Institut de Robòtica i Informàtica Industrial

CSIC

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

PhDday 2024

Multi-User Multi-Objective Personalization In Robotic-Assisted Tasks
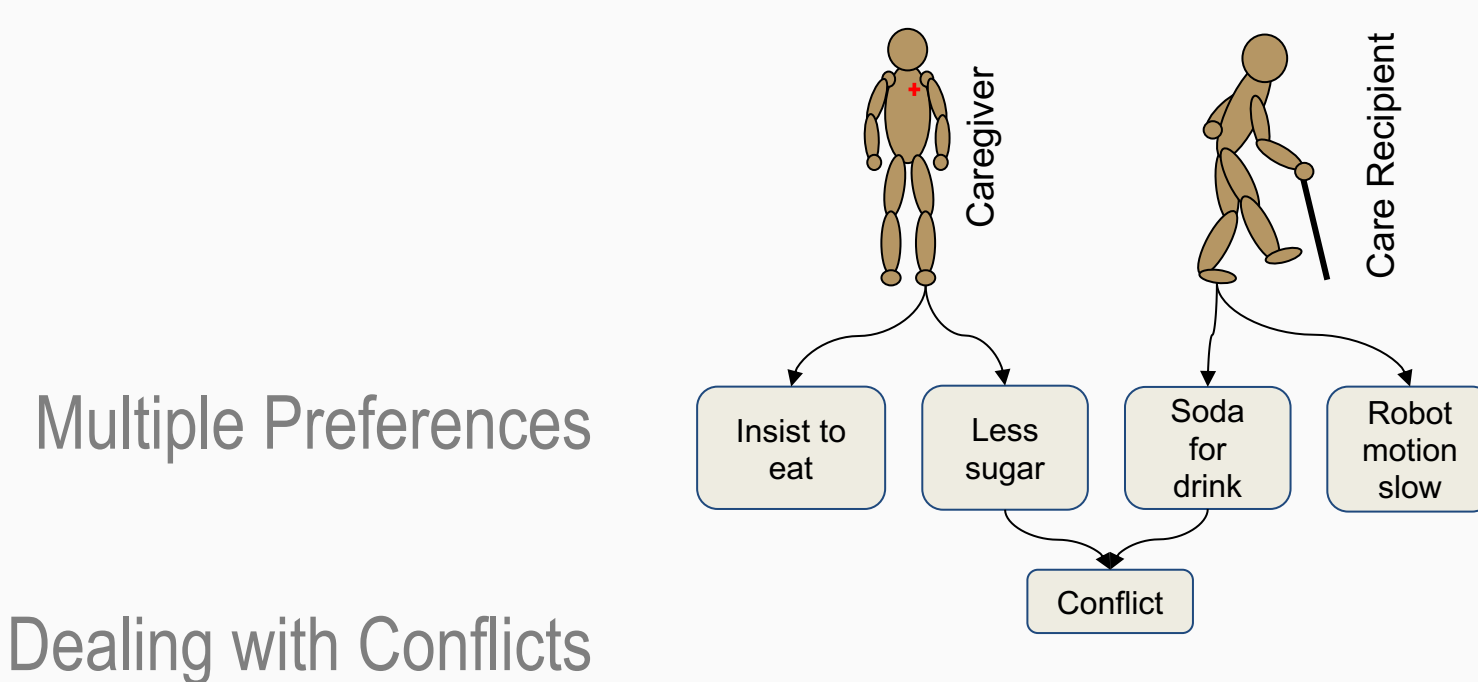
Author: Aniol Civit

Supervisors: Antonio Andriella and Guillem Alenyà

MOTIVATION

- Current personalization approaches only consider **Single-User preferences** in the decision-making.
- In an assistive task, the **preferences of the caregivers** are also important.
- Robots must be capable of **continuously learning** the potentially changing users' **preferences and needs** in long-term interactions.

OBJECTIVES

- Design a **Multi-User Multi-Objective** (MUMO) **decision-making** algorithm that considers the preferences of user and caregiver in assistive tasks
- Design an **Active Learning** algorithm for **MUMO** Optimization Problems that **learns the preferences and needs** in an assistive task, allowing the insertion of knowledge easily.
- **Evaluation** of the proposed framework **in a real-world scenario** for different assistive tasks.

APPROACHES

MULTI-USER MULTI-OBJECTIVE OPTIMIZATION

Multiple Preferences

Dealing with Conflicts

MULTI-USER ACTIVE PREFERENCE LEARNING

Preferences Changes

Preferences Learning
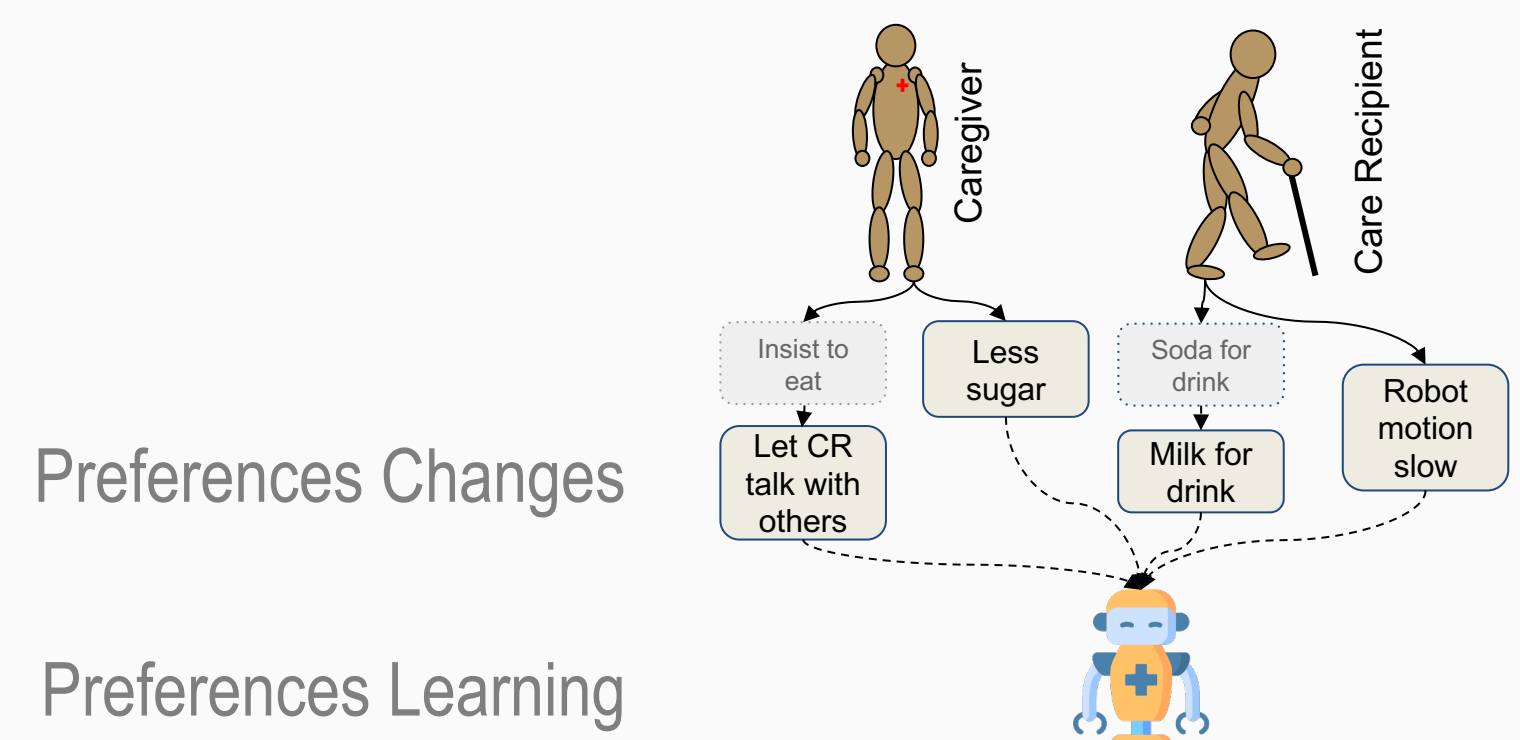

FIRST USE CASE

FRAILTY ASSESSMENT SYSTEM

- Social robots to assess older adults' frailty autonomously [1].
- Measuring performance in TUG and SPPB tests.
- **Co-design** with healthcare professionals.

EXPERIMENTS AND RESULTS

- **Metrics Accuracy Validation:** 21 samples of each test, comparison between the robot measurements and OptiTrack (gold standard). Mean Absolute Percentage Error <5% for time completion of all tests [2].
- **Pilot Study:** 22 older adults, **significant correlations** between the time measured by the doctor and that of the robot [2].
- **Ongoing:** User Study programmed in the next months.

TESTS ANALYSIS
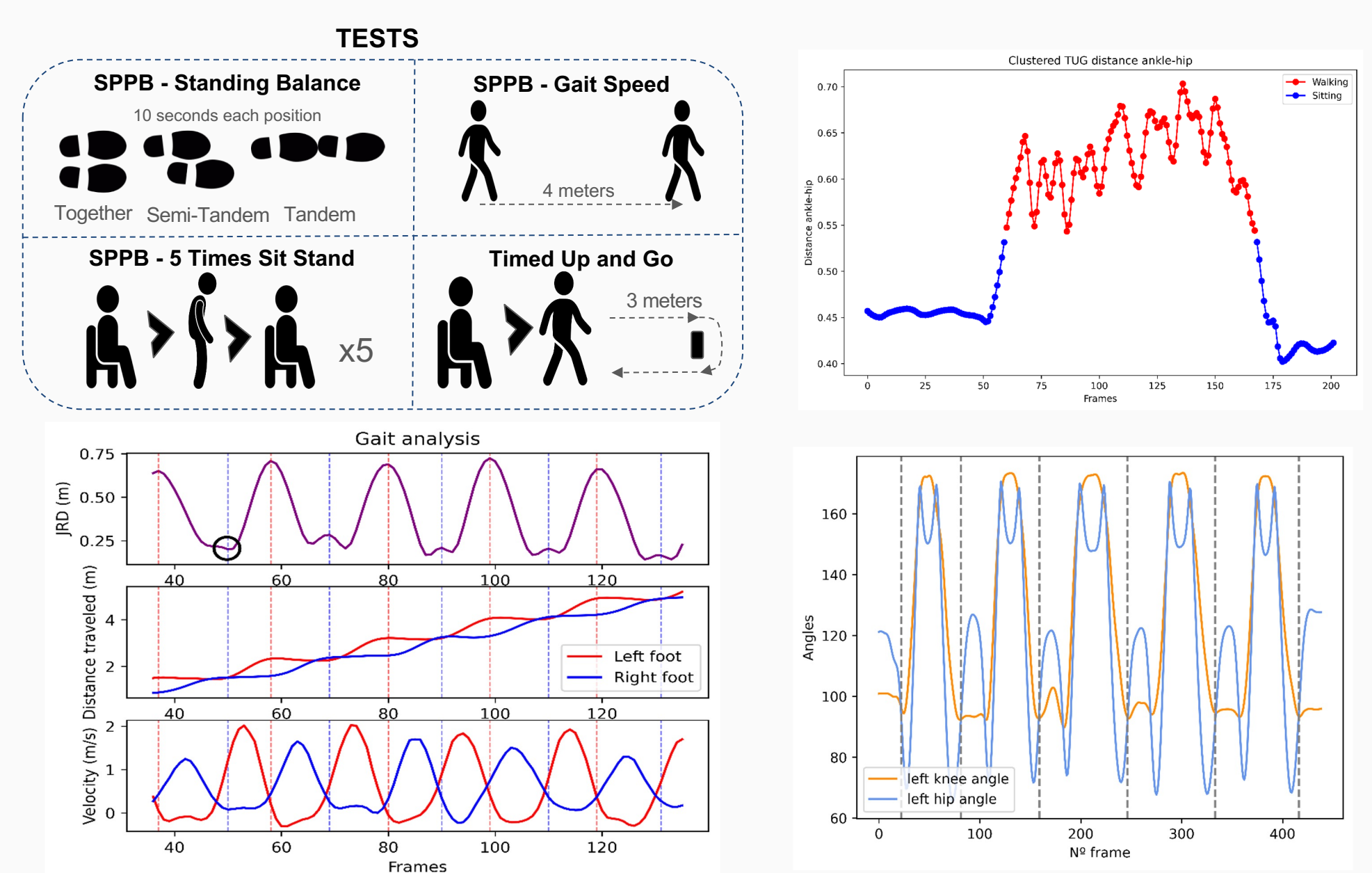
Start date: June 2023
Research Plan defense: July 2024

Research collaborations and research stays

- Collaboration with the Institut Català d'Oncologia (2 conference papers)
- Collaboration with the Parc Sanitari Pere Virgili (ongoing)
- Collaboration with the RPL group from KTH Royal Institute of Technology, Sweden (workshop extended abstract)

Funding

Publications

[1] A. Civit, A. Andriella, C. Barrué, M. Antonio, C. Boqué & G. Alenyà. (2024). **Introducing social robots to assess frailty in older adults.** In Companion of the ACM/IEEE International Conference on Human-Robot Interaction.

[2] A. Civit, A. Andriella, M. Antonio, C. Javierre, C. Boqué & G. Alenyà. (2024). **Exploring the potential of a robot-assisted frailty assessment system for elderly care.** In Proceedings of the 33th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), to appear.