

iMOTION

Virtual assistant for voice-activated emotional state recognition in palliative care patients

Challenger

Los **Montalvos Hospital** (Palliative Care Unit, 1998) has been, for more than 20 years, the reference centre of the health system of Castilla y León (Spain) in charge of the integral socio-health care of advanced patients, providing training, assistance and research in palliative care. In addition to the Hospitalisation Unit, another important service is the Home Support Teams. The hospital has two teams, one for the rural area and the other for the urban area, which provide services 365 days/24 hours a day.

In addition, Los Montalvos Hospital count with the collaboration of ACPD (Association for the Development of Palliative Care in CyL), a non-profit association dedicated to the development, research and intervention in the field of PC. It is integrated in the PC Unit of the University Complex of Salamanca.

Challenge description

In recent years, the number of people with a limited life prognosis with an additional component of pain, suffering and dependency has increased notably. Around 308,475 people need palliative care in Spain (20,011 in Castilla y León), of which 126,640 (8,235 in Castilla y León) will require the intervention of specialised palliative care (PC) teams, although only 40% of them receive it. Although CYL is a pioneer in offering people with an advanced or terminal illness the support they need so they can continue to live in their chosen home while the disease progresses, this care process is always a challenge in Castilla y León, given its demographic and territorial reality. INTecum project (led by Gerencia Servicios Sociales JCYL) which has provided support to almost 600 (579) people, shows that 20% of people in need of personal support live alone.

The scaling up of PCs to rural areas requires the existence of effective, low-cost technological tools that allow patients to be monitored at home and remotely, anticipating their evolution in order to avoid situations that generate suffering in people.

It is necessary for both the patient and his or her family have a network from the beginning, when the patient is included in the Integrated Palliative Care Process, which, to be effective, must have a great capacity for flexibility and versatility according to the evolution of the illness and their emotional state. Despite the high prevalence of psychological symptomatology in advanced disease or at the end of life, specific assessment and intervention for these needs is lacking. Only 50% of patients (10% in 2014) with these needs receive the necessary psychological help to cope with their situation. Therefore, it is necessary to provide social and healthcare professionals in PC with tools for assessing the emotional state of the patient from the initial examination to enable them to act in a timely and appropriate manner in the intervention and to provide clinically validated and reliable monitoring of the patient's emotional evolution in order to prevent and anticipate the risk of emotional distress (ED).

Challenge main objectives

The main objective is to detect the emotional state of palliative care patients for the palliative care team professionals (the challenger) to consider it in the patients' personalised intervention plan, mainly at home. The expected benefit is to improve the psychosocial support of patients and enhance their emotional wellbeing and quality of life to prevent emotional distress.

A secondary objective is to validate, by the challenger, the use of a digital assistant capable of recognising these emotional states through voice recognition processing using NLP (Natural Language Processing) and DSP (Digital Signal Processing) techniques.

Solution functional requirements

Compulsory functional requirements

To comply with the objectives of the challenger the solution should address:

1. Identification of speech patterns through NLP (Natural Language Processing) and DSP (Digital Signal Processing) techniques in both the time and frequency domains, with the aim of discerning emotional states or moods in patients.
2. Use of technological tools such as personal assistant to recover the patient voice.
3. Provide an alert and reporting system to the PC team in order to be able to act in case of emergency or to prevent and anticipate (by monitoring the evolution of the historical data of the patient)

As compulsory requirements, the solution should meet:

1. Record the patient's conversation with the Palliative Care Professionals or relatives.
2. Identifies speech patterns through NLP (of the basic emotional states: fear, sadness, anger, joy, surprise and disgust) from the patient's conversations (what he/she says and how he/she expresses him/herself).
3. Allows the creation of rules based on speech patterns of the patient.
4. Provide an alert and reporting system to the Palliative Care Professionals to anticipate to Emotional Distress.
5. Allows to store and monitor the history of speech patterns as well as emotions.

Desirable functional requirements

1. The solution shall be adapted to patients' held devices like smartphones, tablets or personal assistants.
2. Provide feedback to patients on their emotional state.
3. Contain an interface easy to use and intuitive for patients and PC professional.

Pilot scope

Type and number of targeted end-users

The target population for this project are patients with chronic diseases or long-term illnesses in early stages of palliative care at home and inpatients in Castilla y León (Spain) and Socio-healthcare professionals (doctors, nurses, psychologists, social workers) from the Palliative Care Home Support Teams.

End-user type	Role	Number
PC Patients	Provide 100 (ideal) natural, unstimulated and unforced conversations with professionals	50
PC Home Support Professionals	Provide requirements, Manage the conversations with patients Identify basic emotions Use and validate the solution	2-3

Table 1. Targeted users

Language

The derivable should work under Spanish spoken pattern.

Other aspects

Another important aspect to consider is the possible drop-out of patients during the pilot due to the special characteristics of this group, which could affect the sample size.

Pilot set up conditions

The pilot setup conditions correspond to the objective of detecting the emotional state of palliative care patients by the Home Palliative Care Professionals.

During the pilot they will manage the conversations with patients in a natural, not forced way, and associate these conversations or parts of them, with one or more of the basic emotions.: fear, sadness, anger, joy, surprise, disgust or Neutral state. The conversation should be recorded in order to professionals can labelling emotions to identify speech patterns from the patient's conversations (what he/she says and how he/she expresses him/herself).

The pilot will be developed in a period of 12 months, including design, validation, testing and measuring of the impact of the co-created solution.

Ethical, legal or regulatory

As the sample is made up of **very vulnerable people**, the guidelines for research with this type of population will be followed.

Prior to the start of the pilot, the study protocol will be designed for approval by the Clinical Research Ethics Committee. This protocol will include:

- Study design to test the feasibility of the technology: The study will involve 50 patients and 2-3 professionals from Palliative Care Home Support Teams. An additional % will be recruited to ensure drop out replacement for patients
- Inclusion and exclusion criteria for participants. The study will target patients with long-term illnesses, cared for at home or in hospital settings.

The study will be conducted in accordance with the ethical principles that originate from the Declaration of Helsinki, and with the corresponding standards of good clinical practice, and current laws and regulations. In addition, participants' personal information will be kept confidential and will not be disclosed under any circumstances. In accordance with Organic Law 3/2018 on Personal Data Protection and guarantee of digital rights, which adapts Spanish legislation to the General Data Protection Regulation of the European Union, all patients will be notified (Patient Information Sheet) about their rights of access, modification, deletion and correction of data by requesting it to the corresponding researcher.

The iMOTION solution will apply the methodology "ethical artificial intelligence by design" in accordance with the Digital Rights Charter of the Spanish Government's Secretary of State for Digitalisation and Artificial Intelligence (SEDIA) of July 2021, which states that human-centred AI should guide any development framework that is built and thus demand that intelligent systems are not only explanatory, secure and robust, but also comply with European principles such as non-discrimination (bias), diversity and fairness and the protection of privacy.

Technological

A pilot implementation plan will be proposed, which will include:

- The installation of the equipment at homes/hospital, ensuring the quality and risk management of the experimentation.
- The elaboration of guidelines for the successful introduction of the technological and person support tools to maximise acceptance and satisfaction.
- the training of professionals and patients.
- From the technical point of view, possible incidences will be collected for the improvement of the system and a helpdesk will be set up to provide support.
- The systems and servers needed for running the pilot will be hosted by the Solver.
- The Solver will be responsible for the collection, management and analysis of the data during the study and for its destruction once the study is over.

Data access

No prior data is expected to be available, meaning all users will start as new users in the system.

Expected impact and KPIs

The solver solution should be used by the Palliative Care Home Support Teams. The solution should monitor the history of speech patterns as well as emotions each week so the professional can track the emotional state of patients between visits. Currently, to organize the visit the professional team, performs around 100 phone calls per week. (20-30 per days, 5 days a week).

Using iMOTION, the team expect to improve the service thanks to:

- A reduction in the number of weekly phone calls to appointment visits to patients due to emotional state: *at least in a 20%*
- A reduction of phone calls time duration cause the symptoms are known in advance: *at least in a 15%*

- A higher degree of satisfaction PC professionals in the use of the solution (SUS *System Usability Scale*¹) at least 70 points.
- To achieve a high degree of patient's perception in the appropriateness of the service received by Palliative Care Home Support Teams to the improvement of their emotional well-being by using the application: Degree of satisfaction with PC service >5 (1-10).

Business opportunity

Market size

At the challenger organization, the primary end-beneficiaries of using iMOTION solution are around 200 patients with chronic diseases or long-term illnesses with a life-limiting prognosis attended by the 4-6 professionals (doctors, nurses, psychologists, social workers) of the Palliative Care Home Support Teams

iMOTION could also be extend to the psychosocial care teams (EAPS) from 8 hospitals (five of them in CYL that are part of the Northwest Commission) (Salamanca, Avila, Zamora, Valladolid, Burgos, Asturias, Pontevedra and La Coruña) and even to transfer it to National and European level (for example to North Portugal) if the experience is positive and provides useful results.

Beyond its use in palliative care, other future possible beneficiaries of iMOTION could be other vulnerable groups with psychosocial support needs.

Adoption Plans

If the pilot is successful, Hospital Los Montalvos intends to adopt the solution, by shared ownership of the solution and procure its maintenance.

Intellectual Property Rights

This section sets the rules for the evaluation, ownership, and exploitation of Intellectual and Industrial Property Rights.

Evaluation and Documentation: Each party shall evaluate and document in the Pilot Action Plan their respective contributions to the new solution. This assessment will consider each party's background knowledge, resources, and tasks undertaken in the co-creation pilot project, determining the ownership and rights of the resulting shared IP&IPR.

Intellectual Property (IP) Rights: The intellectual property rights developed or contributed by Hospital Los Montalvos are inalienable, reflecting the knowledge and resources provided by Hospital Los Montalvos, including work time, patient access, and real-environment validation. These rights will be set out in the relevant IP agreement.

Industrial Property Rights (IPR): Hospital Los Montalvos will opt-out of the commercial exploitation of the solution as it is not their objective, in exchange for certain compensations such as:

- Reduced overall cost in licensing and maintenance of the solution.

¹ System usability scale (SUS) is a simple, ten-item attitude Likert scale giving a global view of subjective assessments of usability.

- Allocated hours for corrective and evolutionary maintenance.
- Priority status for Hospital Los Montalvos in new developments.
- Collaboration by Hospital Los Montalvos in promoting the solution.

These rights will be set out in more detail in the relevant IPR agreement.