Intensity-based sentiment analysis

The 2020 Aegean Earthquake

LEARNING FROM EARTHQUAKES: BUILDING RESILIENT COMMUNITIES THROUGH EARTHQUAKE RECONNAISSANCE, RESPONSE AND RECOVERY

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OUTLINE

- Background
- Methods
- Results
- Conclusions

Aerial view of Izmir after the 2020 Aegean earthquake
Source: Collapsed building after European-Mediterranean Seismological Centre
Background

Collapsed building after the Aegean earthquake.

Tsunami effects

Collapsed building after the Aegean earthquake.
Background

The LastQuake app screen (left) contains the latest felt earthquakes. Felt reports are collected by choosing one of the 12 cartoons (right) presenting different shaking and damage levels.


LastQuake app – EMSC

3,028 Users reports
2,546 Users reports
2,518 Users reports

2,371 app – 123 mobile phone - 24 Desktop
### Background

#### Languages

<table>
<thead>
<tr>
<th>Languages</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkish</td>
<td>1264</td>
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<tr>
<td>English</td>
<td>898</td>
<td>36%</td>
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<tr>
<td>Croatian</td>
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<tr>
<td>German</td>
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<tr>
<td>Bosnian</td>
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<td>0%</td>
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<tr>
<td>Slovenian</td>
<td>10</td>
<td>0%</td>
</tr>
<tr>
<td>Punctuation marks</td>
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<td>0%</td>
</tr>
<tr>
<td>Albanian</td>
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<td>0%</td>
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<tr>
<td>Numbers</td>
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<tr>
<td>French</td>
<td>5</td>
<td>0%</td>
</tr>
<tr>
<td>Greek</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>Italian</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>Undefined</td>
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<td>0%</td>
</tr>
<tr>
<td>Bulgarian</td>
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<td>0%</td>
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<tr>
<td>Arabic</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Azerbaijani</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Czech</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Hungarian</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Latvian</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Polish</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>Slovak</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2518</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

LastQuake users reports location. Data source: EMSC
Background

Background

Modified Mercalli (MM) Intensity scale

10 Extreme
9 Violent
8 Severe
7 Very strong
6 Strong
5 Moderate
4 Light
3 Weak
2 Weak
1 Not felt
The house really moved. Feel this one was the strongest since the big one. I felt very light. It was pretty violent, but it was short. It woke me up from my sleep. I was afraid it would continue. I tried to create the triangle of life next to the sofa. Nothing moved, but I heard walls cracking. I think it was because of the earthquake. Everything rattled for a few seconds. The cracks in our walls are getting bigger... Yep felt that one too. Short but strong 10:34 am Kuşadası - kadınlar Sea Mah. Happened 2 times. It woke me up. It took about 7 seconds..
The house really moved. Feel this one was the strongest since the big one. I felt very light. It was pretty violent, but it was short. It woke me up from my sleep. I was afraid it would continue. I tried to create the triangle of life next to the sofa. Nothing moved but I heard walls cracking. Idk if it was because of the earthquake. Everything rattled for a few seconds. The cracks in our walls are getting bigger... Yep felt that one too. Short but strong 10:34 am Kuşadası - kadınlar Sea Mah. Happened 2 times. It woke me up. It took about 7 seconds..
Methods: Sentiment Analysis (SA)

1. Data collection
2. Data storage
3. Data extraction
4. Data process
5. Data analysis
6. Database
7. Polarity map

Components of EMSC’s multichannel rapid information system Source: Bossu et al. (2020). Figure 3. Pag. 35

 Izmir flagged, we felt it violent. There is a destroyed building.

LastQuake app users

Translation to English
Correct spelling mistakes

Sentiment Analysis (SA)
Supervised classification
Positive - Negative - Neutral

Database

Polarity map
### Methods: Sentiment Analysis (SA)

#### Rules

<table>
<thead>
<tr>
<th>Polarity</th>
<th>Rules</th>
</tr>
</thead>
</table>
| Positive  | - Reports of light intensity  
             - Reports of short seismic movements  
             - Reports of slight shakes  
             - Supporting and solidarity messages  
             - Emergency response messages  
             - Preparedness measures                       |
| Negative  | - Reports of long seismic movements  
             - Reports of strong shakes  
             - Reports of strong intensity  
             - Reports of aftershocks  
             - Report of damages in buildings and/or lifelines  
             - Reports of injuries and/or casualties  
             - Reports of fear and anxiety                      |
| Neutral   | - Seismic information                                                   |

Rule-set for polarity classification of text data produced by LastQuake app users.
Results

Positive

- ‘Low damage’
- ‘We felt it, but it was short’
- ‘Everybody should respect and act according to scientific rules and regulations. Otherwise, everybody will lose’

Negative

- ‘Everything rattled for a few seconds. The cracks in our walls are getting bigger’
- ‘Chios, Vrontados. Very strong shake, ground floor, cracks in walls objects fell.’
- ‘I felt that earthquake when I was in school in Athens. The floor was moving and the walls too. It was very scary because it happened so suddenly!’

Neutral

- ‘The epicentre is in Samos, Greece, not in Western Turkey’.
- ‘Moment intensity VI’
- ‘It is not Dodecanese islands. It is North Aegean Samos island’
Results

1. Felt (99)
2. Shook (56)
3. Light (54)
4. Short (45)
5. Seconds (42)
Results

1. Felt (231)
2. Shook (214)
3. Long (196)
4. Seconds (143)
5. Strong (127)
Results

1. felt (155)
2. seconds (65)
3. Istanbul (34)
4. earthquake (20)
5. shock (20)
Results

Polarity of LastQuake app user comments per levels of intensity in the MMI Scale.
# Results

<table>
<thead>
<tr>
<th>MMI (Levels of intensity)</th>
<th>Positive Polarity (number of comments)</th>
<th>Negative Polarity (number of comments)</th>
<th>Neutral Polarity (number of comments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>-.664*</td>
<td>-0.545</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.036</td>
<td>0.103</td>
<td>0.051</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Positive</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>0.499</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.036</td>
<td>0.142</td>
<td>0.003</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Negative</td>
<td>Pearson Correlation</td>
<td>-0.545</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.103</td>
<td>0.142</td>
<td>0.001</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Neutral</td>
<td>Pearson Correlation</td>
<td>.837**</td>
<td>.870**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.051</td>
<td>0.003</td>
<td>0.001</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Two-tailed Pearson correlation analysis
Results

Location of LastQuake app users comments polarity.
Results

Dataset

Available for public consultation at:
Contreras Mojica, Diana; Wilkinson, Sean; Fallou, Laure; Landès, Matthieu; Bossu, Rémy; Aktas, Yasemin Didem (2021): Polarity and topic supervised classification of LastQuake app user’s comments - Aegean 2020 earthquake. Newcastle University. Dataset. https://doi.org/10.25405/data.ncl.14604354.v3

DOI: https://doi.org/10.25405/data.ncl.14604354.v3
Conclusions

- **Comments with negative polarity include more data** that the comments in other polarities

- As the levels in the **MMI scale** increase the number of comments with **positive polarity** decrease.

- The **spatial distribution of negative polarity** is a proxy indicator of the location of damages.

- The description of **damages in buildings** is present in **comments with negative polarity** associated with the intensity reports from **III to VII** in the **MMI scale**

- The effects of the **tsunami** are described in **comments with negative polarity** associated with the intensity reports from **III to VII** in the **MMI scale**.
References
