Analysis and Visualization of Big Data (2022), 1, 1–5

UNIVERSITAT DE BARCELONA

MINI ARTICLE

More precise data treatment could imply a better response to natural disasters emergencies

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Abstract

With the rising trend of temperature increase due to climate change, natural disasters are becoming more frequent. But how can the Catalan government prepare for it? This part of the work will focus on determining the correlation between rescues by the fire department and incidents reported by the 112 emergency services. It will be shown that, as expected, more mountainous regions experience an increased number of fire department rescues. This translates into the identification of regions that require more mountain-specialized firefighters. At the same time, this work finds that constructing prediction models to anticipate the resources needed in each region is challenging with the present data, as a more precise categorization should be performed.

Keywords: fire department; mountain rescues; 112 emergency; Generalitat de Catalunya

1. Background

The fact that the climate is changing, and global temperatures are rising, is a scientifically proven reality acknowledged by the entire scientific community. This climate change contributes to the increasing trend of natural disasters each year. This raises the question: how can the Catalan Government prepare to address the emergency response implications? In an attempt to answer this question, this work aims to analyze the government's preparedness for nature-related incidents. It seeks to determine the effectiveness of activating civil protection plans and their correlation with rescues by the fire department in nature, as well as incidents reported by the 112 emergency department call center. The comprehensive study will strive to achieve this goal by analyzing this data geographically and temporally. Specifically, the focus will be on establishing the relationship between incidents and rescue actions through a geographical lens.

The data for this project were collected from the Dades Obertes open database. Dades Obertes is a portal from the Generalitat de Catalunya that compiles various datasets collected by public organizations. Public administrations publicly display

these datasets to allow citizens access and use. Unless the dataset indicates otherwise, this data is subject to a license that permits the use of information, its distribution, public communication, and the transformation of said information to perform derived services. The two datasets used in this study fall under this license.

The datasets to be discussed include a list of incidents handled by the 112 emergency service [2] and the rescue actions in nature performed by the fire department of the Generalitat de Catalunya [1].

The first dataset comprises a list of all operative incidents collected by the 112 Emergency Service of Catalunya. They are termed operative incidents because this dataset considers incidents that are genuine emergencies and lead to the activation of the emergency department. Incidents are classified into ten main categories: Security, Medical Assistance, Traffic, Civility, Fire, Non-traffic accidents, Leak, Other incidents, Environment, and Meteorology. Since this data is intended to be compared with the nature-related rescue actions dataset, only nature-related types will be used in the correlation. These types include Medical assistance, Fire, Accident, and Meteorology.

The second dataset is the number of nature rescues by the fire department of the Generalitat de Catalunya. These rescue actions are also classified into typologies, but since they are all related to rescue actions in mountains, rivers, or wells, all types have been considered to study the correlation between datasets. It is important to bear in mind that the regions Vall d'Aran and Barcelonès have their own fire department, so data could be affected for this reason.

Because the datasets cover several years' worth of data, it was decided that all further studies would be based on data restricted to the period from 2018 to 2022.

2. Methods

When working with the datasets, the first step was to convert the different CSV files into Python DataFrames. Once this was accomplished, various filtering steps were necessary, such as limiting the data to the desired years. Since the region was the key needed to compare both datasets, it was essential to have them in the same format. The incidents had the region name in capital letters, while the rescue actions were written with accents and in sentence format. The conversion of the latter into capital letter format was necessary, so the Unidecode function was used. *Note: The character "ç" is transformed into "c" with the Unidecode function; careful treatment is recommended.*

The previously mentioned types were filtered, and the different datasets were grouped by region. Therefore, the number of incidents per region was obtained in one DataFrame, and the number of rescues per region in another. To achieve this, the sum of all incidents in each region and a count of all the rescue actions in each region throughout the last five years were performed. These two DataFrames were merged to obtain a single unified DataFrame. From this, the percentage of rescues by the fire department in nature with respect to the total nature-related incidents was computed. This final variable was then represented on a map for each region.

The code developed can be found in the GitHub repository: https://github.com/belenmvinhas/AVDM_ioib/tree/main/Imma

3. Results

When studying the percentage of rescue actions by the fire department in each region in relation to the total reported incidents that are nature-related, the map presented in Figure 1 was obtained. In order to visualize the comparison with the geography of the regions Figure 2 is provided.

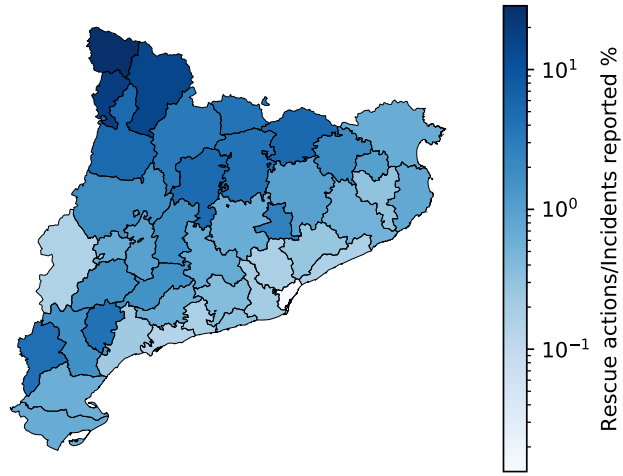

Figure 1. Geographical representation of the percentage per region of fire department rescue actions with respect to incidents reported by the 112 emergency department.

Figure 2. Geographical map of Catalonia. Extracted from [3]

This plot clearly showed that regions with a greater natural environment presence had more rescues per incident. This implies that in those regions, more incidents

required the intervention of the fire department, particularly those near the Pyrenees. Simultaneously, coastal regions presented the lowest percentages. The region "Vall d'Aran" exhibited the highest percentage. It's crucial to note that this region has its own fire department, and therefore some rescues may not be registered in the consulted database, potentially making this percentage even higher.

Since the incidents used in these percentages were only those related to nature, we questioned whether this proportionality would also hold if total incidents were considered. This led us to investigate the proportion of incidents related to mountain rescues compared to the total incidents per region. The proportion of nature-related incidents with respect to total incidents can be seen in Figure 3. The cases of Vall d'Aran and Barcelonés were highlighted for initial comparison.

From this figure, it can be observed that for almost every region, incidents related to nature represent approximately 30% of the total incidents or a similar percentage. Therefore, there are indeed some regions that require more rescues per number of incidents. However, this suggests that for every region, the proportion of incidents related to nature is relatively constant, unaffected by the geography of the region. This led us to believe that the data classification used by the emergency department may not be very precise. For instance, medical assistance could include rescues in the mountains requiring medical assistance, but it could also encompass medical assistance for someone who fell on the street. This means that the impact of this category, when strictly referring to natural incidents, could be overestimated, potentially affecting the previous results.

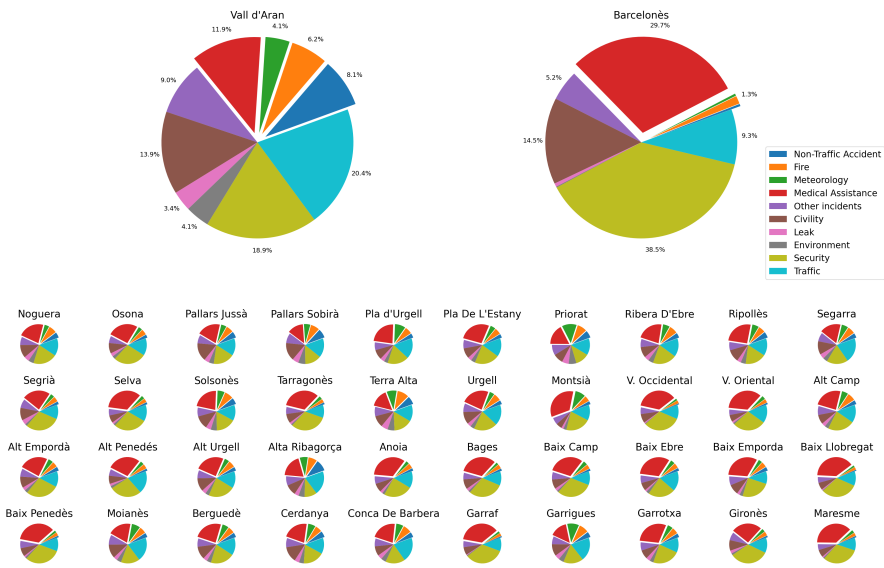

Figure 3. Circle chart of the incidents at each region. The emphasised sectors are the ones that can be related to nature incidents.

4. Conclusions / Discussion

In summary, it has been demonstrated that there is indeed a correlation between the number of rescues conducted by the fire department in natural environments and the regions with more natural surroundings. This observation aligns with expectations, as higher mountains entail more risky situations that can lead to the necessity for rescues. This underscores the importance for the Catalan government to ensure an adequate number of firefighters and specialized fire stations in these regions, specifically equipped for mountain rescues. This proactive approach would ensure an optimal response to potential incidents that may arise.

Simultaneously, it has been determined that natural incidents represent almost the same percentage of total incidents in each region. This particular observation raises questions about the classification used by the emergency department, encompassing a broad spectrum of situations, which complicates the extraction of correlations and conclusions from the data. A potential improvement suggestion involves introducing subcategories within this main category to provide more specificity and detailed information about the type of incident. This subcategorization would facilitate the development of prediction models, enabling a more realistic estimation of the resources needed in each region.

References

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