



Hochschule
Bonn-Rhein-Sieg
University of Applied Sciences



Personalised Behaviour Model for Autism Therapy

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Michał Stolarz
Alex Mitrevski
Mohammad Wasil
Paul G. Plöger

Motivation

- 1 in 160 children all over the world is diagnosed with Autism Spectrum Disorder [1].
- Children with autism find robots easier to communicate with than human therapists [2].
- It is desirable to increase the autonomy of the robot in order to reduce the workload of the therapist during Robot-Assisted Therapy.



Figure 1: Autism therapy assisted by the robot [3]

- [1] S. Jain, B. Thiagarajan, Z. Shi, C. Clabaugh, and M. J. Mataric, "Modeling engagement in long-term, in-home socially assistive robot interventions for children with autism spectrum disorders," *Science Robotics*, vol. 5, no. 39, 2020
- [2] B. Robins, K. Dautenhahn, and J. Dubowski, "Does appearance matter in the interaction of children with autism with a humanoid robot?" *Interaction Studies*, vol. 7, no. 3, pp. 479–512, 2006
- [3] D. O. David, C. A. Costescu, S. Matu, A. Szentagotai, and A. Dobrean, "Developing Joint Attention for Children with Autism in Robot-Enhanced Therapy," *International Journal of Social Robotics*, vol. 10, no. 5, pp. 595–605, 2018

Goal and Requirements

The robot should:

- help the therapist in improving the child's performance,
- prevent the child from getting bored,
- personalise its behaviour based on the feedback from the therapist.

The goal is to develop a behaviour model that:

- is suitable for the robot **decision-making** process,
- learns adequate behaviour **continuously** during the therapy.

Approach

The approach is to apply Reinforcement Learning, where:

- Robot's state is defined with child's engagement, motivation and game performance.
- Robot can perform three actions: encouragement, waving or proposition.
- Robot suggests action to the therapist and obtains reward before executing an action.

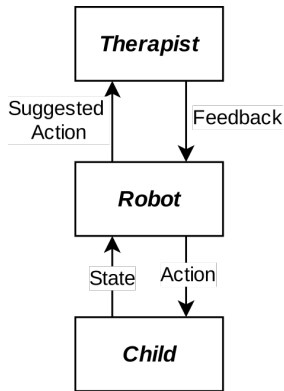


Figure 2: Robot learning

Application

- Evaluation using a rule-based child model, which includes processes that are dependent as well as independent on the robot behaviour [4].
- Deployment on the QTrobot used as a tutor in tablet-based therapeutic games.

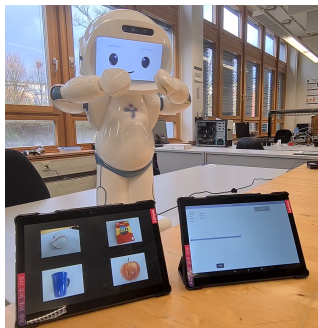


Figure 3: QTrobot

[4] E. Senft, P. Baxter, and T. Belpaeme, "Human-guided learning of social action selection for robot-assisted therapy," in *Machine Learning for Interactive Systems*. PMLR, 2015, pp. 15–20