**Hiwi-Job**

Robot Air Hockey Player

The institute has an air hockey table where one side of the playing field is equipped with a 2 degree of freedom robot to control the bat. Additionally, a camera is mounted above the center of the table to detect the puck.

The goal is to automate this air hockey table such that the robot plays automatically against a human player. A Kalman filter is already implemented to estimate the puck position and direction and velocity. The existing code has been ported to ROS almost completely. A pyboard is used as interface to the robot, where the code for controlling the robot is already implemented.
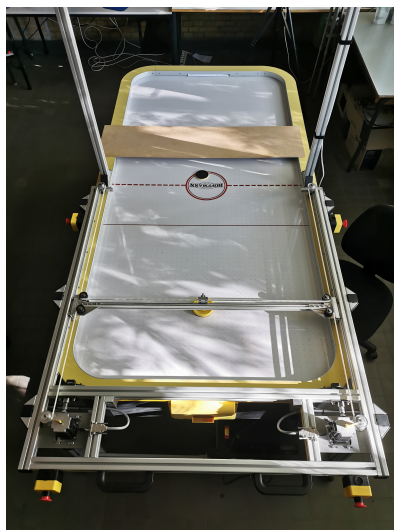
Air hockey table with robot

The first planning algorithm should be rule-based to try to intercept the puck's path to achieve a defensive behavior. A first step towards this is to evaluate the reactivity of the robot to control commands and identify delay time. Next, the physical laws of collision should be used to hit the puck in the desired direction to aim at the opponent's goal.

In the end, a reinforcement learning policy should be learned for the robot to play well against a human. This can be achieved by first training a policy in simulation and then fine-tuning it on the real system.

This sounds exciting? Then apply to us! Ideally, you have experience with hardware, microcontrollers, or ROS.
The rough task roadmap for this project is:

+ Finalize porting existing code to ROS
+ Get familiar with robot interface via pyboard
+ identify delay time for robot control
+ Implement defensive control strategy
+ Implement aimed hits for opponent's goal
+ Train reinforcement learning agent in simulation
+ Transfer learned RL policy to real air hockey robot

I am happy to answer any questions you might have. Feel free to ask for an appointment or directly ask at my office!

Institute of Measurement and Control Systems (MRT)
Prof. Dr.-Ing. Christoph Stiller

Advisor:
Johannes Fischer, M.Sc.

Programming language(s)[1]:
Python   advanced

System, Framework(s):
Linux, ROS, pyboard

Required skills:
- Solid mathematical foundations
- Work on your own

Language(s):
German, English

For more information please contact:

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Or directly send in your application including your current grades as well as our questionnaire!

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[1] **skill levels:**

beginner	< 500 lines of code (LOC)
advanced	500 – 5000 LOC
proficient	> 5000 LOC