Refine impact categorization
- Evaluation of the user interface – please email Lydia at pricelydia776@gmail.com if you would like to participate