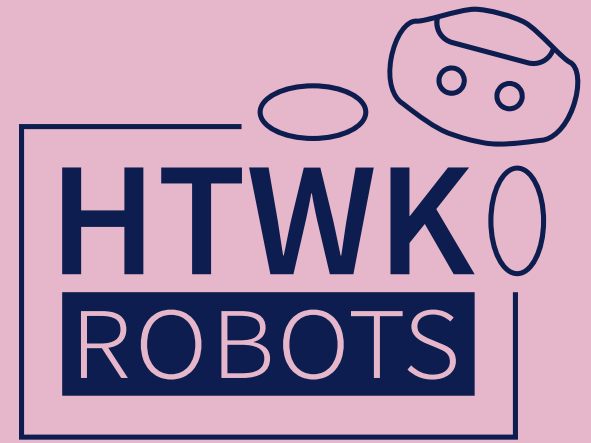


HTWK

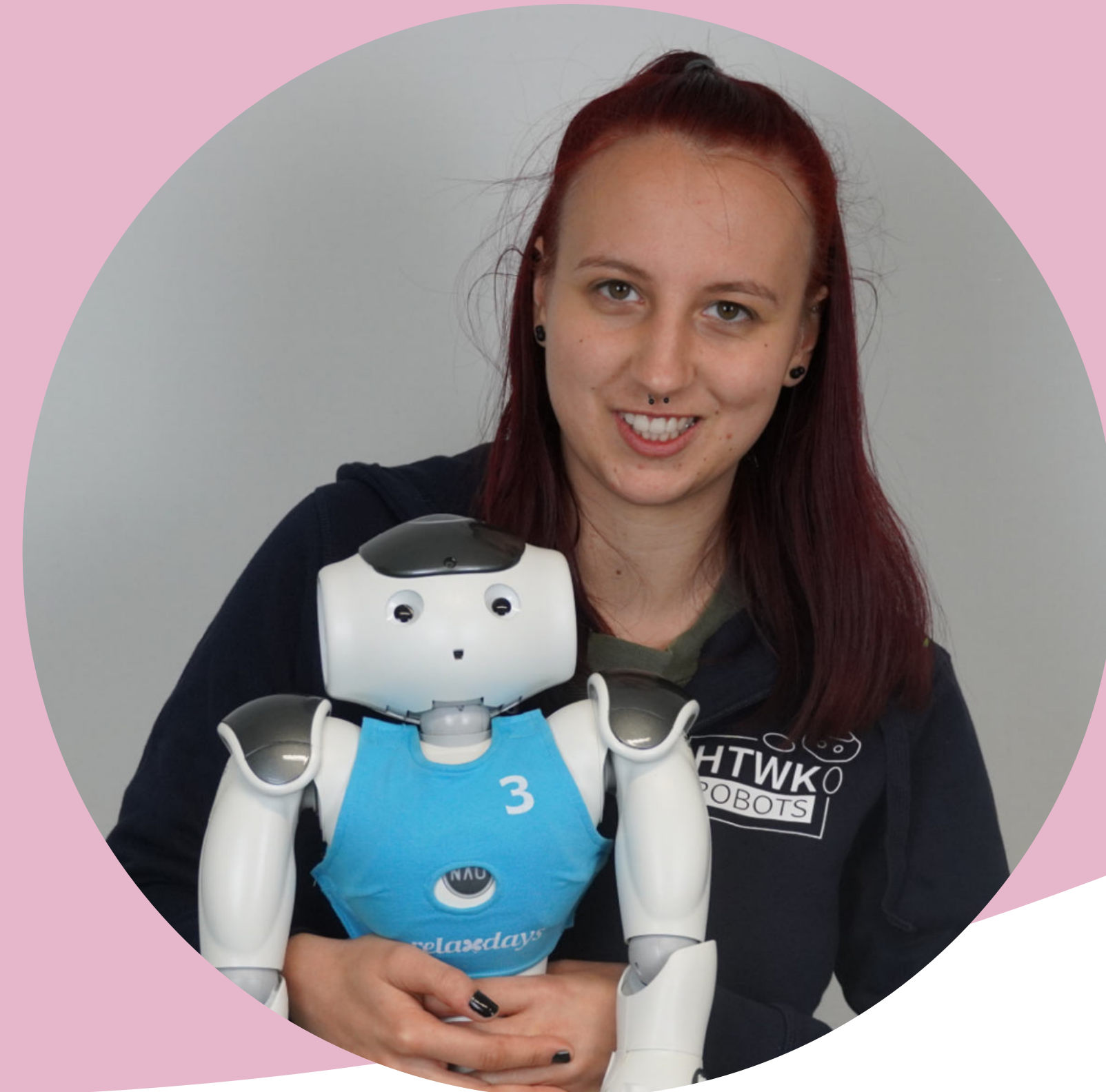
ROBOTS



HTWK Robots

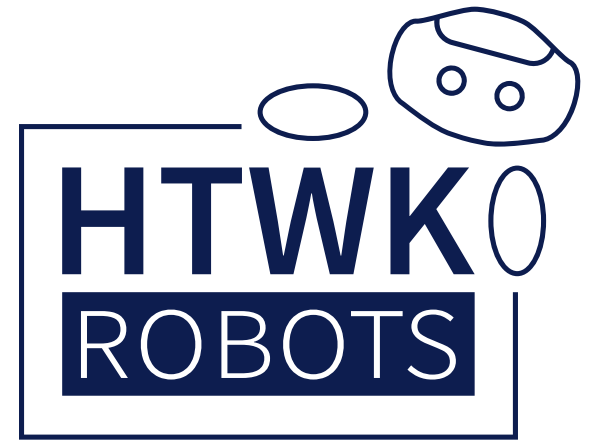


Felix, B.Sc. Informatik



Lea, M.Sc. Informatik

Oktober & November
Alles neu!



HTWK ROBOTS  [htwk.robots](https://www.instagram.com/htwk.robots)

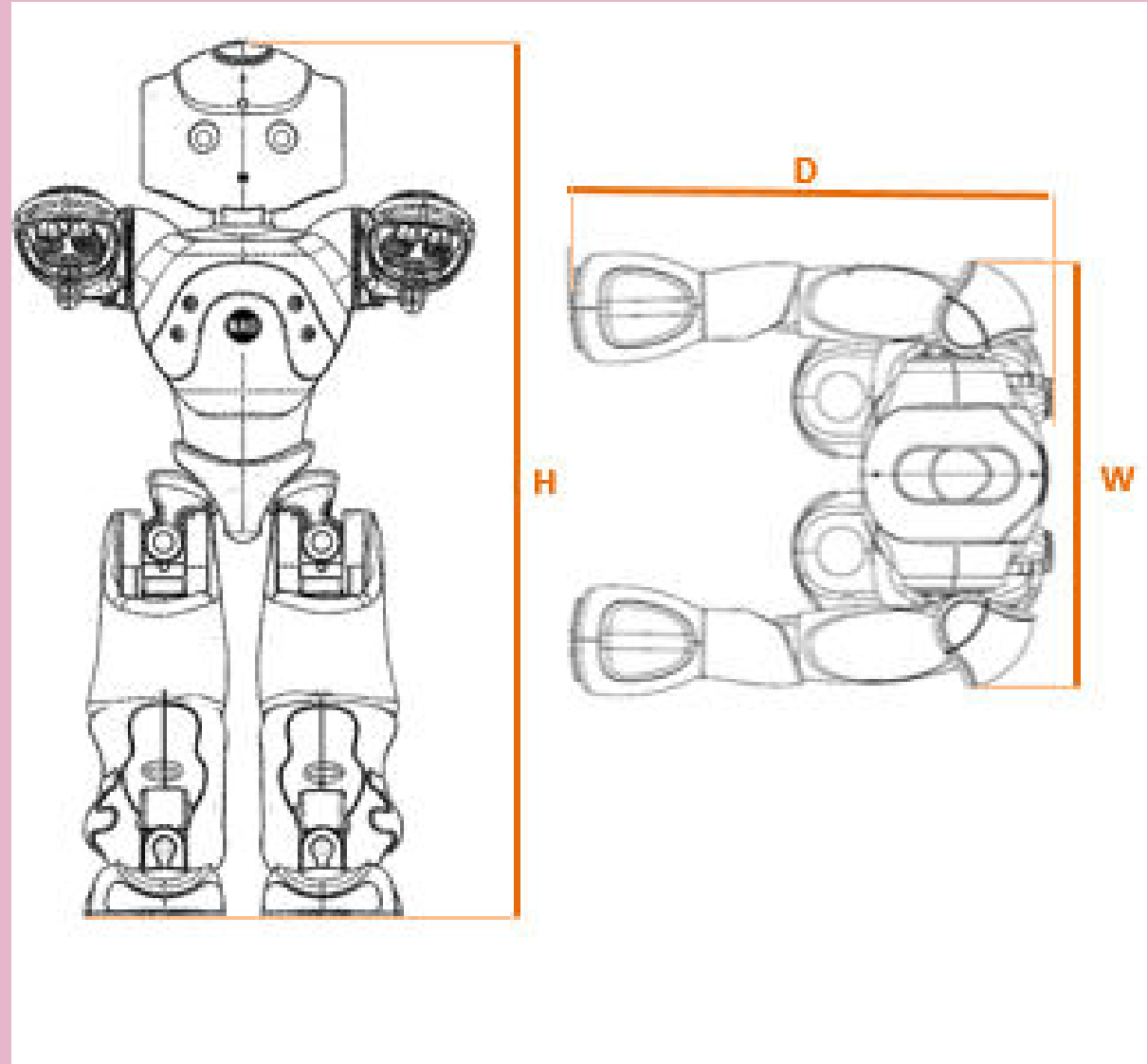
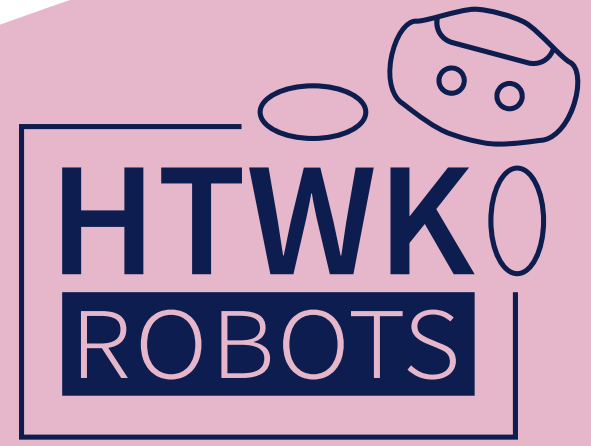
HACKATHON

11-12. November 2023



Dezember

Zeit für Experimente



Januar

Neue Herausforderungen

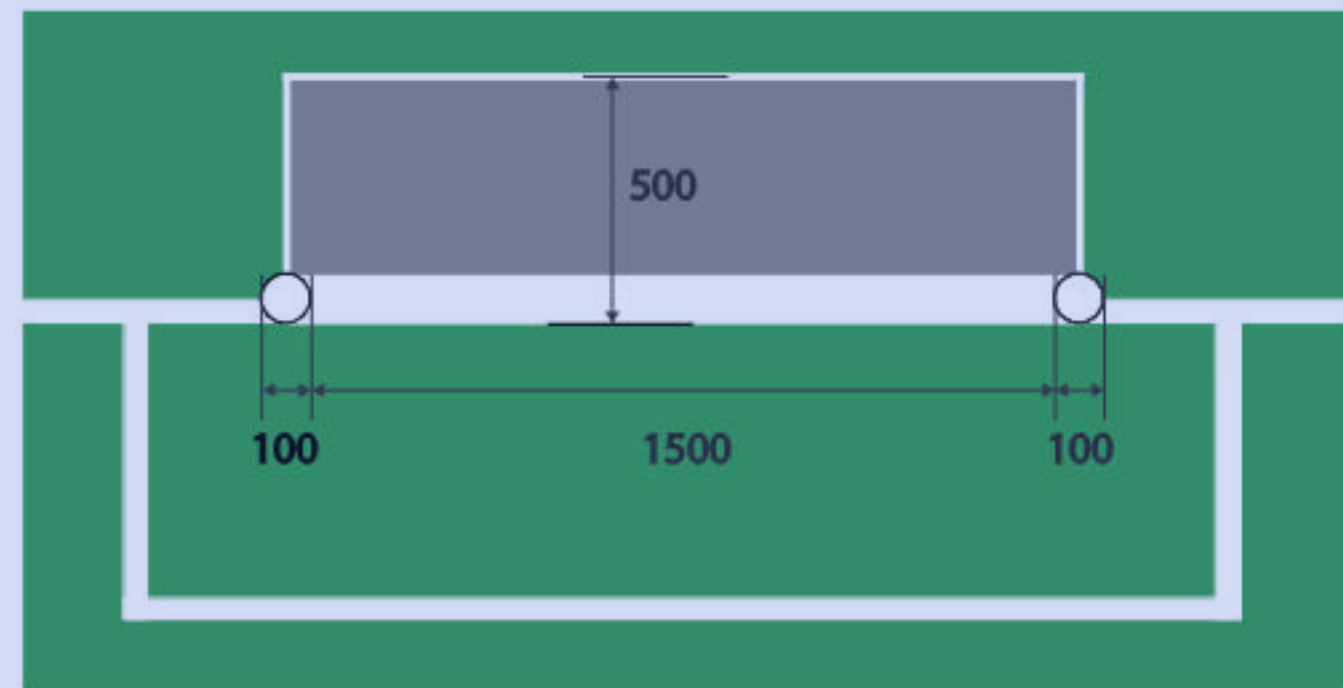
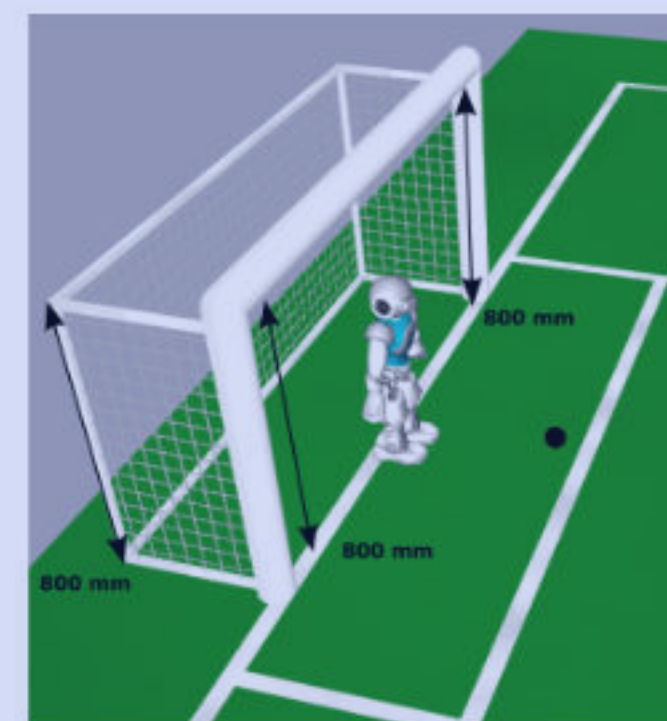


Figure 2: Dimensions of the goal (in mm), viewed from above, and its placement on the field.



The goalposts and crossbar are made from 3 white cylinders with a diameter of 100 mm. The net:

- has a height of 800 mm
- is of white, gray or black color
- is tightly supported via the support structure, in a way to minimize interference with the goalkeeper
- has a weave with holes smaller than the ball diameter.

Figure 3: Appearance and dimensions of the goals.

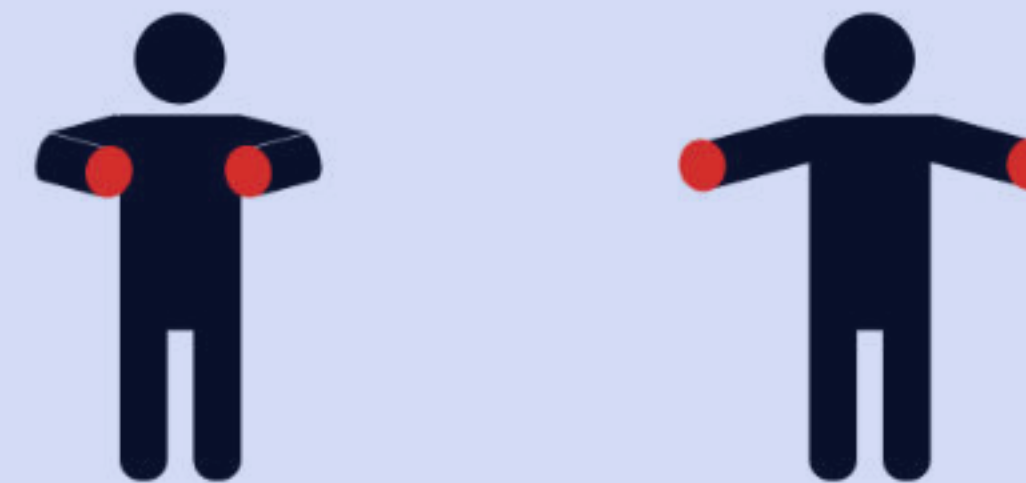
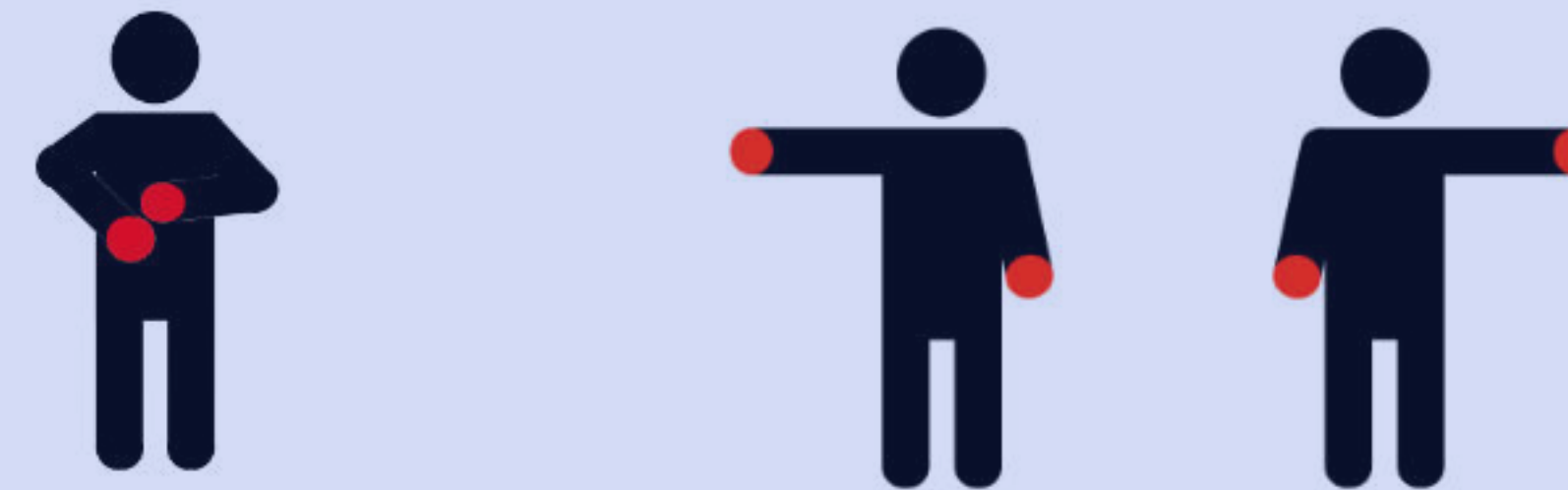


Figure 6: **Full-Time.** Dynamic two-handed signal. Both arms slowly move symmetrically inward and outwards on a horizontal plane, bending at the elbows.



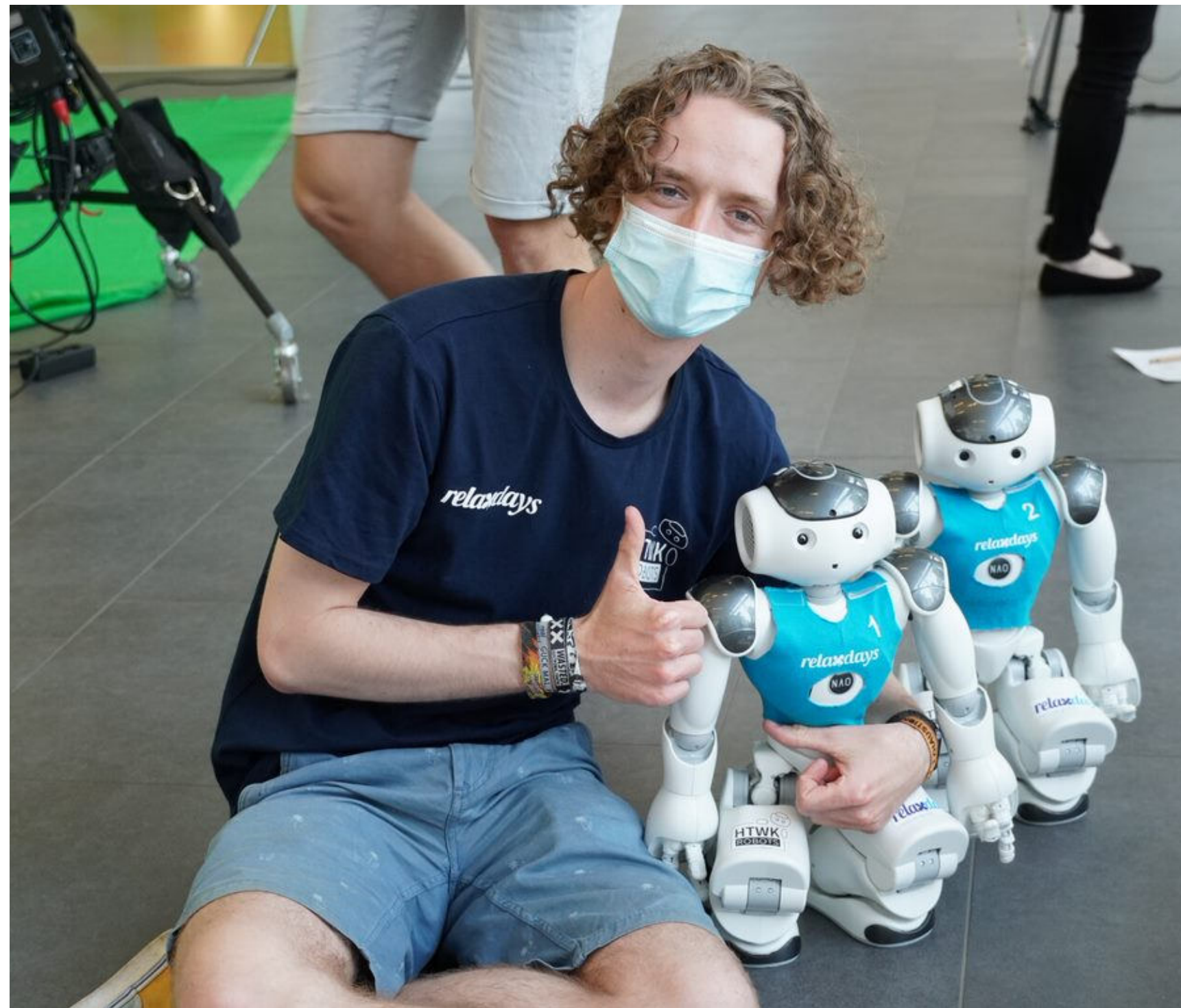
(a) Rotation around virtual axis to indicate substitution.

(b) Kick-in signal to indicate the team which is substituting a player. Two possible directions.

Figure 7: **Substitution.** Dynamic two-handed signal. Both arms slowly rotate symmetrically around a virtual horizontal axis parallel to the touchline. After three rotations the referee indicates the team which is substituting a player with the kick-in signal.

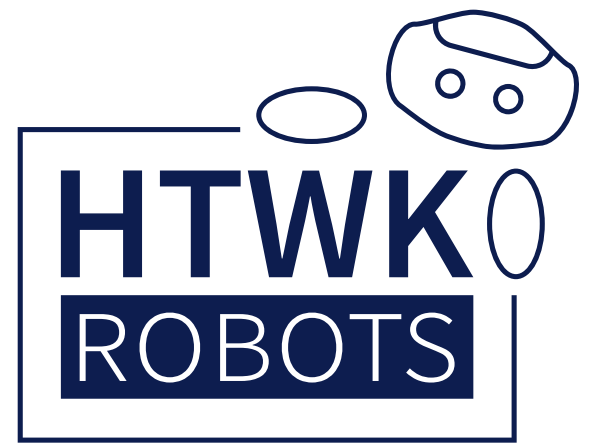
Februar

Große Ideen



März

Die großen Fragen



L'UNIVERSITÉ DE BORDEAUX PRÉSENTE



RoboCup23

BORDEAUX, NOUVELLE-AQUITAINE, FRANCE

SYMPOSIUM

JULY 10, 2023 **BORDEAUX**

2023.ROBOCUP.ORG

A graphic illustration of a robot head, a soccer ball, and gears, symbolizing the intersection of robotics and sports.

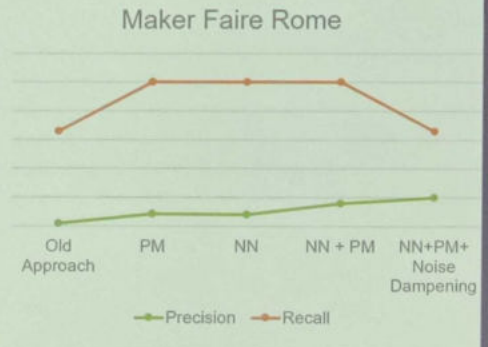
Evaluation

Comparison of the different parts:

1. Old Approach
2. Physical Model (PM)
3. Neuronal Network (NN)
4. NN + PM
5. NN + PM + Noise Dampening

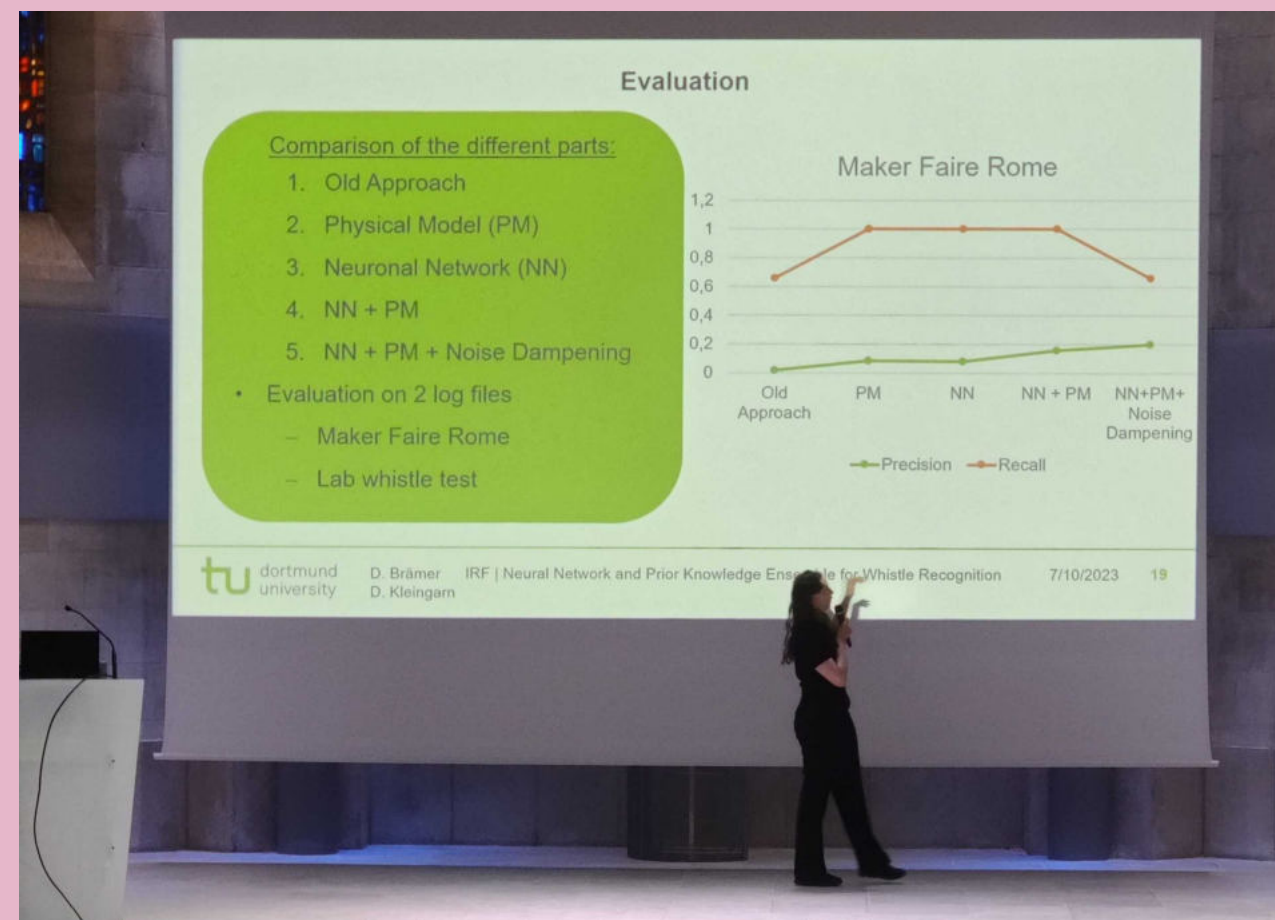
• Evaluation on 2 log files

- Maker Faire Rome
- Lab whistle test



Approach	Precision	Recall
Old Approach	0.0	0.6
PM	0.1	1.0
NN	0.1	1.0
NN + PM	0.1	1.0
NN+PM+ Noise Dampening	0.2	0.7





tu dortmund university D. Brämer | IRF | Neural Network and Prior Knowledge Ensemble for Whistle Recognition 7/10/2023 19

A photograph of a person standing at a podium, presenting a slide on a screen.

Amy Eguchi
Nuno Lau
Maike Paetzel-Prüsmann
Thanapat Wanichanon (Eds.)

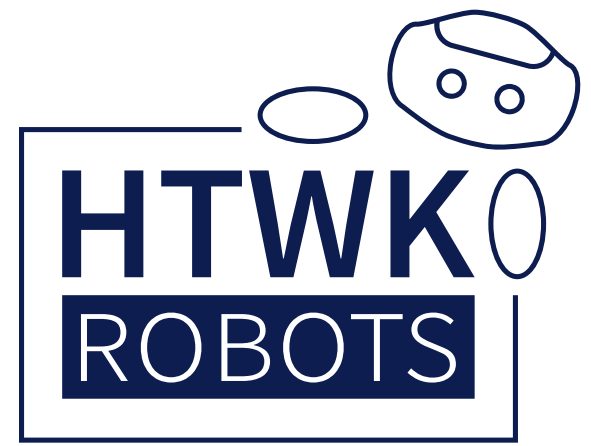
LNAI 13561

RoboCup 2022:
Robot World Cup XXV

A photograph of a small, white, two-wheeled robot with a screen on top, likely a RoboCup robot.

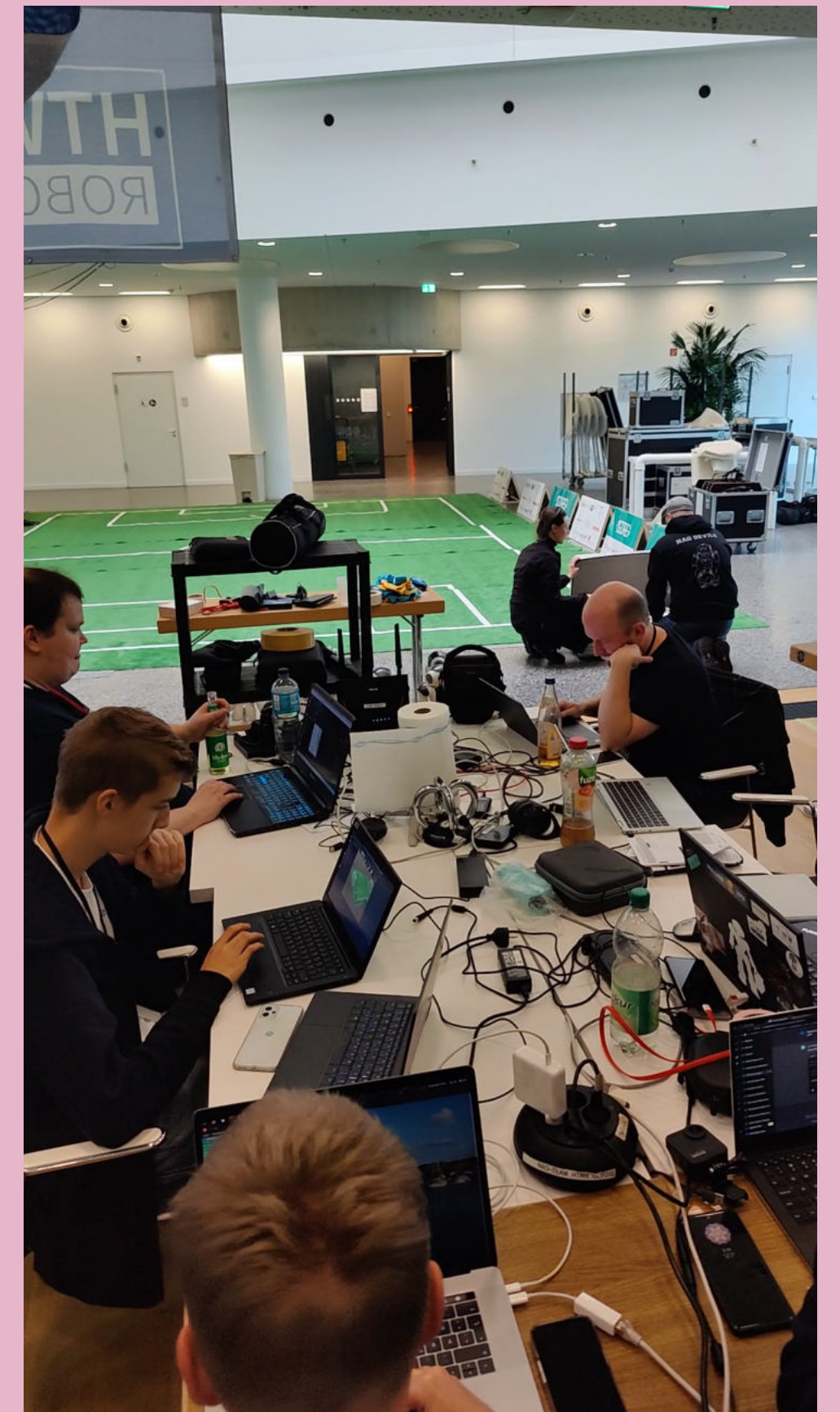
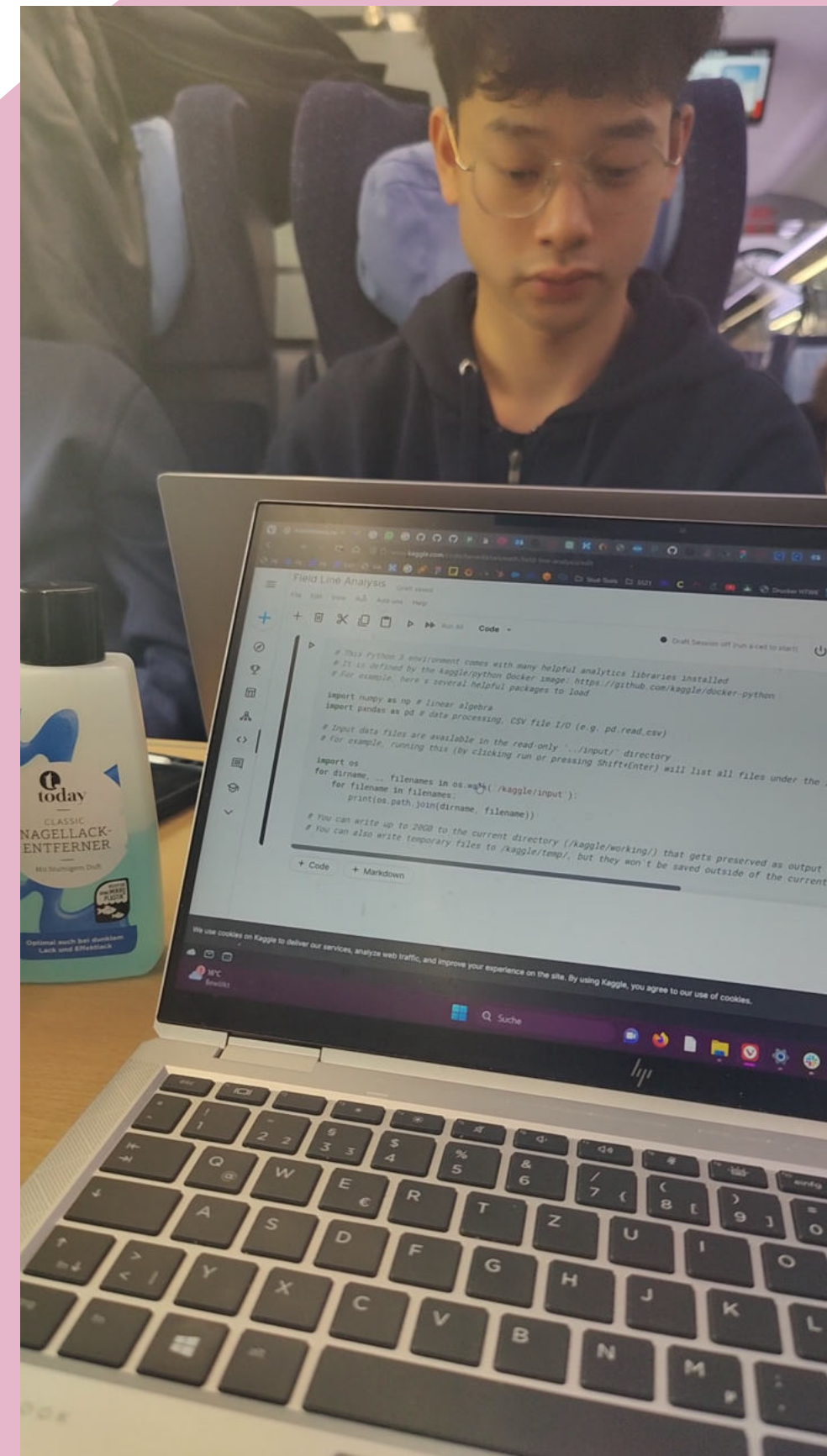
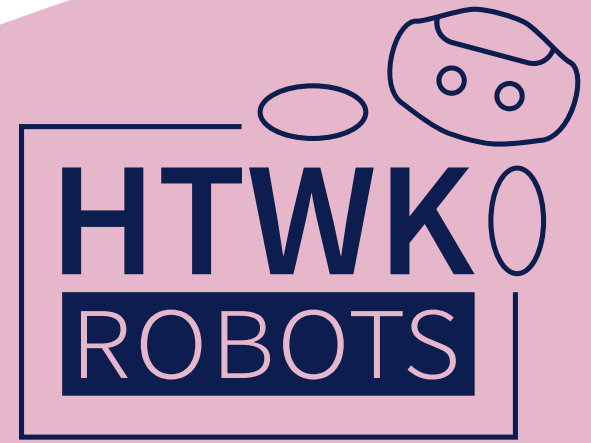
April

Probe auf's Exempel



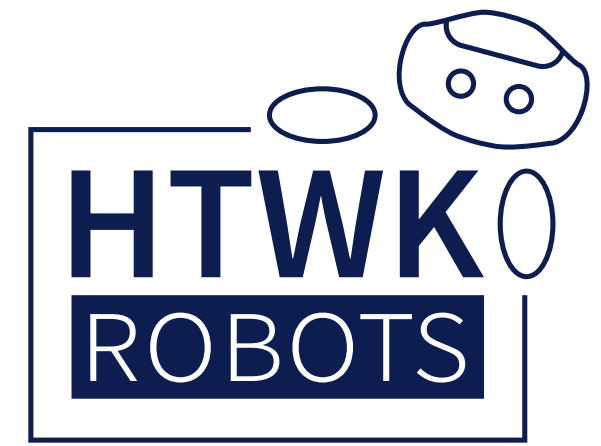
Mai & Juni

Crunchtime



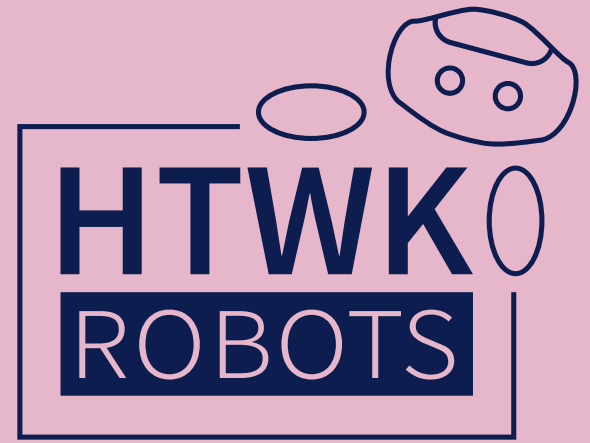
Juli

Mit- & Gegeneinander



August

Code Release



HTWK Robots
NaoHTWK

Popular repositories

- HTWKVision** (Public) C++ 9 stars 3 forks
- HTWKMotion** (Public) C++ 5 stars 1 fork
- WhistleDetection** (Public) C++
- HTWKStrategy** (Public) C++ 7 stars
- LolaConnect** (Public) C++

Follow

Hochschule für Technik, Wirtschaft und Kultur Leipzig, Leipzig University of Applied Sciences

HTWK ROBOTS

Whistle Detection Using Overtones

Due to past rule changes and the need to detect more whistle signals including more kinds of signals during game play, we decided to revise our approach towards the task at hand. One key challenge was filtering out false positives from interference by games played simultaneously.

We solved this problem by restructuring the whistle detection using different kinds of frequency bands: the fundamental frequency of the whistle, as well as higher frequency bands for overtone detection. All frequencies were constantly monitored during game play up to 22kHz using STFT (short time Fourier transformation) although the data have shown that frequencies >19.500kHz are hardly ever detected.

Figure 1: sample wave form with cumulative amplitudes and spectrogram with formants

Any acoustic signal is uniquely distinguished by its overtone profile which can in turn be used to identify the kind of source it originated from. A characteristic overtone profile is a function over the strictly ordered set of natural overtones (overtone series). Since overtones are rapidly decaying over time and space and are only locally stable, interference from false positive whistle signals is minimized – the overtones are largely undetectable one field over. A further defense against interference arises from the compositional nature of overtones: overtones are bound to the overtone series - the frequency of overtone n is $1/n$ of the frequency of the fundamental frequency. Naturally, overtones attenuate exponentially faster the further along in the series they are, however, the characteristic overtone profile is defined by its deviation from the expected decay in amplitude. This new implementation is not only more resistant to interfering signals but also ignores the low frequency sounds made by robots in motion.

Vision Optimization

Our previous line detection implementation struggled with dynamic changes in lighting during game play where adjustments could not be performed on the fly. We targeted the f score by means of on scan lines using black box optimization on Facebooks Ax platform. In particular, we focused on grid density and aggregation thresholds for extrapolation.

Figure 2: precision improvement throughout optimization

Figure 3: recall improvement throughout optimization

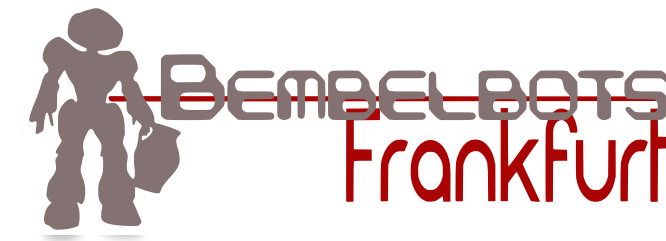
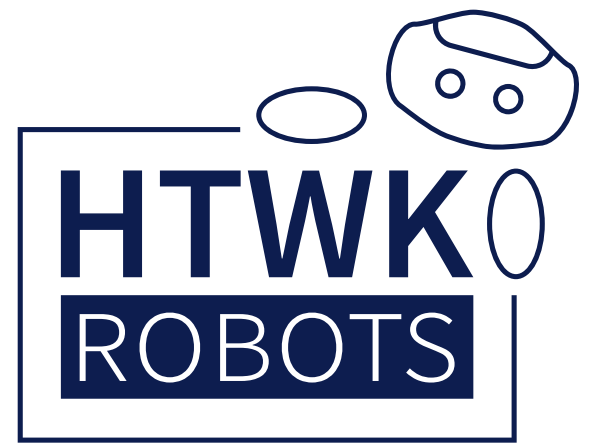
Figure 4: side-by-side comparison of old line detection implementation and optimized version

Prefiltering non-field data, we identified loci of color transitions from turf-green to line-white and optimized accordingly. Based on this, aggregation thresholds for accepted field lines were tuned to account for the modified function space resulting from the previous optimization. See figures 2 and 3 for an overview of optimization performance.

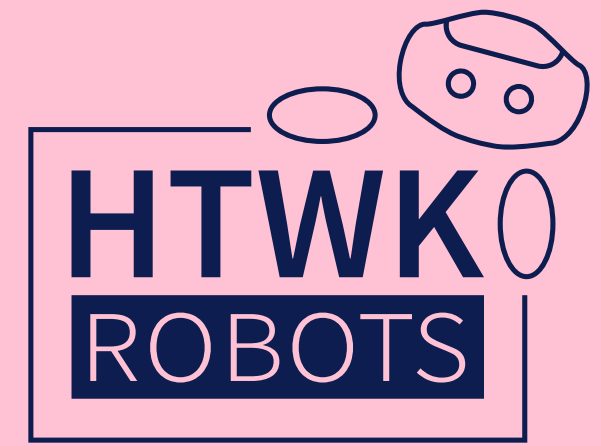
HTWK Robots 2023, htwk-robots.de

September

Mehr als ein Hobby



Vielen Dank!



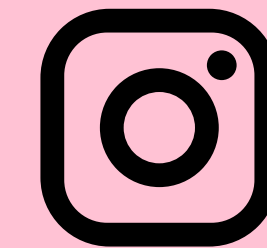
HTWK Robots Hackathon

11.11. - 12.-11.

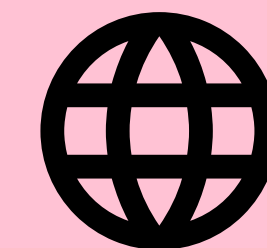
Coden, Quatschen, Chillen und Mate

HTWK
Nieper
Bau

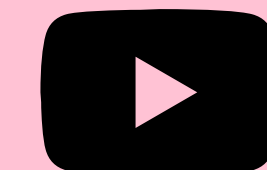
Weblinks:



[@htwk.robots](https://www.instagram.com/htwk.robots)



htwk-robots.de
blog.htwk-robots.de



[HTWK Robots](https://www.youtube.com/htwk-robots)