



ERCIM "ALAIN BENSOUSSAN"
FELLOWSHIP PROGRAMME



Scientific Report

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I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During this fellowship, I started learning to work with the Nao robot and its programming. I practiced python language programming as an online course. I tried to use an evidence-based practice as a solid intervention with a robust methodology for educating advanced cognitive social skills to children. This practice was designed based on decades' experiences with promising results. I prepared its knowledge base for each session to enter into the robot base, however, when it came to the conduction, we found Norwegian elementary schools are so strict for accepting the robot as an educational method.

After this, we shift to another project that focuses on the elderly population. During this time, I tried to define projects for using a social robot for the elderly. Based on this, we wrote two proposals for both prevention and educating interventions in different aspects of the elderly life. We applied for two research calls by these proposals, the Nordforsk call and the Romanian call. One call gave acceptance for its first stage and we applied for the final stage and now waiting for the results. During this process, we made strong connections with other professors and researchers in other countries such as Romania, Denmark, and the UK.

Some social robot projects have been defined for the elderly but they are lack of robust methodological structure and use simply daily communication or some games as interventions without any specific novel aspect. For our project on using Pepper robot for the elderly, we introduced a solid plan as well as a variety of novel aspects as follows. First, this project is going to use a comprehensive promising evidence-based practice, encompassing social, physical, and cognitive aspects of elderly persons. This program has been developed by a health expert with decades of experience of working with the elderly, both healthy and those with dementia. Further, every participant voluntarily attends this intervention and can have an individualized educational plan (IEP), enjoying setting her/his own goal to attain based on her/his capabilities. Third, every elderly person receives real-time feedback and has a visual self-monitoring progress paper at the end of each week, implicating how much she/he has achieved the goals. These feedbacks are visual, readily to be understood, motivating, and encouraging. Forth, this intervention creates a sense of accomplishment, releasing them from the feeling of uselessness, common in this age. Fifth, before the start of the intervention, it is required to establish a strong relationship between humans and robots. This is well known as familiarity sessions in social robot studies while in this study, we aim to have more than some familiarity sessions. It is required to have a strong relationship with the clients before starting an educational intervention.

For this purpose, the principles for an empathetic, therapeutic relationship are gained from psychology. The functions such as recognizing every participant, calling her/his name, talking about her/his interests, hobbies, and memories are considered to develop in the robot. Sixth, during familiarity and intervention sessions, the robot should be able to recognize the emotions of participants and provide them with adaptive feedback. For example, when a participant is sad or bored, the robot can offer fun activities, including jokes, playing music, dancing, displaying interesting pictures or clips specific for each person. Also, using Pepper's connectivity to the internet, the elderly could enjoy the huge info on the web and ask Pepper to read news, history, or show whatever they want via its monitor. To provide such functionalities, we constituted a multidisciplinary team from different universities to develop linguistic and visual capabilities, so that Pepper could correctly identify the elderly emotions and verbally interact with them.

In terms of speech, we need to develop a new linguistic model for Norwegian adapted to the conditions from a nursing home (using SpaCy – a python library for natural language processing – NLP). While building linguistic models is not novel for common languages like English, doing this for a not so popular language such as Norwegian is novel for the simple reason that there are no other alternatives for this task now, especially when considering their implementation on Pepper. Moreover, adapting the model to the scenarios and vocabulary that might arise in a nursing home raise new issues, as they require building specific scripts for Pepper to follow. Such scripts will be developed using the RASA framework. For the project, we benefit from the team's expertise from different countries in building such models.

On the second hand, while detecting the human's face and body posture from videos is a solved task, doing this from the level of Pepper's sensors, also considering different angles of viewing the face, possible occluding and the situation of seeing multiple persons, becomes a not so trivial task. To solve it, we considered vision techniques based on deep learning.

Furthermore, identifying emotions based on their facial cues, body postures, and speech analysis involves combining the outputs of the previous two modules, inheriting their issues, but, at the same time, combining their advantages.

Other activities were defining projects for assessing the preference of the elderly for having a social robot and finding a new collaborator willing to work with us for future conduction from France. For this project, we define different stages of using the eye-tracking system and virtual reality to find out the important part of robots and finding the preference of the elderly by presenting different types of robots. This project can be as a base for all upcoming social robot projects.

Further, before getting have to work online because of coronavirus, I was setting up the requirements of another educational intervention and also tasting using Nao robot combined with other technologies in our Newton Room but before going further we had to stopped it because children could not attend this program.

In the late of my fellowship, we planned to write a proposal for using a social robot to provide the elderly with appropriate and crucial services during the Corona pandemic. Currently, Coronavirus has been a big challenge and for the elderly, this could be more challenging. Many older persons were left alone in their home alone since human contact could be a risk for spreading this disease. Even worse, some of them died as did not receive any services. Further, they could not attend preventive classes (interventions) designed against dementia and related aging diseases so such situations can increase the risk of diseases and perhaps cause emotional problems and health issues. Therefore, aside from monitoring health status in emergency conditions as current Coronavirus pandemic, it is important to consider different aspects of the older person's life. For this purpose, we work on a multifunctioning social robot for the elderly person, trained for medical check-ups, and providing daily activities and stimuli for them.

It should be noted that the first project on NAO and children and also other projects for the elderly have received ethical confirmation by NSD. It means I registered for ethical evaluation and all were OK with the NSD and confirmed, ready to be conducted. All procedures, content, and participants' rights were confirmed that they do not violate human rights while attending the interventions.

I continue my collaboration with Ibrahim for developing novel projects and interventions implemented by social robots. We have also a review paper ready to submit to a journal. This review paper has a basic idea, investigating which features of social robots can be more important for older persons. Current studies are employing available social robots

while human preferences have been neglected concerning the type of social robot. We reviewed the studies related to the preferences of older adults for having a social robot. Based on the current studies reviewed, it seems social robots can be acceptable and likable by older adults but they demand more intelligent SARs. Regarding SARs appearance, which rarely studies found to address strongly this aspect for the elderly population, the results are not inclusive and there is a need for further work on this area with more robust homogenous methodology to obtain comparable results. Currently, because of some methodological issues such as small sample size and heterogeneous designs, it is difficult to conclude about the preference of the elderly for a social robot's appearance.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

Mahmoudi, M., Hameed, I.A. (2019). Cognitive rehabilitation for the elderly using social robots: a brief review. In Proceedings of ICERI2019, Spain.

Hameed, I.A., Mahmoudi, M. (2019). "ICPS-NAO": Nurturing thinking children using a social robot. In Proceedings of ICERI2019. Spain.

III – ATTENDED SEMINARS, WORKSHOPS, CONFERENCES

- Attended ICERI 2019, 12TH INTERNATIONAL CONFERENCE of EDUCATION, RESEARCH and INNOVATION, Seville, Spain
- A seminar on using technology for health at NTNU, Aalesund
- One day visit of professors working on health and technology at NTNU, Trondheim.
- Attending an event on green earth and running the Nao robot for children as a playmate and observing their interaction

IV – RESEARCH EXCHANGE PROGRAMME (REP)

For my exchange program, I visited ISTC-CNR under the supervision of Amedeo Cesta. During this visit, we had several meetings and presentations and I worked in their lab from February 4 to February 11, 2020, Rome, Italy. Riccardo De Benedictis, Gabriella Cortellessa, and Francesca Fracasso were other researchers I visited in this group. This group had a long time experience in using social robots for the elderly and I learned about the variety of their work and their experiences. We discussed upcoming collaborations such as helping us in conducting interventional programs. I also visited other researchers from other groups and especially two of them shared their technological work on children with autism and typical children. They creatively used technology for educational purposes. Professor Cesta offered me an open position for a postdoc in case if I want to live in Rome.

