

Emergency Management and Information Technology: challenges and potentials



Giuseppe Lelow

DiSVA, Laboratorio Riduzione Rischio Disastri

Tutor: Prof. Fausto Marincioni



THE ART OF EMERGENCY COMMUNICATION: INNOVATIONS IN CROWDSOURCED DATA MANAGEMENT

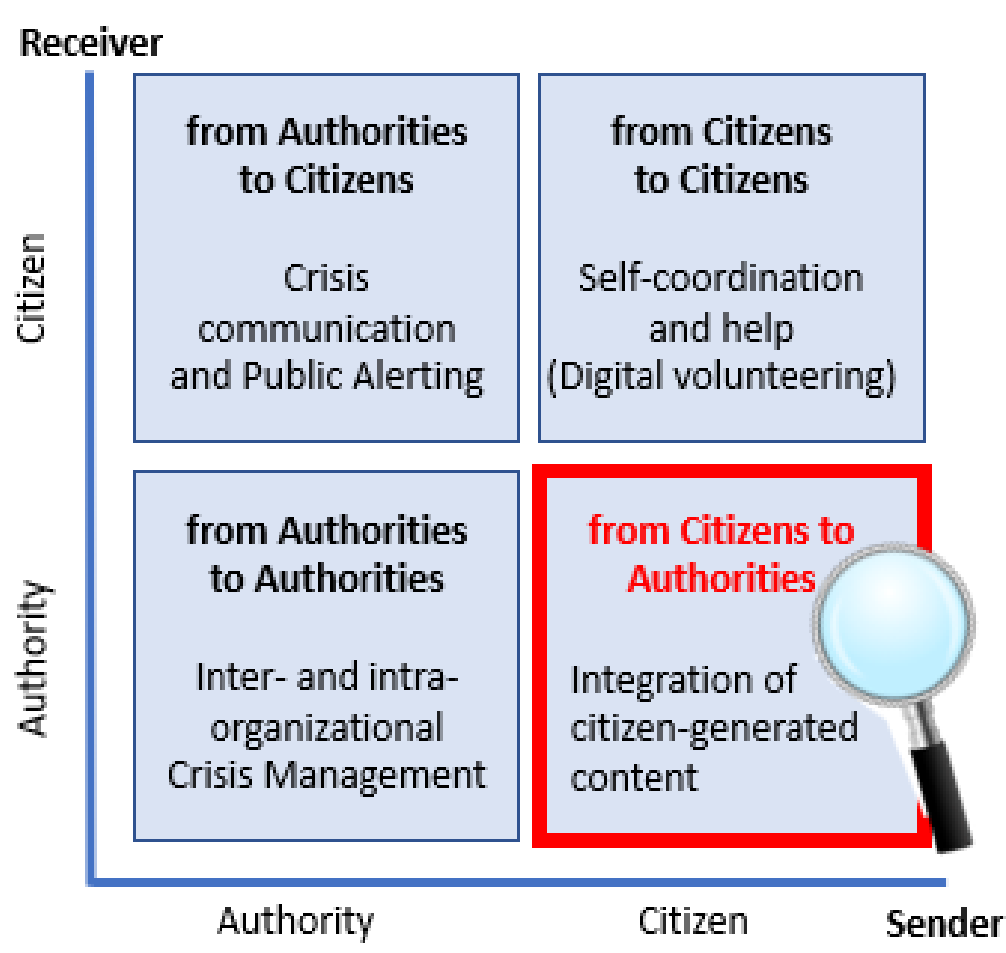


Dear reader, thank you for stopping by my poster, I am currently at the Disaster Research Center (DRC) at the University of Delaware (USA) as a visiting scholar to collect 911 emergency data.

If you scan the QR code on the left, you will be directed to a video file where I present my research using a Ted Talks format. This talk was featured during the 60th anniversary of the DRC (May 2-4, 2024). STEP BACK, RELAX AND ENJOY THE VIDEO!

1. INTRODUCTION

CRISIS COMMUNICATION MATRIX



The rapid technological development of recent decades is revolutionizing emergency management, providing unprecedented access to a wide range of information [1]. The widespread diffusion of portable devices enables data collection and knowledge sharing through various communication networks, some of which involving citizens. The paradigm of **citizen-sensing** defines how information can be gathered and exchanged by individuals, through their devices, acting de facto as "human sensor" [2]. Crowd-sourced information from **social media** (e.g., messages, photos, videos) has the potential to better portray an ongoing emergency [3]. The matrix shown left [4] synthesizes the research directions on emergency communication through social-network. For example, taking advantage of the information generated by citizens during an emergency.

2. RESEARCH GOAL

The overall objective of this Ph.D. project is to gain insight into the challenges and potentials of **crowd-sourced emergency data** and highlight a new form of citizen-sensing: **emergency calls to the European Emergency Number 112**.

3. MAIN HYPOTHESIS

Crowd-sourced data (e.g., social media content and emergency calls to emergency numbers - such as US 911 and European 112) can support the Civil Protection System, enhancing situational awareness and decision-making in large-scale emergencies.

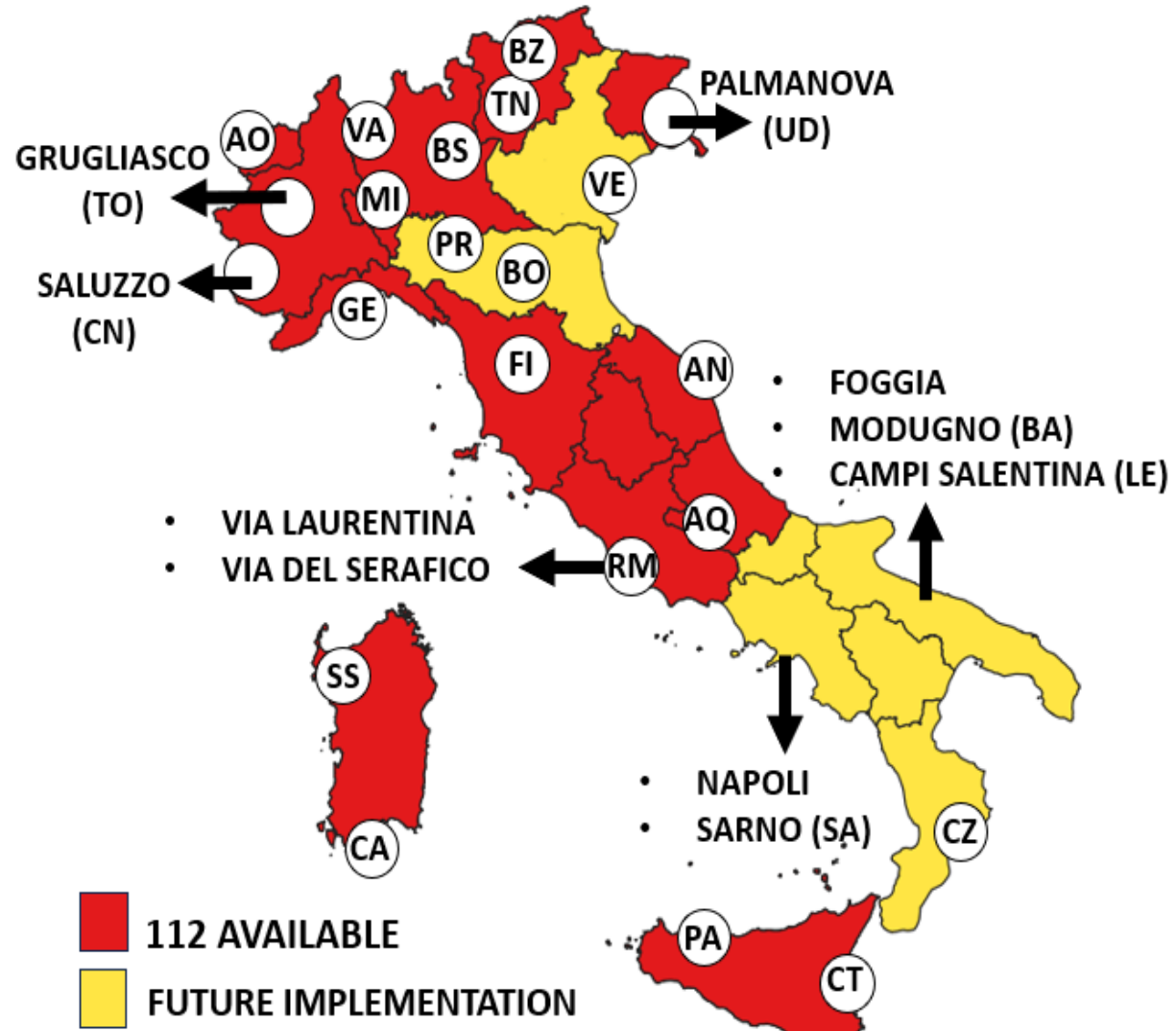
4. MATERIALS AND METHODS

The methodologies applied in different phases of the project include:

- **Scientific literature review on the state-of-the-art of emergency communication through social network**
- **Qualitative analysis of the processes of call management at the European emergency number 112.** The analysis was conducted through a wide variety of gray literature, including technical reports of the European Emergency Number Association. Italy has been chosen as a case study due to the complex organization of emergency services and the wide variety of natural hazards insistent on its territory.
- **Quantitative analysis of emergency calls to 112 during the October 2018 heavy rainstorm over Liguria.** This was the only Italian Region that so far shared their data for this research. The objective is to reconstruct the evolution of the emergency in a GIS environment and verify whether the "human sensors" input can enhance the effectiveness of emergency response.

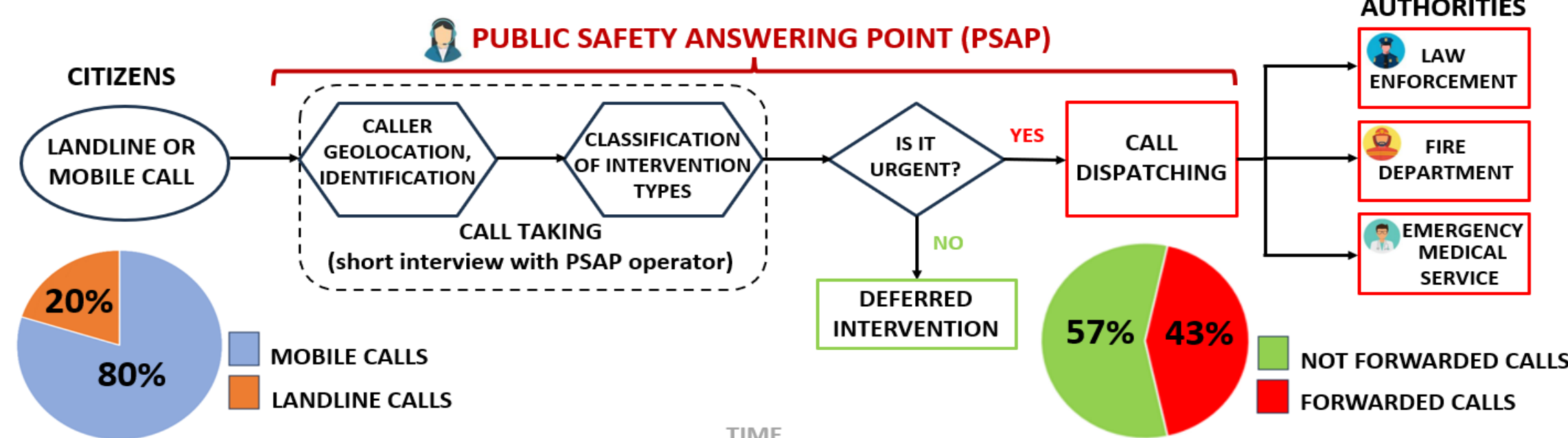
5.1 RESULTS (1st YEAR)

CURRENT IMPLEMENTATION OF THE 112 EUROPEAN EMERGENCY NUMBER IN ITALY

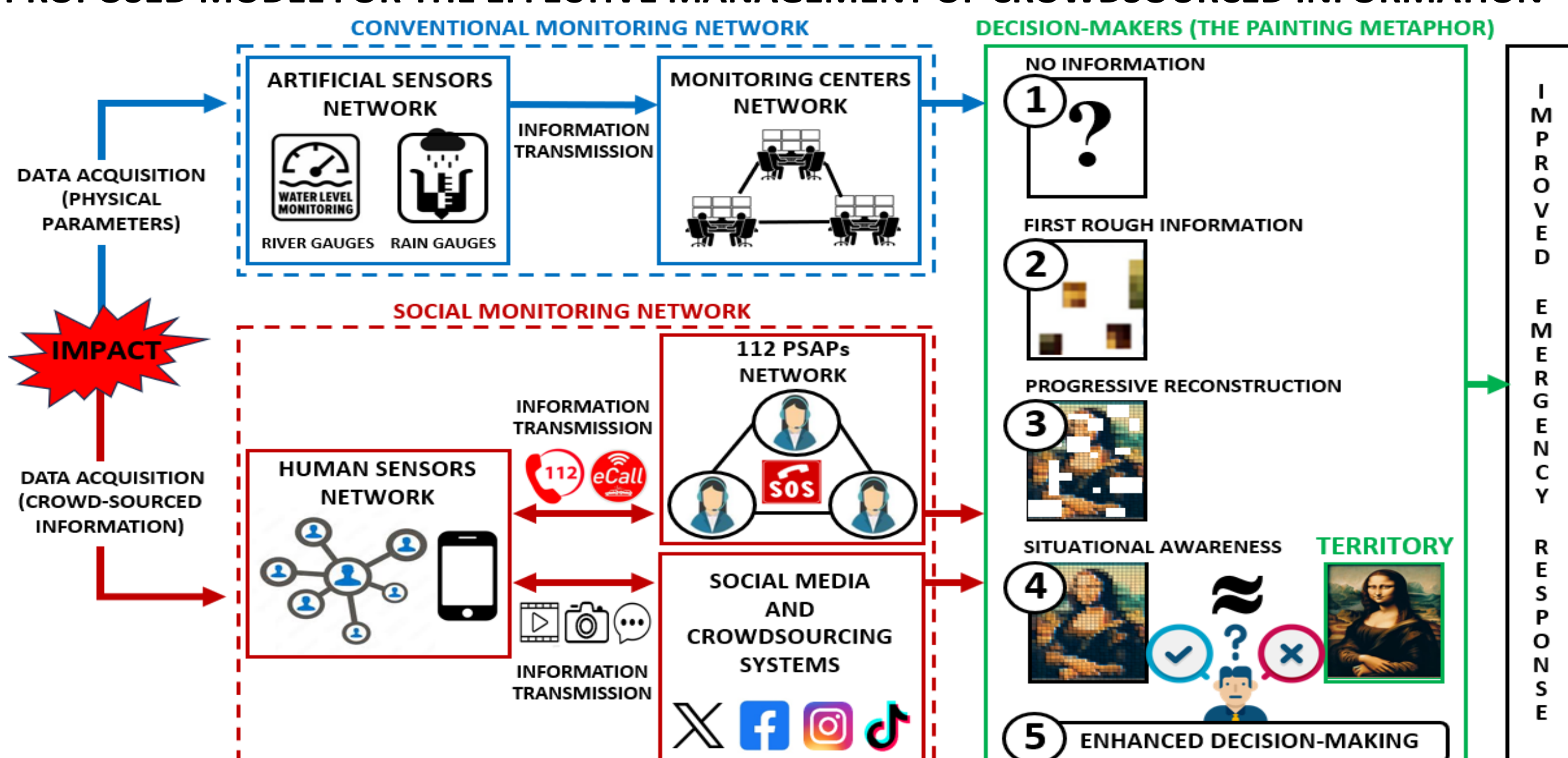


Italy was one of the last European countries to introduce the **single emergency number 112** and the implementation of the public safety answering points (PSAPs) in all Regions should be completed by 2025. The handling processes of 112 calls shows that **emergency calls** has the potential to overcome the challenges associated with managing social media data during emergencies (information overload and fake news); ensuring precise location, user identification, and validated/filtered information. Therefore, citizens calls to 112 represent a very useful information source better to inform the **operational response**.

HANDLING OF 112 EMERGENCY CALLS IN ITALY



PROPOSED MODEL FOR THE EFFECTIVE MANAGEMENT OF CROWDSOURCED INFORMATION



5.2 PRELIMINARY RESULTS (2nd YEAR)

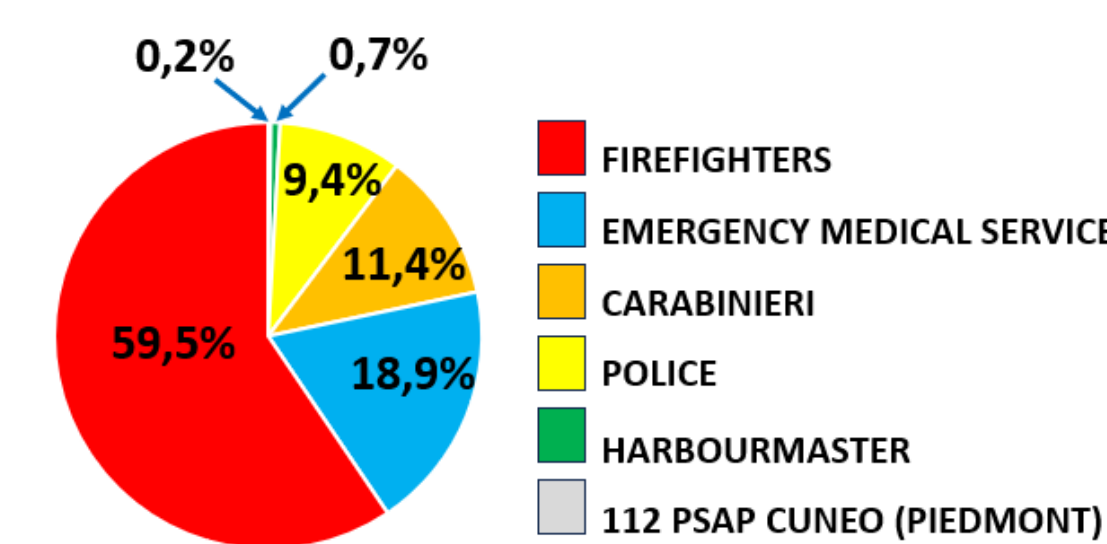
Case study: Storm Vaia in Liguria (October 29th - 30th, 2018)

Vaia hit Liguria with storm surges and heavy rainfall, causing numerous landslides and floods, causing significant damage especially along the coastal areas. The analysis of residents' calls to 112 shows that nearly 2/3 of these asked for rescue interventions. These emergency calls were mainly concentrated in the central and eastern parts of the Region, in correspondence of areas recording the maximum rainfall values. The next phases of the research will delve deeper into the relationship between the meteorological and the human sensors.

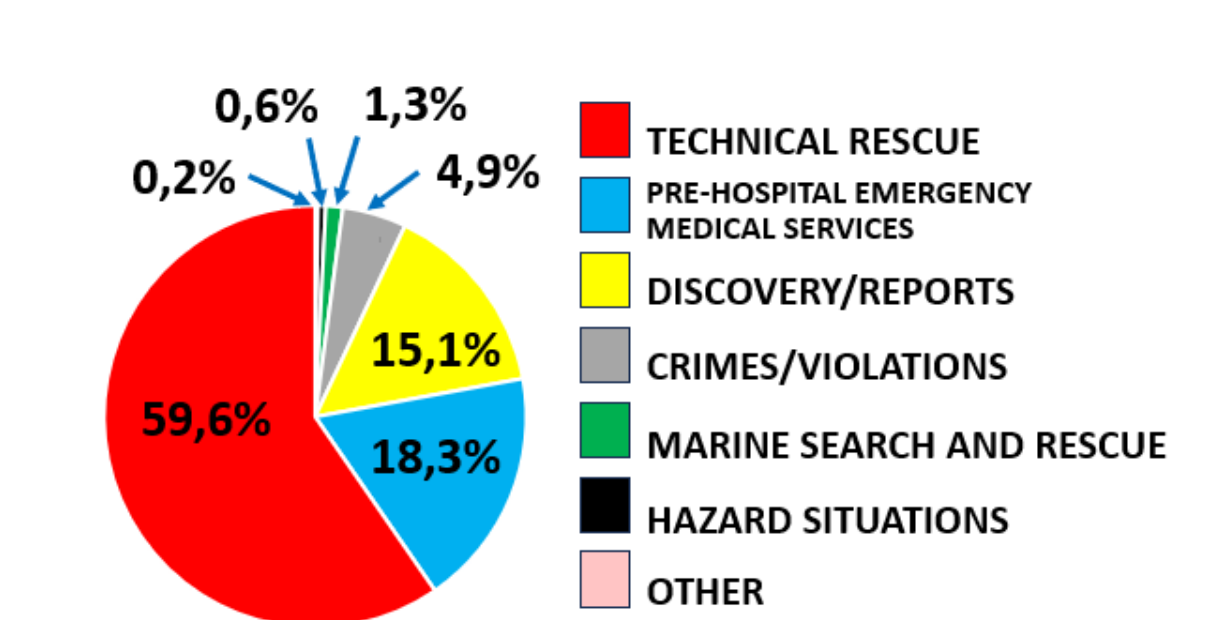
TOP 5 EVENTS WITH THE HIGHEST NUMBER OF CALLS

Ranking	Date	No. of calls	Event description
1	29/10/2018	9.897	Vaia storm - Storm surge in the provinces of Genoa and Imperia
2	30/10/2018	6.628	Vaia storm - Storm surge in the provinces of Genoa and Imperia
3	11/12/2017	6.386	Severe Weather Warning - Storm surge in the province of Savona
4	09/03/2020	6.229	COVID-19 - Calls following the Government's declaration of lockdown
5	10/03/2020	5.933	COVID-19 - Calls following the Government's declaration of lockdown

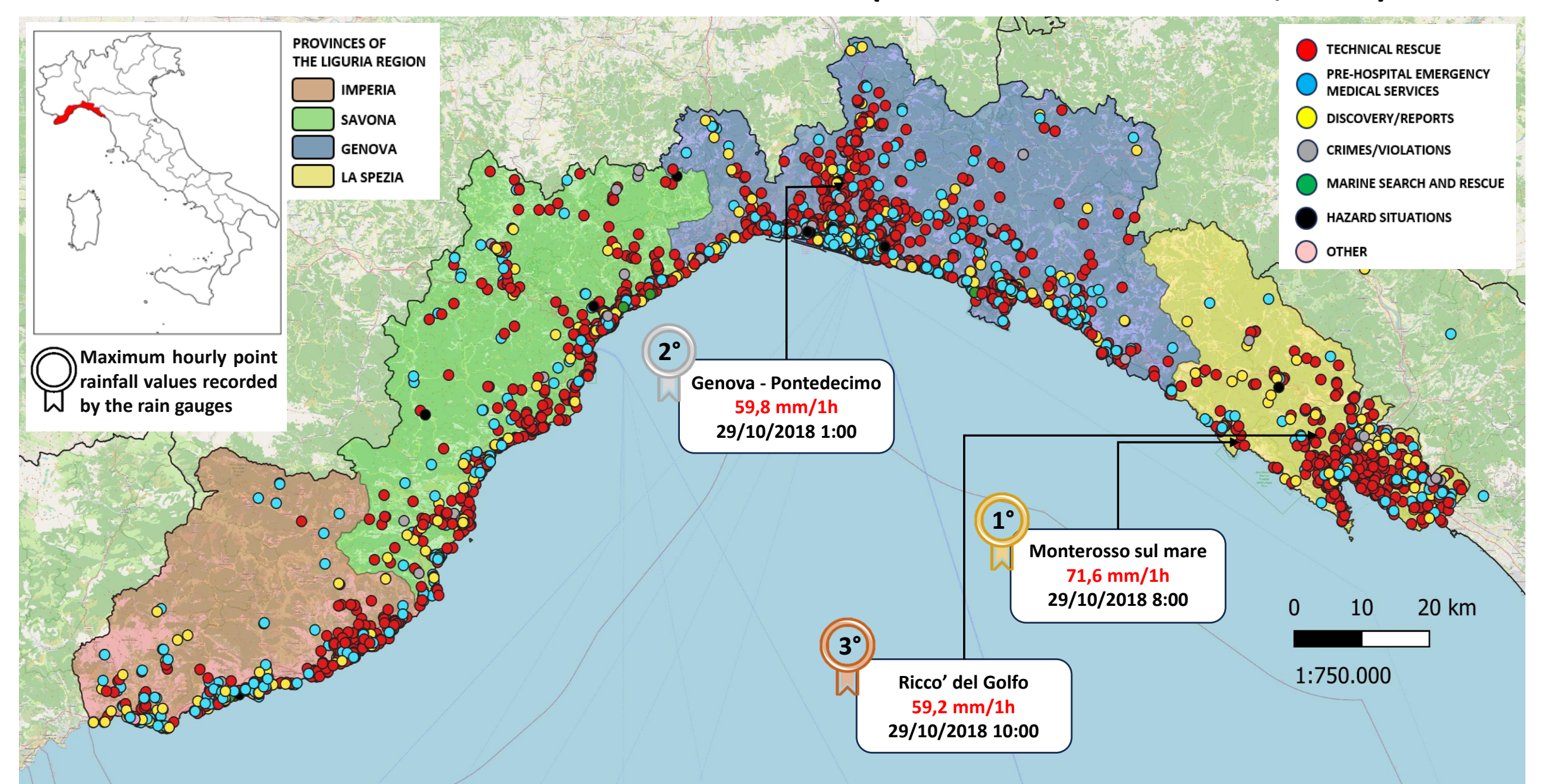
PERCENTAGE DISTRIBUTION OF FORWARDED CALLS TO AUTHORITIES



CLASSIFICATION OF INTERVENTION TYPES



DISTRIBUTION OF EMERGENCY CALLS TO 112 (OCTOBER 29th AND 30th, 2018)



[1] Fakhruddin et al. Progress in Disaster Science Vol. 16 (2022): 100254. [2] Avvenuti et al. SpringerPlus 5, 43 (2016).

[3] Castaldi et al. Acta Biomed 91 (9-5) (2020): 29-33. [4] Reuter et al. Journal of Contingencies and Crisis Management 26(1) (2018): 41-57.