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AI_Lume: Artificial intelligence tool for the improvement of firefighting access routes

Código de la comunicación (07-003)

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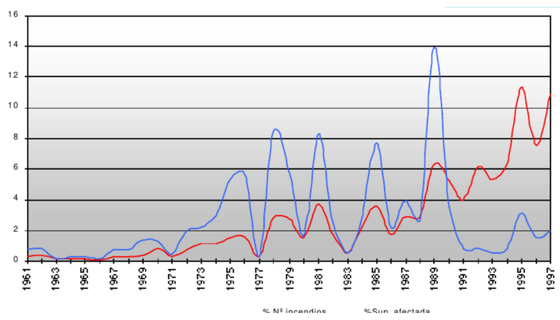
1. Introduction

Forest fires are one of the few events that can be objectively assured of having a global significance, both historically and in the present day, and especially with regard to the future. In accordance with tradition, the efficiency of an extinguishing service could be evaluated by measuring its response time. This is defined as the time interval in minutes between the detection of a fire and the arrival of the first extinguishing units at the location.

The ability to respond as soon as possible with the available resources is exemplary in the extinction process.

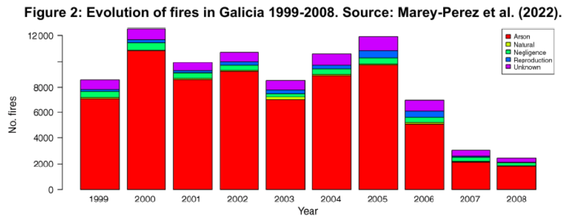
First stage (1990 – 1997)

Figure 1: Evolution of fires in Galicia 1961-1997. Source: Marey-Perez et al. (2003).

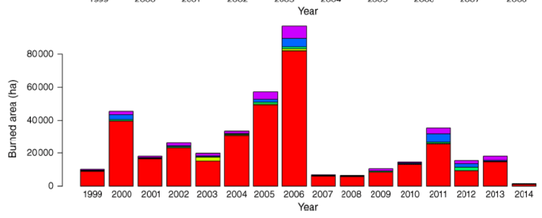


Second stage (1998 – 2006)

Figure 2: Evolution of fires in Galicia 1999-2008. Source: Marey-Perez et al. (2022).



Third stage (2006-2024)



The objective of this work is to produce a comprehensive mapping of roads and trails, based on pre-existing, completed and unified roads that meet the following four conditions:

1º Are topologically correct: segmented into sections connected by nodes, without the presence of disconnected graphs, malformed geometries, etc.
2º Have the necessary attributes for an effective route calculation, adapted to the needs of the fire prevention service.
3º Offer complete coverage of key elements such as water points.
4º Use of conventional methodologies and comparatively with artificial intelligence (AI) tools is carried out in a comparative way.

2. Material and methods

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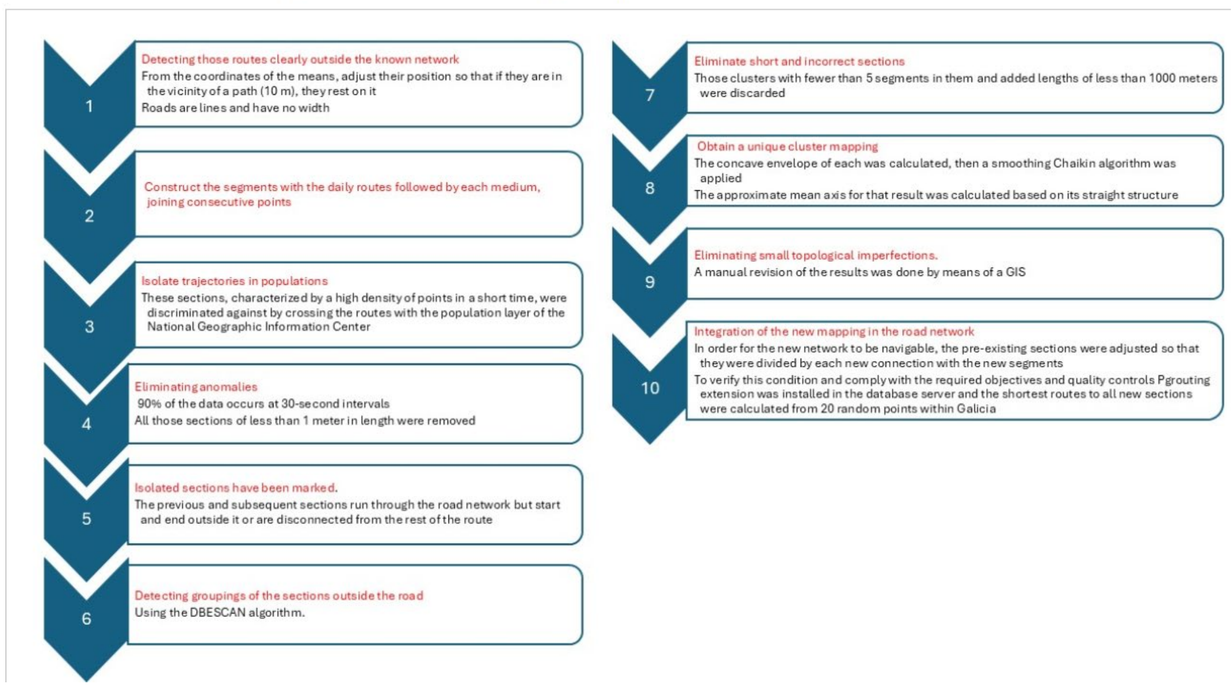
Figure 3: Methodological procedure followed



3. Results

Table 1: Data used for the elaboration of the work

Type	Resource	Number of records
Forestry agent	Territorial forestry agent mobile phone	494.538
Forestry agent	Forestry agent mobile phone	2.033.981
Municipal team	Mobile phone	208
SPDCIF team	Mobile phone	3.558.137
Municipal motor pump	Mobile phone	476.767
SPDCIF motor pump	Mobile phone	1.878.623
Others	Mobile phone	153.794
Technician	Forestry technician mobile phone	160.813
Technician	Chief of district or chief of provincial mobile phone	64.989
	Total	8.821.850

Figure 4: Example of DBSCAN application in an area of action

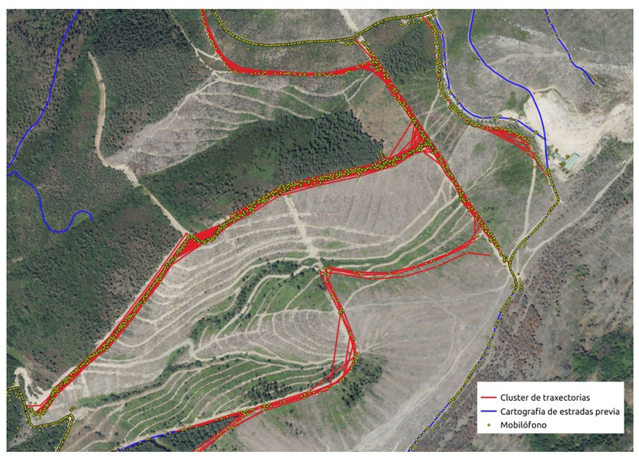


Figure 5. Flow process for detecting inaccesible road sections.

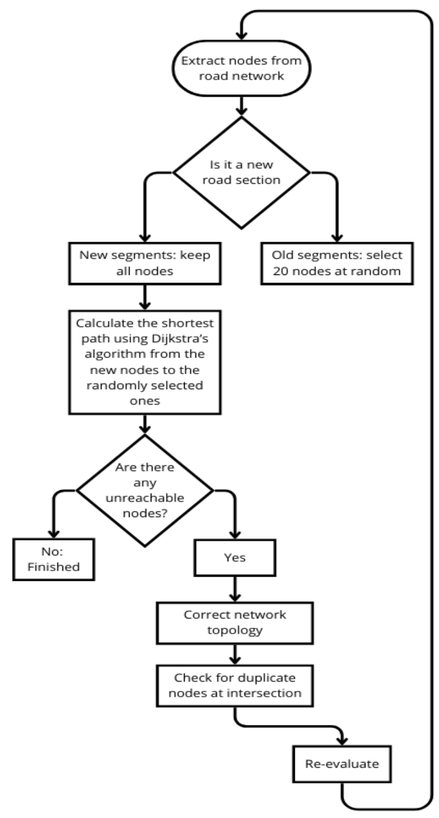
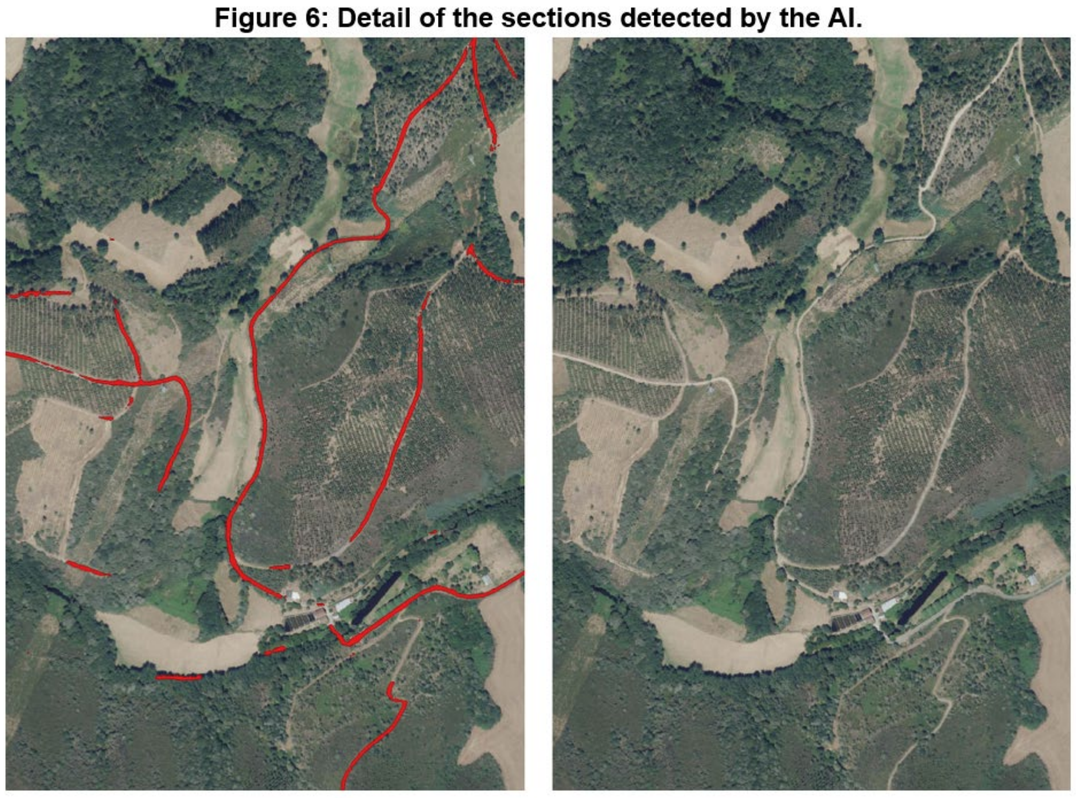


Figure 6: Detail of the sections detected by the AI.



4. Conclusions

Prior pilot work is essential to establish a robust methodology, identify necessary equipment, and define acceptable thresholds for the results that can be obtained.

Topologically correct cartography has now been produced, albeit at a high cost in terms of field revision time. As a future improvement, we suggest integrating new variables, such as slope or logging data, for the zoning of revision areas. This is of great interest to the fire-fighting teams, as they will be able to monitor traffic speeds and predict the arrival times of all types of vehicles at fires, as well as access to strategic infrastructure such as water points.

The use of AI to achieve objectives has been contrasted in such a way that it can serve as an aid at present, but it cannot replace the production of cartography with the level of precision and quality restrictions established in this project.