Using the Social Humanoid Robot Pepper for Training Tasks

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ABSTRACT

In this position paper we discuss the opportunity of using social humanoid robots like Pepper for training tasks of patients.

Within our project E-BRAiN (Evidence-Based Robot Assistance in Neurorehabilitation) we try to support post-stroke patients in their arm-ability training. Such a robot has a lot of sensors. However, it is difficult to check the correct performance of tasks on paper. Therefore, we digitalized some training tasks in such a way that paper is replaced by tablets. In this way, the correct observation of the performance of tasks has been improved.

In the near future, we will evaluate, which groups of patients like the support by pepper.

Currently, the interaction between patient and robot is not very much personalized. This will be changed in the future. A first concept of user modelling is discussed. Additionally, the idea of a domain-specific language for specifying the collaboration of patients and robots is discussed. This language is designed in such a way that code can be generated for Pepper.

CCS CONCEPTS

• Software and its engineering → Software notations and tools → Context specific languages

• Software and its engineering → Software creation and management → Collaboration in software development

KEYWORDS

Social humanoid robot, User modeling, Interaction design, DSL CoTaL

ACM Reference format:

Peter Forbrig and Alexandru Bundea. 2020. Using the Social Humanoid Robot Pepper for Training Tasks. In *Proceedings of Workshop on Adapted intEraction with SociAl Robots (cAESAR) in conjunction with IUI 2020. Cagliary, Italy, 2 pages.*

1 Introduction

Stroke is one of the challenges in Medicine in or current society. A lot of patients suffer from related handicaps. However, there are good news too. Sometimes, arm-ability training (AAT) [9] can help to overcome the handicaps. Not affected areas of the brain help to control the movement of the body and to overcome the handicap. However, a lot of training is necessary and the number of therapists is limited. The therapists play the role of personal trainers. They motivate patients and evaluate their performance.

Within our project E-BRAiN (Evidence-Based Robot Assistance in Neurorehabilitation) we study the opportunity to assist therapists by a social humanoid robot. We decided to use Pepper for our experiments.

2 Pepper as Personal Trainer

Our choice for Pepper was based on a research of available social humanoid robots. The robot has already been used in several domains and seems to provide necessary features for our purpose. However, we recognized that the available sensors are not able to evaluate the performance of training tasks like crossing symbols on paper. Therefore, we replaced paper by tablet computers. The applications of digitalized tasks allow a communication with the robot. In Figure 2 the manual task of hitting circles and its digitalized version are shown.

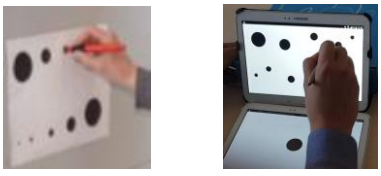

Figure 2: Manual and digitalized training task

Pepper provides a spoken introduction, pictures of important training situations and videos of correct task performance for each training task. At the end of a training task Pepper provides the result in natural language und adds some motivational comments. The tasks have a time limit of one minute and should be repeated four times. After four repetitions, the robot shows a diagram on its tablet that visualizes the results of performed tasks. However, this is still

a topic of our research whether this should be presented always or only if success can be reported.

It is not the intention of our approach to replace a therapist totally. The introduction of the training tasks is provided by a human. After the first session of training tasks the second and all forthcoming trainings could be assisted by Pepper.

3 Challenges for Pepper as Personal Trainer

3.1 User Model

The specification of a useful user model is very important for an adaptive communication. Currently, we specify personal goals of the patient that they want to reach with the training. Such a goal could be: "I want to be able to move chess pieces". The personal goals are used in the motivational sentences like: "You reached 25 points. This task was very well performed. Soon you will be able to move chess pieces".

Challenge 1: How can sentences be formulated to motivate a patient in the right way?

There should be no over motivation but also no depression. Currently, the user model contains the information whether the right or the left arm have to be trained. Instructions, pictures and videos are presented accordingly. However, we are looking for further attributes like stolid or spiky to adapt the interaction between patient and robot accordingly.

Challenge 2: What are the important attributes for the user model?

The identified attributes should be helpful to adapt the interaction related to challenge 3.

Challenge 3: Which kind of information has to be presented to a patient when?

3.2 Specification of Collaborative Activities

We developed a specific task modelling language called CoTaL (Cooperative Task Language) for specifying cooperative activities [2]. Such models can be instantiated and animated in the environment CoTaSE (Cooperative Task Simulation Environment) which can be downloaded from [3]. Additionally, a more human readable domain-specific language was developed. Its name is DSL-CoTaL. It allows the code generation for several tools including CoTaSE. The approach is discussed in [8].

The approach was used to specify a collaboration between a patient and a robot in [7]. In [5] it is discussed how DSL-CoTaL can be used with task patterns and how it can be extended to allow the generation of code for Pepper. The digitalization of different training tasks is discussed in [5] and [6].

Challenge 4: Specification of a DSL that allows the specification of collaborative activities of humans and robots and additionally the generation of code for robots.

3.3 Evaluation of the Acceptance of Pepper by Stroke Patients

Therapists of our project team will have to evaluate the developed applications with patients. They should provide feedback to the provided interactions and identify patients that want to collaborate with pepper and those who do not want this kind of assistance.

Challenge 5: For which kind of patients is assistance by a social humanoid robot like Pepper appropriate?

3 Summary and Outlook

We introduce the idea of our project E-BRAiN for supporting post-stroke patients by a social humanoid robot Pepper. Additionally, we expressed five questions that were characterized as challenges for further research. We hope that during the discussion in the workshop some support for answering the questions can be identified.

ACKNOWLEDGMENTS

This joint research project "E-BRAiN - Evidence-based Robot Assistance in Neurorehabilitation" is supported by the European Social Fund (ESF), reference: ESF/14-BM-A55-0001/19-A01, and the Ministry of Education, Science and Culture of Mecklenburg-Vorpommern, Germany. This work was further supported by the BDH Bundesverband Rehabilitation e.V. (charity for neuro-disabilities) by a non-restricted personal grant to TP. The sponsors had no role in the decision to publish or any content of the publication.

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