Microblog Retrieval in a Disaster Situation: A New Test Collection for Evaluation

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Outline

1. Introduction and Motivation
2. The Test Collection
3. Retrieval Method
4. Future directions
Role of Microblogs during Disasters

- Lot of useful *situational information* posted on microblogging sites like Twitter during disaster events
- Challenges in extracting the important information
  - Important information obscured amongst lot of sentiment, opinion, ...
  - Microblogs are very short and written informally
  - Large variation in vocabulary of crowdsourced content
- No standard test collection for evaluating strategies for microblog retrieval in disaster scenario
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The Microblog dataset

- Collected tweets posted during Nepal earthquake in April 2015
- Used Twitter Search API with keyword 'nepal'
- About 100K tweets in English collected
- After de-duplication final dataset of 50,068 tweets
Consulted members of NGOs work in disaster-affected regions – what are typical information requirements during disaster relief operation?

Identified five broad information requirements (*topics*)

- T1: What resources were available
- T2: What resources were required
- T3: What *medical* resources were available
- T4: What *medical* resources were required
- T5: What infrastructure damage and restoration were being reported
Two phases, involving human annotation

**Phase 1**
- Each annotator given the microblog collection and topics, asked to identify all tweets relevant to each topic, *independently*
- Tweets indexed using the Indri IR system

After Phase 1, the set of tweets identified to be relevant to the same topic by different annotators, was considerably different

**Hence, Phase 2**
- For a topic, all tweets judged relevant by *at least one* annotator considered
- Relevance finalised through discussion among all the annotators and mutual agreement
Number of tweets in final gold standard

- T1: What resources were available (589 tweets)
- T2: What resources were required (301 tweets)
- T3: What medical resources were available (334 tweets)
- T4: What medical resources were required (112 tweets)
- T5: What infrastructure damage and restoration were being reported (254 tweets)
Examples of relevant tweets

**T1: What resources were available**
- India sends 39 #NDRF team, 2 dogs and 3 tonnes equipment to Nepal Army for rescue operations: Indian Embassy in #Nepal
- If O+ve Blood is needed around Ilam, I am ready just mention. #NepalQuake
- Dr. Madhur Basnet leading medical team going to remote villages of Gorkha dist which was epicenter of earthquake. His cell: [number]

**T2: What resources were required**
- Body bags, Tents, water, medicine, pain killers urgently needed in #earthquake stricken #Nepal
- plz send medicine and food packets to nepal if possible. #NepalEarthquake
- There is shortage of Blood as well as oxygen cylinders...Nepal is in huge crisis.
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Query Generation from Topic

- Manual Query: Selecting intuitively important terms from topic
- Automatic Query: By pre-processing and POS tagging, nouns, verbs, and adjectives extracted automatically from narrative part of the topics
Pre-processing the Dataset

- Removing standard English stop-words, URLs and punctuation symbols
- Discarding terms having frequency less than 5 in corpus.
- Case-folded and stemmed using Porter stemmer.
Microblog Retrieval and Ranking

- Retrieving microblogs using language modeling: Indexed and ranked using Indri
- Retrieving microblogs using word embeddings: Ranked and retrieved using Word2vec
Word2Vec Retrieval Method

- Trained Word2Vec over pre-processed set of tweets
- Continuous bag of words model, Vector size: 2000, Context size: 5, Learning rate: 0.05
- Query-vector: sum of term-vectors of all terms in the query
- Tweet-vector: sum of term-vectors of all terms in the tweet
- Ranked tweets in decreasing order of cosine similarity between corresponding query-vector and each tweet-vector
- Top ranked 1000 tweets are retrieved
## Evaluation

<table>
<thead>
<tr>
<th>Query type</th>
<th>Ranking Model</th>
<th>Prec @20</th>
<th>Recall @1000</th>
<th>MAP @1000</th>
<th>MAP Overall</th>
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</thead>
<tbody>
<tr>
<td>Manual</td>
<td>Indri</td>
<td>0.3900</td>
<td>0.5635</td>
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<tr>
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</table>

Table: Retrieval performance with initial queries (manual and automatic) and two ranking models – language model of Indri and word2vec-based model. The values for the performance measures have been averaged over the five topics. The performances by word2vec are statistically significantly better ($p < 0.05$) than that of Indri for both types of queries.
Query Expansion

**Pseudo (or blind) relevance feedback:** 10 top-ranked tweets retrieved by the original query, and select $p = 5$ terms from these 10 top-ranked tweets to expand the query

- **Rocchio Expansion:** $tf \times idf$ Rocchio scores for each distinct term is considered
- **Expansion using Word2vec:**
  - Identifying set of terms (within 10 top-ranked tweets) most related to context of query
  - Checked cosine similarity between term-vector and Query-vector
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</tr>
</thead>
<tbody>
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</table>

**Table:** Retrieval performance (averaged over the five topics) for queries expanded using two strategies – Rocchio and Word2Vec-based. For comparison, the performances with the initial queries as was reported in are also shown.
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Future directions

- Lot of improvement in microblog retrieval still necessary
- More standard test collections needed
- Used the collection in FIRE 2016 Microblog Track
- Two more topics included
  - T6: What were the requirements & availabilities at specific locations
  - T7: What were the activities of various NGOs / Government organizations
- Improved gold standard by Phase 3 – standard pooling
  - Top 30 results of all the submitted runs pooled and judged by annotators
  - Majority opinion considered for the rest
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Thank You!