Detection of Human-Object Interactions in Video Streams for Foresighted Robot Navigation

Lilli Bruckschen   Sabrina Amft   Moritz Wolter   Julian Tanke   Jürgen Gall   Maren Bennewitz

Humanoid Robots Lab, University of Bonn

Motivation

- Detection of human-object interactions is a key component in many applications.
- E.g. activity recognition, human intention understanding or prediction of human movements.
- As the system is based on video streams it can be used online by mobile robots.

Methodology

1. Apply an R-CNN to detect objects and a pose estimation system to detect human and poses from RGB-D data.
2. Use position and depth data to find overlaps between object bounding boxes and human hand positions.
3. Utilize pose information to check whether the human is facing objects that overlaps with their hand.
4. Check if this potential interaction occurs over multiply frames and compute a likelihood based on this.
5. Return all interactions with a sufficient likelihood as interactions.
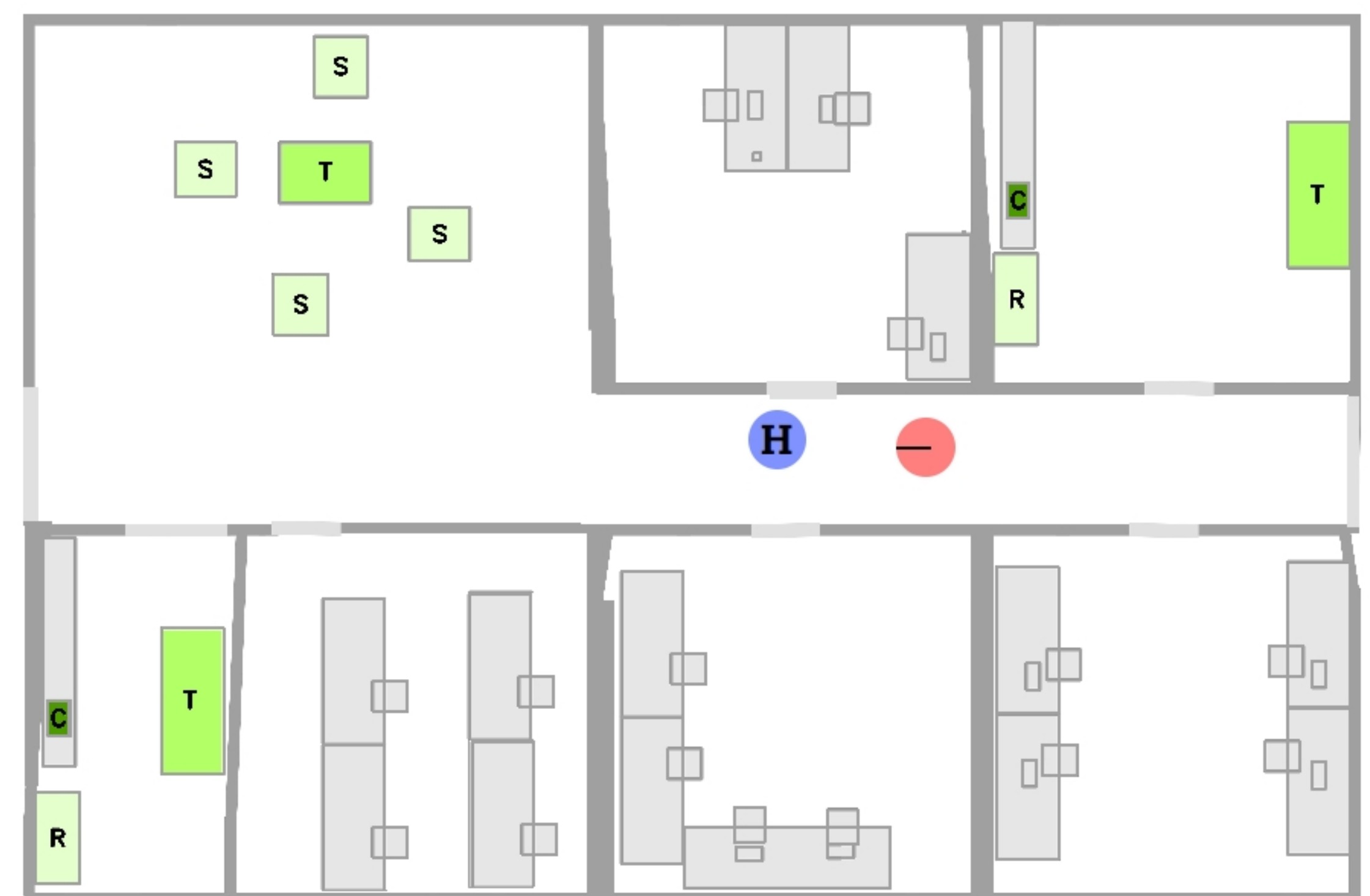
Example Interaction Detection

Evaluation Results

- Evaluation on 195 human-object interactions of 10 different people over 27 minutes of video data.
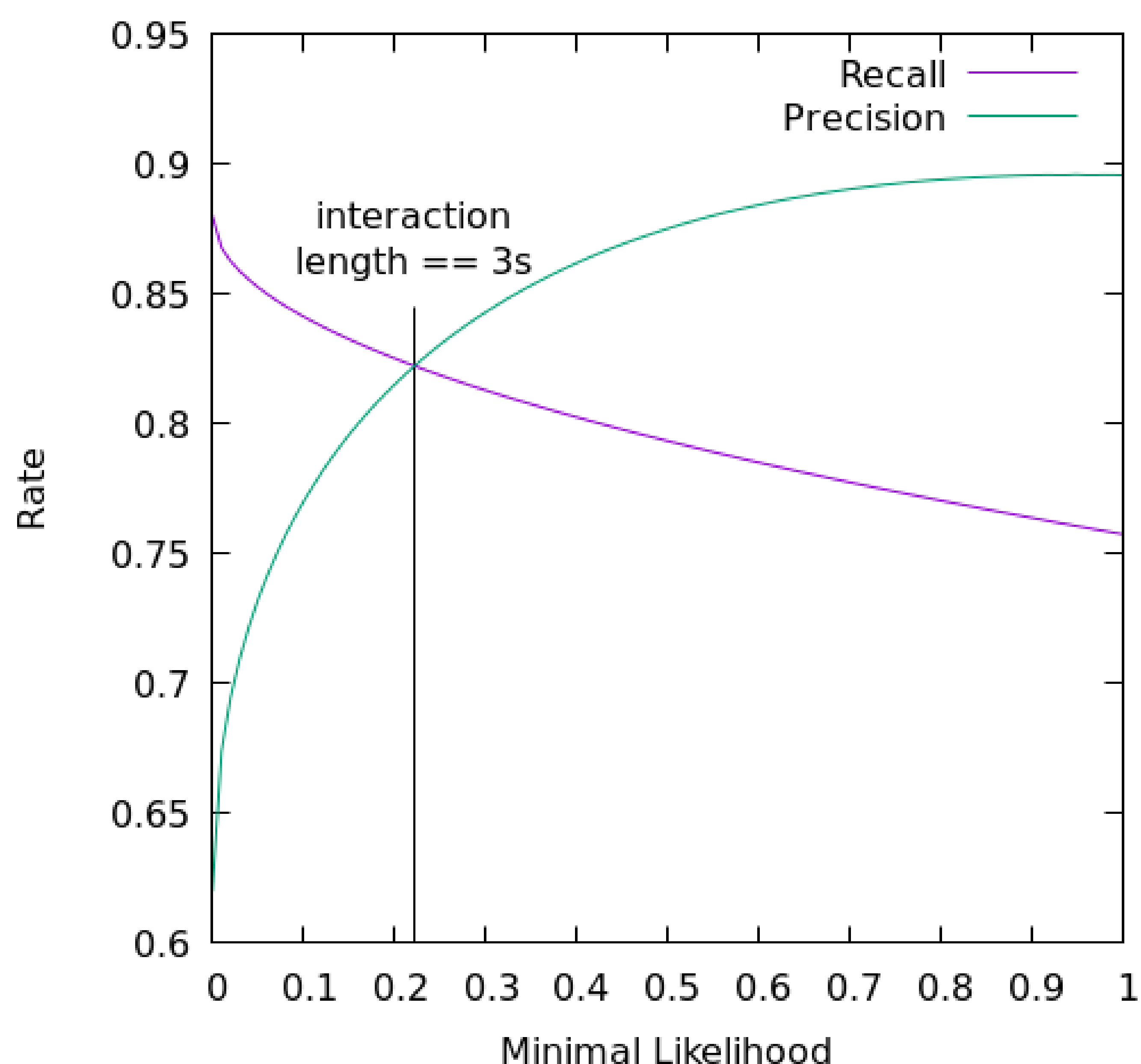
Application

- Useful for foresighted robot navigation.
- Humans tend to move between objects.
- E.g. if a human interacts with a cup it is likely that they next interact with a coffee machine.

Ongoing Work

- Semantic room mapping based on object occurrence to adapt the likelihood function.

Relevant Papers

[1] Lilli Bruckschen, Sabrina Amft, Julian Tanke, Jürgen Gall, and Maren Bennewitz.
Detection of generic human-object interactions in video streams.
In *Proc. of the International Conference on Social Robotics (ICSR)*, 2019 to appear.

[2] Lilli Bruckschen, Nils Dengler, and Maren Bennewitz.
Human motion prediction based on object interactions.
In *Proc. of the European Conference on Mobile Robots (ECMR)*, 2019.

[3] Lilli Bruckschen, Nils Dengler, Moritz Wolter, and Maren Bennewitz.
Human-aware positioning and navigation by motion prediction based on object interactions.
In *International Conference on Robotics and Automation (ICRA)*, 2020 submitted.

Contact Information

- Web: https://www.hrl.uni-bonn.de/
- Email: brucksch@cs.uni-bonn.de

UNIVERSITÄT BONN

RHEINISCHE
FRIEDRICH-WILHELMS-
UNIVERSITÄT BONN

HUMANOID
ROBOTS
LAB

HRL