

# Machine Learning for Human-Robot Interaction

We welcome applications of PhD students in the domain of **human-robot interaction** with a focus on **machine learning** in its widest sense to enable social interactions between humans and robots.

One previous line of work within the Robotics Research Group focussed mostly on robotic language acquisition, which we are seeking to extend towards social interaction more generally. Listed below is one exemplary research topic of interest. However, any applicant with a serious interest in enabling genuine social interaction between robots and humans is encouraged to contact Dr Frank Förster to discuss ideas.

Topics will likely revolve around human-robot interaction (HRI) experiments acting as a testbed for evaluating potential new algorithms and will likely involve the iCub humanoid robot. However, other robots are available too.

As indicated by the topic below, the research is highly interdisciplinary, connecting different research areas within robotics and computer science - human-robot interaction, machine learning, natural language processing, cognitive and developmental robotics, signal processing, and affective computing – as well as having links to linguistics, philosophy of language and mind, psychology, and sociology (conversation analysis).

## Topic: Repair Mechanisms in Interaction

Human interaction, whether by speech or otherwise, is partially enabled through robust repair mechanisms some of which have been documented in the conversation analytical literature. While early research exists on how to operationalise repair in dialogue systems, we would like to extend this research into the multimodal domain to encompass gestural and other forms of bodily communication. The lack of these mechanisms in human-machine interaction systems, be it dialogue systems or others, renders these comparatively brittle and prone to interactional breakdowns. Equipping speech-enabled robots with means to engage in such repair will make them more resilient concerning interactional breakdowns. Research on this topic may employ several state-of-the-art ML techniques, but the to-be-developed system will ultimately need to be tested in human-robot interaction experiments.

If you are interested in this topic and like to learn more, have a look at the recent WTF workshop publications, available under the link below, as well as our WTF workshop summary article linked in the reference section on the next page.

<https://arxiv.org/abs/2401.04108>

## Background / Person Profile

Applicants should optimally have a background in computer science or a similar field. However, given the interdisciplinary nature of the topics, applicants with a background in psychology or philosophy will be considered too. Any applicant will need a strong background in at least one programming language – existing implementations were written in Python and/or C++. Interest in languages, language acquisition, and human interaction more generally is a plus, and knowledge of the later Wittgenstein a big plus.

Useful skills and knowledge on the computer science side include signal processing, knowledge of robotic middleware such as ROS or YARP, experience in robotic software development, knowledge of speech processing in general, machine learning more generally, or knowledge of dialogue system

design. Useful skills and knowledge outside of computer science side include speech act theory, pragmatics, conversation analysis, and other methods of behaviour coding.

## Contact

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## References

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