CS5803: Natural Language Processing

Project Title: Disaster Tweet Classification

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Problem Statement

- During a disaster, people share huge information on Social Media which can be used to respond to the calamity.
- Proper and timely information can help the disaster response teams immensely.
- This project aims to classify tweets in informative and non-informative tweets to extract important information.
- The overall task involves three subtasks finding if a tweet contains information related to disaster, whether any humanitarian aid is required and how much damage has been caused.
- The task needs to be performed sequentially as a pipeline (if a task is informative then only it is processed further to see if humanitarian need is required).

Problem Statement
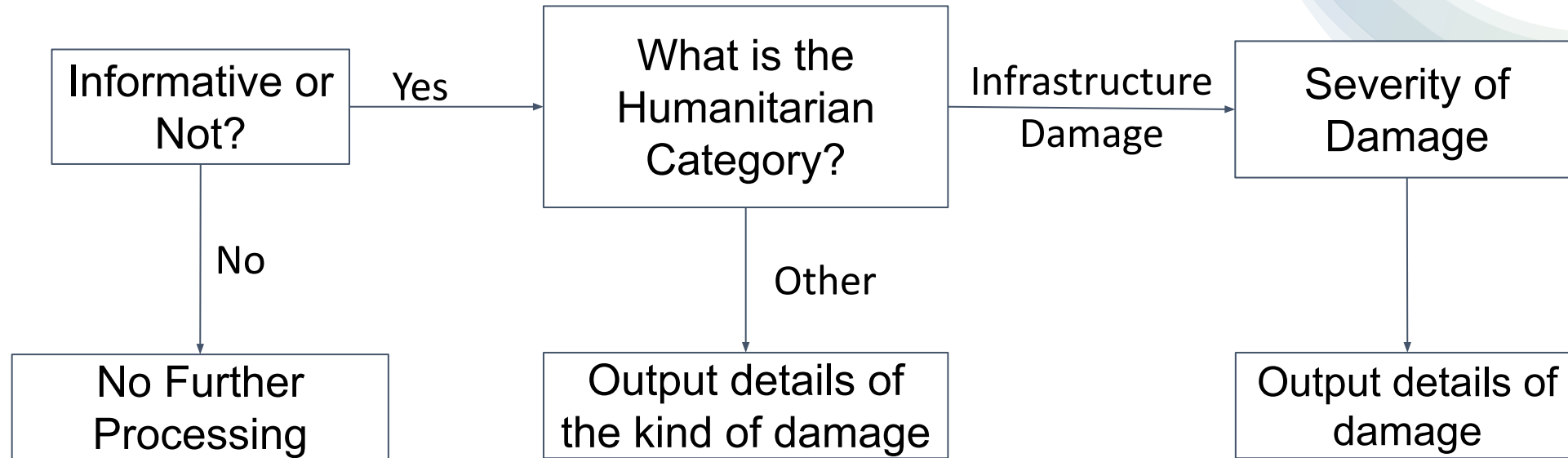
Dataset Details: CrisisMMD

- Several thousand manually annotated tweets and images.

- Tweets from seven major Natural Disaster worldwide : Hurricane Irma, Hurricane Harvey, Hurricane Maria, California Wildfires, Mexico Earthquake, Iran Earthquake, Sri Lanka Floods

- 3 type of annotation :-
    - Informative vs Not informative
    - Humanitarian categories
    - Damage severity assessment

Dataset Details: CrisisMMD

- Task 1: Informative vs Not informative
  - Informative
  - Not informative

- Task 2: Humanitarian categories
  - Affected individuals
  - Infrastructure and utility damage
  - Injured or dead people
  - Missing or found people
  - Rescue, volunteering or donation effort
  - Vehicle damage
  - Other relevant information
  - Non-Humanitarian

- Task 3: Damage severity assessment
  - Severe damage
  - Mild damage
  - Little or no damage
  - Don't know or can't judge

Dataset Details: CrisisMMD

Informative
Other relevant information

Informative
Affected individuals

Informative
Infrastructure and utility
damage
Severe damage

Not informative
Not humanitarian

Informative
Infrastructure and utility
damage
Severe damage

Informative
Infrastructure and utility
damage
Severe damage

Informative
Infrastructure and utility
damage
Severe damage

Informative
Infrastructure and utility
damage
Severe damage

Source: https://aidr-dev2.qcri.org/apps/crisismmd

Dataset Details: CrisisMMD

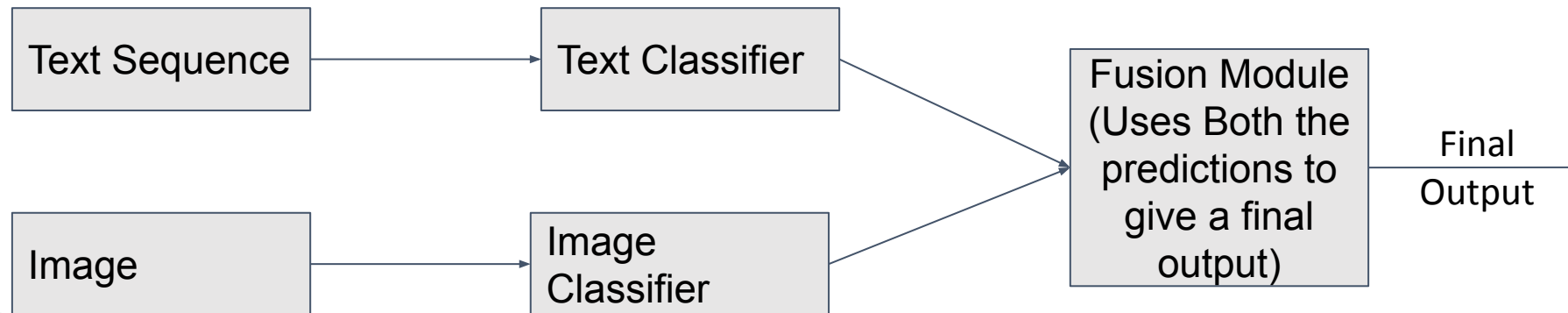| Crisis Name	Keywords Used to collect tweets
Hurricane Irma	Hurricane Irma, Irma storm, Storm Irma, Irma Hurricane, Irma
Hurricane Harvey	Hurricane Harvey, Harvey, HurricaneHarvey, Tornado
Hurricane Maria	Hurricane Maria, Maria Storm, Maria Cyclone, Maria Tornado, Tropical Storm Maria, HurricaneMaria, puerto rico
California wildfires	California fire, California wildfire, Wildfire California, USA Wildfire, California wildfires
Mexico earthquake	mexico earthquake, mexicoearthquake
Iraq-Iran earthquake	kuwait earthquake, iran earthquake, halabja earthquake, Iraq earthquake
Sri Lanka floods	flood Sri Lanka, FloodSL, SriLanka flooding, SriLanka floods, SriLanka flood, typhoon mora, cyclone mora, mora, CycloneMora

Proposed Solution

- The problem is a multimodal (sequence and image) classification task.
- The labels of texts and images of the tweets are not always same and so the predictions from the two might also be different.

```
Text Sequence  →  Text Classifier  ─┐
                                     ├→  Fusion Module        → Final
                                     │   (Uses Both the         Output
Image          →  Image             │   predictions to
                  Classifier  ──────┘   give a final
                                        output)
```

Proposed Solution

Fusion Module:

Various ways has been proposed in literature to fuse outputs in multimodal tasks, such as,

- Using an OR block
- Average the output probabilities from the two blocks
- Attention based decision fusion

We plan to implement these and see which one works best for this task.

Preliminary Results

- We have implemented a unimodal text classifier which classifies the tweet as informative or not.
- The implementation uses a bert language model followed by a linear classifier to classify the tweets.
- It sets a baseline and we will improve upon the results obtained in further work.

The results on validation dataset:
    Accuracy : 0.73
    f1 score : 0.83

```
Average training loss: 0.61
        Accuracy: 0.72
        F1 Score: 0.83
```

References

- Ferda Ofli, Firoj Alam, and Muhammad Imran, Analysis of Social Media Data using Multimodal Deep Learning for Disaster Response, In Proceedings of the 17th International Conference on Information Systems for Crisis Response and Management (ISCRAM), 2020
- Xukun Li, Doina Caragea, Improving Disaster-related Tweet Classification with a Multimodal Approach, Social Media for Disaster Response and Resilience Proceedings of the 17th ISCRAM Conference, 2020
- Hua XS., Zhang HJ., An Attention-Based Decision Fusion Scheme for Multimedia Information Retrieval. In: Aizawa K., Nakamura Y., Satoh S. (eds) Advances in Multimedia Information Processing - PCM 2004.

Thank you.