Universität Hamburg
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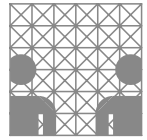
Department of Informatics



Clothes and Fabric Classification

Progress Report

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University of Hamburg
Faculty of Mathematics, Informatics and Natural Sciences
Department of Informatics

Technical Aspects of Multimodal Systems

January 18, 2022

Outline

Recent Work

Current Work

- Clothes Classification
- Fabric Classification

Future Plans

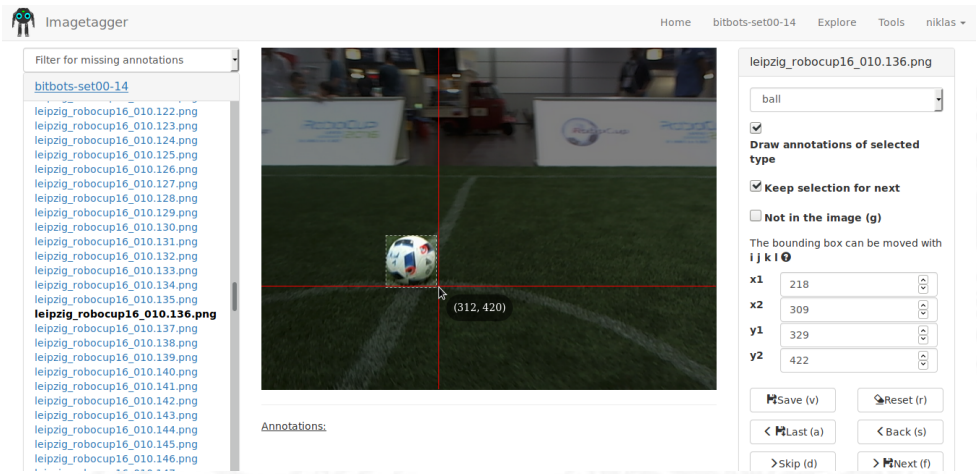
Recent Work

Current Work

Future Plans

Publications with Hamburg Bit-Bots

- Imagetagger: An Open Source Online Platform for Collaborative Image Labeling
- Position Estimation on Image-Based Heat Map Input using Particle Filters in Cartesian Space
- An Open Source Vision Pipeline Approach for RoboCup Humanoid Soccer
- TORSO-21 Dataset: Typical Objects in RoboCup Soccer 2021



Fiedler, N., Bestmann, M., & Hendrich, N. (2018). Imagetagger: An open source online platform for collaborative image labeling. In Robot World Cup (pp. 162-169). Springer.

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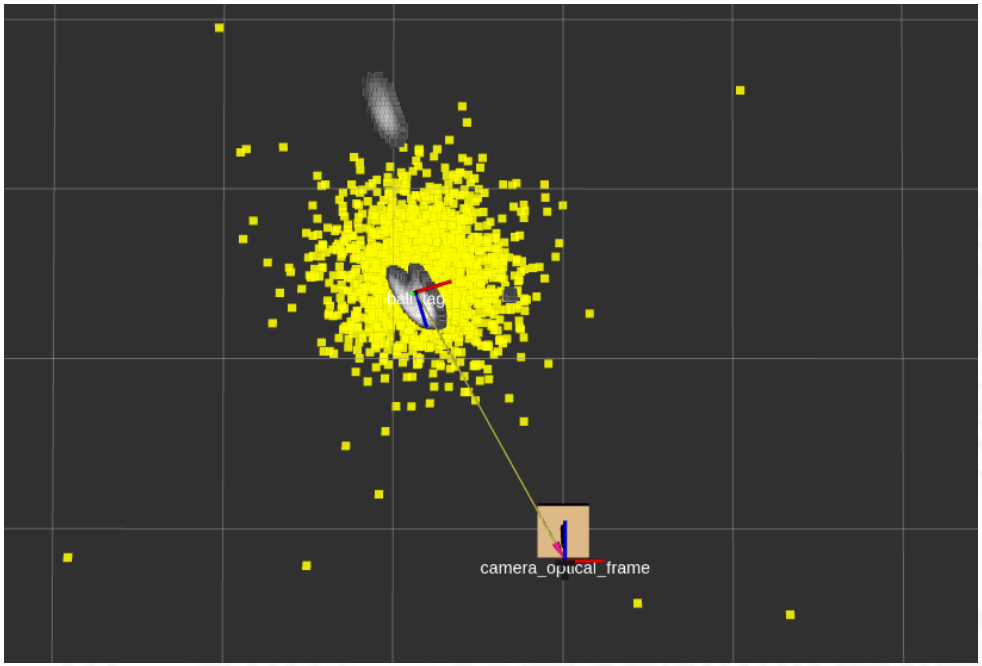

Fiedler, N., Bestmann, M., & Zhang, J. (2019). Position estimation on image-based heat map input using particle filters in cartesian space. In International Conference on Industrial Cyber Physical Systems (ICPS) (pp. 269-274). IEEE.

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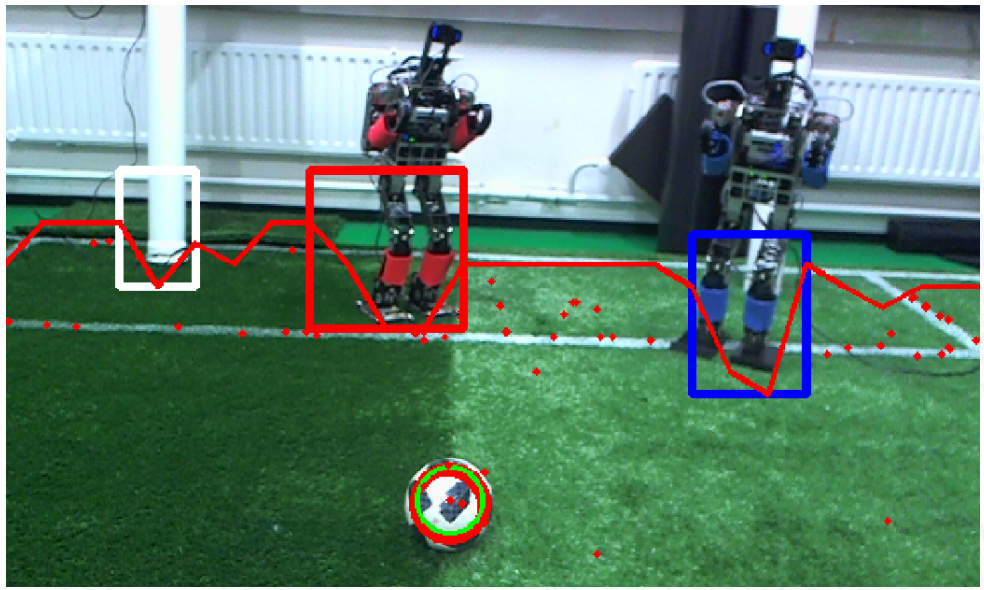

Fiedler, N., Brandt, H., Gutsche, J., Vahl, F., Hagge, J., & Bestmann, M. (2019). An open source vision pipeline approach for robocup humanoid soccer. In Robot World Cup (pp. 376-386). Springer

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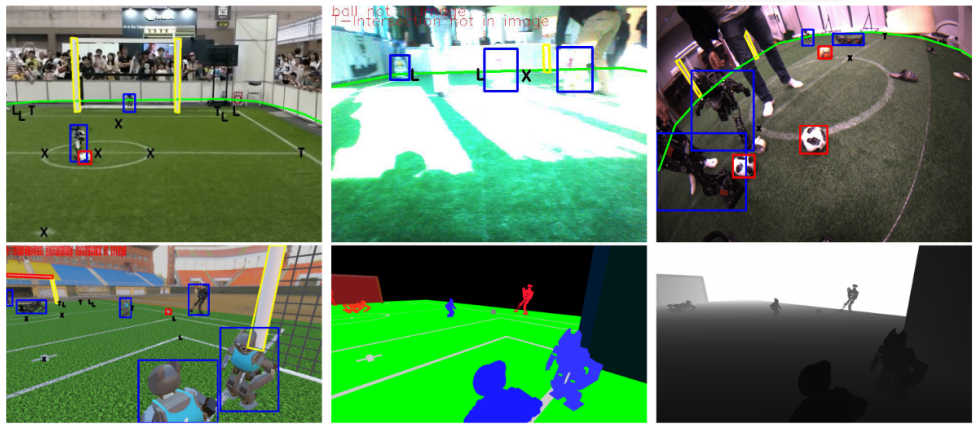
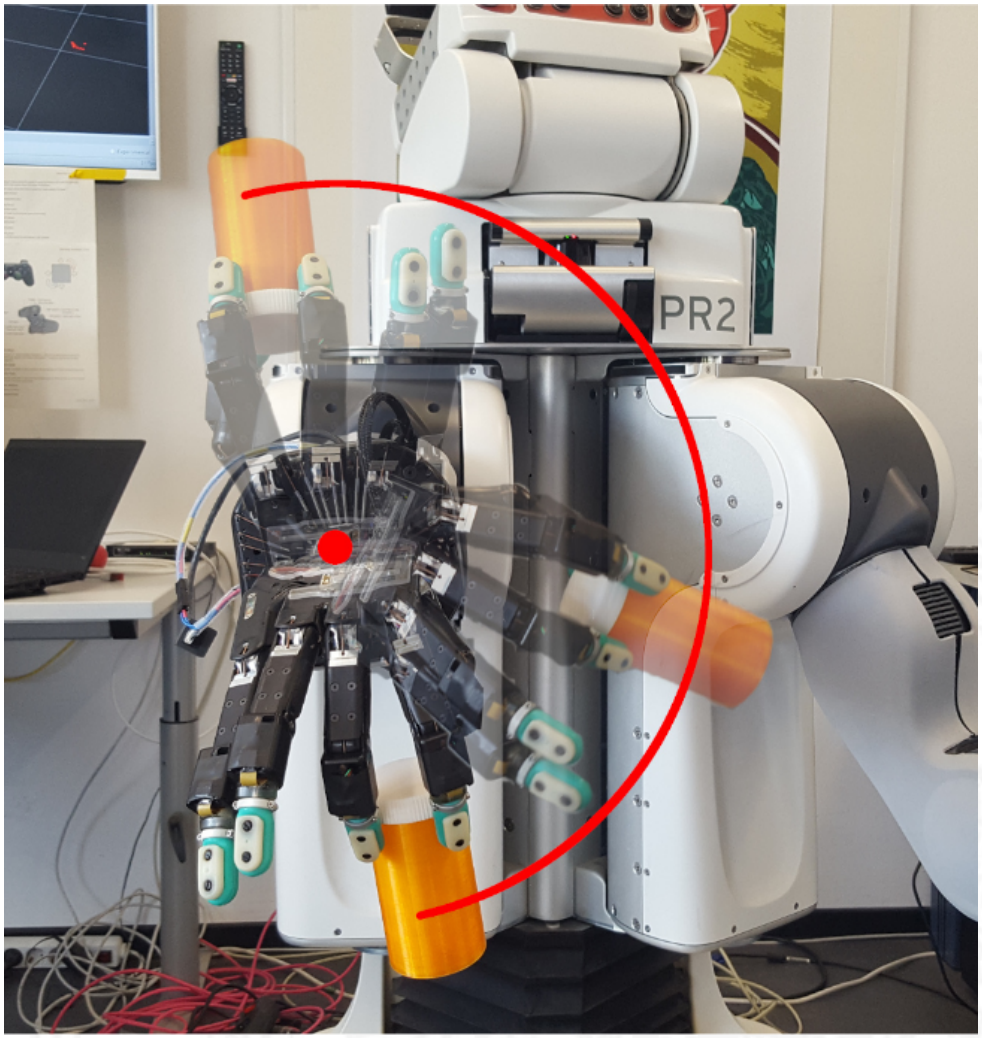


Bestmann, M., Engelke, T., Fiedler, N., Güldenstein, J., Gutsche, J., Hagge, J. & Vahl, F. (2021). TORSO-21 Dataset: Typical Objects in RoboCup Soccer 2021. RoboCup 2021 (pp. 339-346). Springer.

Publications with TAMS

- Multimodal Object Analysis with Auditory and Tactile Sensing Using Recurrent Neural Networks
- A Low-Cost Modular System of Customizable, Versatile, and Flexible Tactile Sensor Arrays



Jonetzko, Y., Fiedler, N., Eppe, M., & Zhang, J. (2020). Multimodal Object Analysis with Auditory and Tactile Sensing Using Recurrent Neural Networks. In International Conference on Cognitive Systems and Signal Processing (pp. 253-265). Springer.

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Fiedler, N., Ruppel, P., Jonetzko, Y., Hendrich, N., & Zhang, J. (2021) A Low-Cost Modular System of Customizable, Versatile, and Flexible Tactile Sensor Arrays. In International Conference on Intelligent Robots and Systems (IROS) (pp. 1771-1777). IEEE.

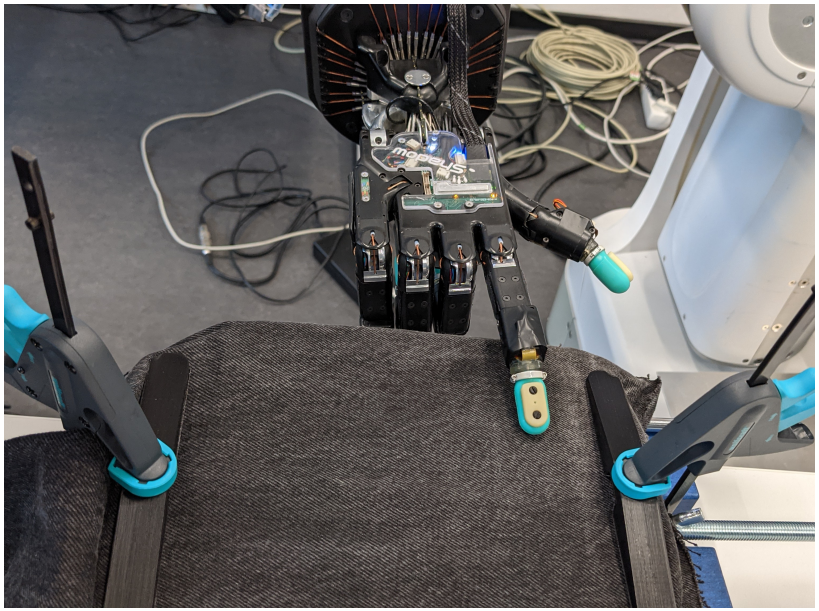
Recent Work

Current Work

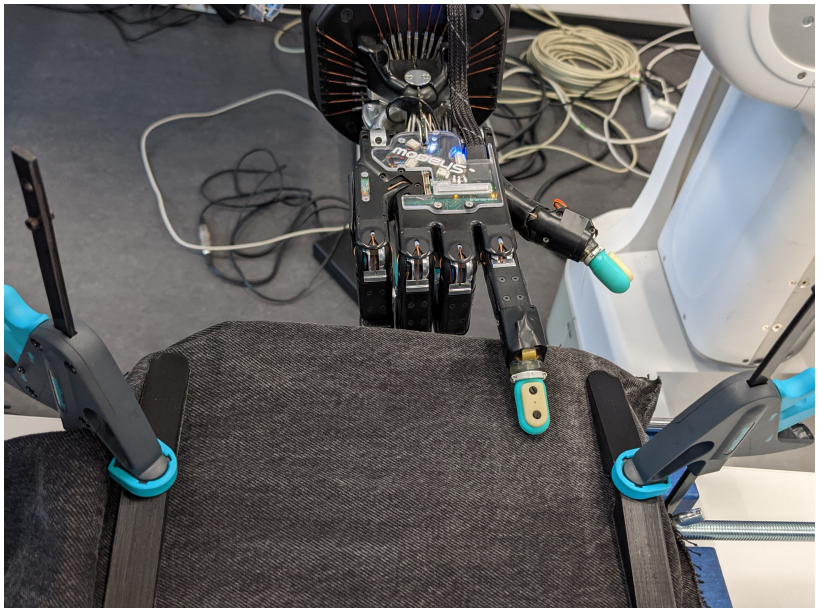
- Clothes Classification
- Fabric Classification

Future Plans

Fabric vs. Clothes Classification



Fabric vs. Clothes Classification



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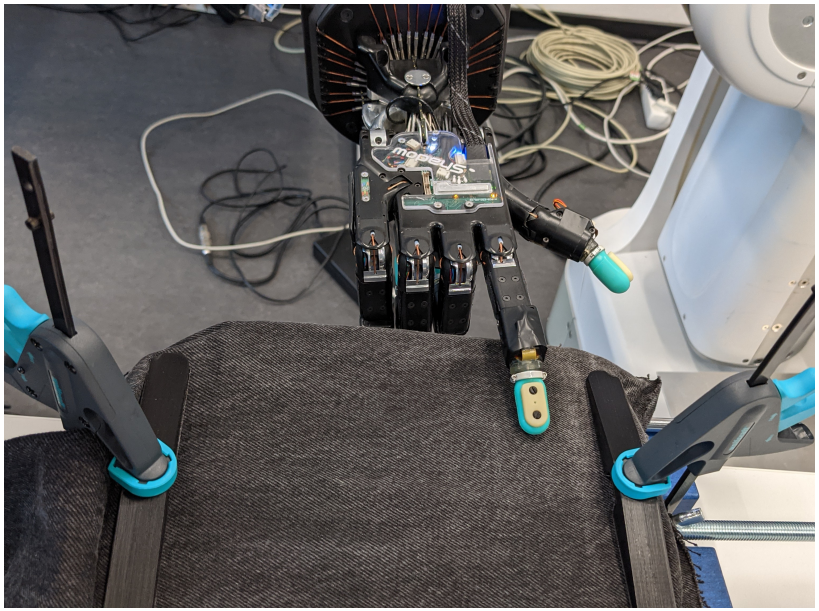
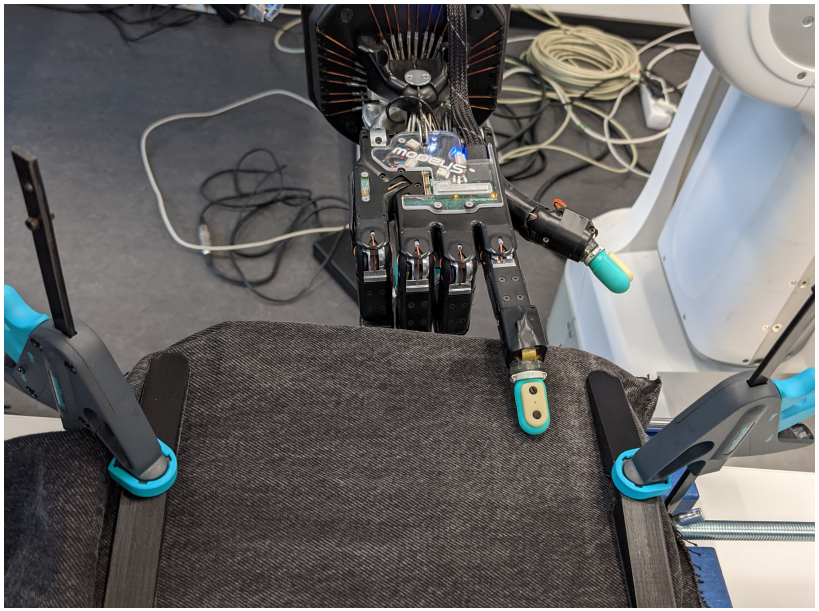


Image sources: https://www.otto.de

Fabric vs. Clothes Classification



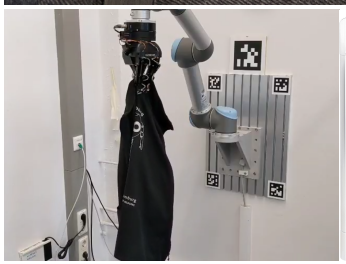
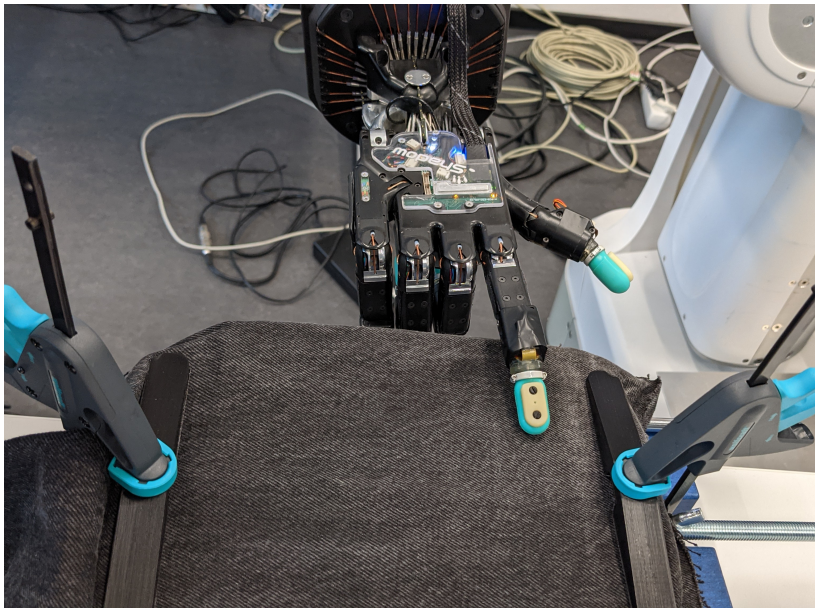


Image sources: https://www.otto.de, https://www.almostzerowaste.com

Fabric vs. Clothes Classification



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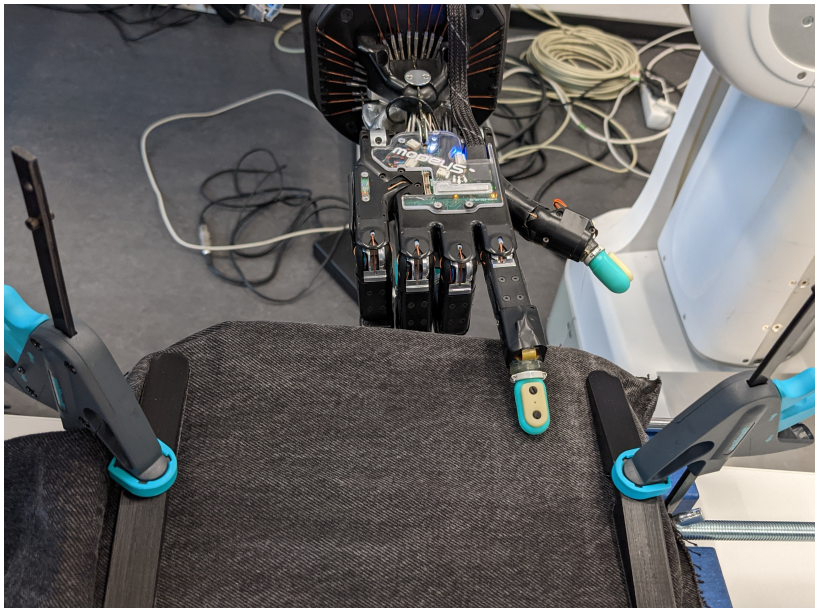




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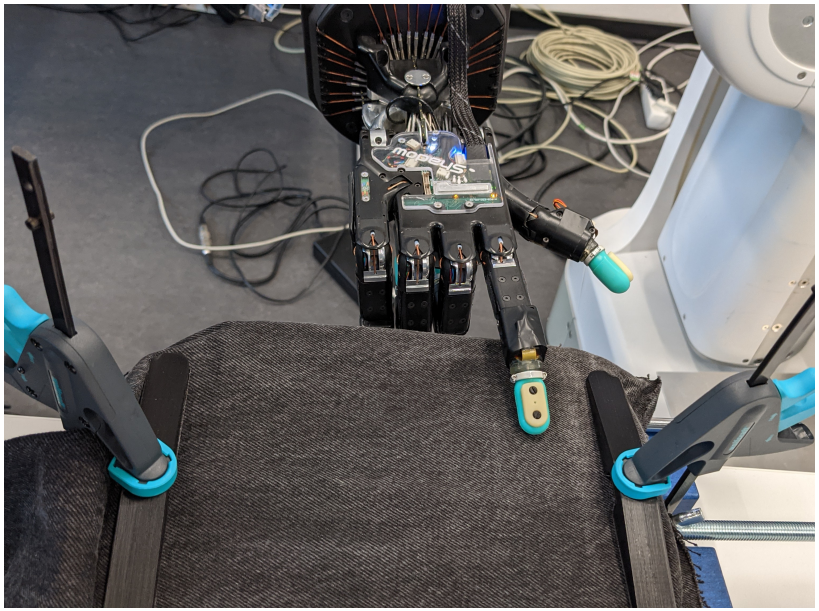
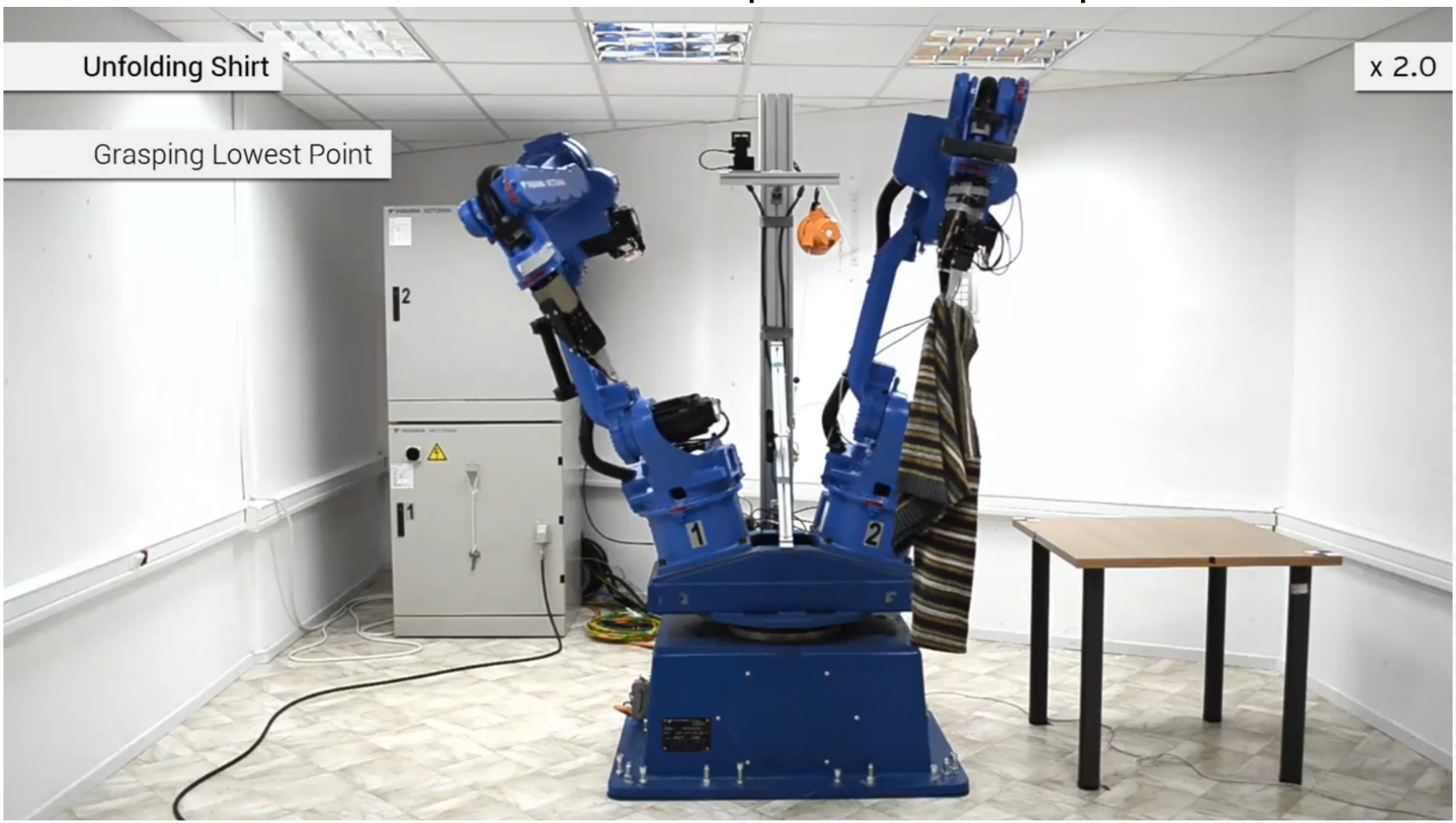






Image sources: https://www.otto.de, https://www.almostzerowaste.com, https://www.instyle.de

CloPeMa - Clothes Perception and Manipulation



http://clopemaweb.felk.cvut.cz/

https://www.youtube.com/watch?v=ToAV_5mgN2Q

Recent Work

Current Work

Clothes Classification

Fabric Classification

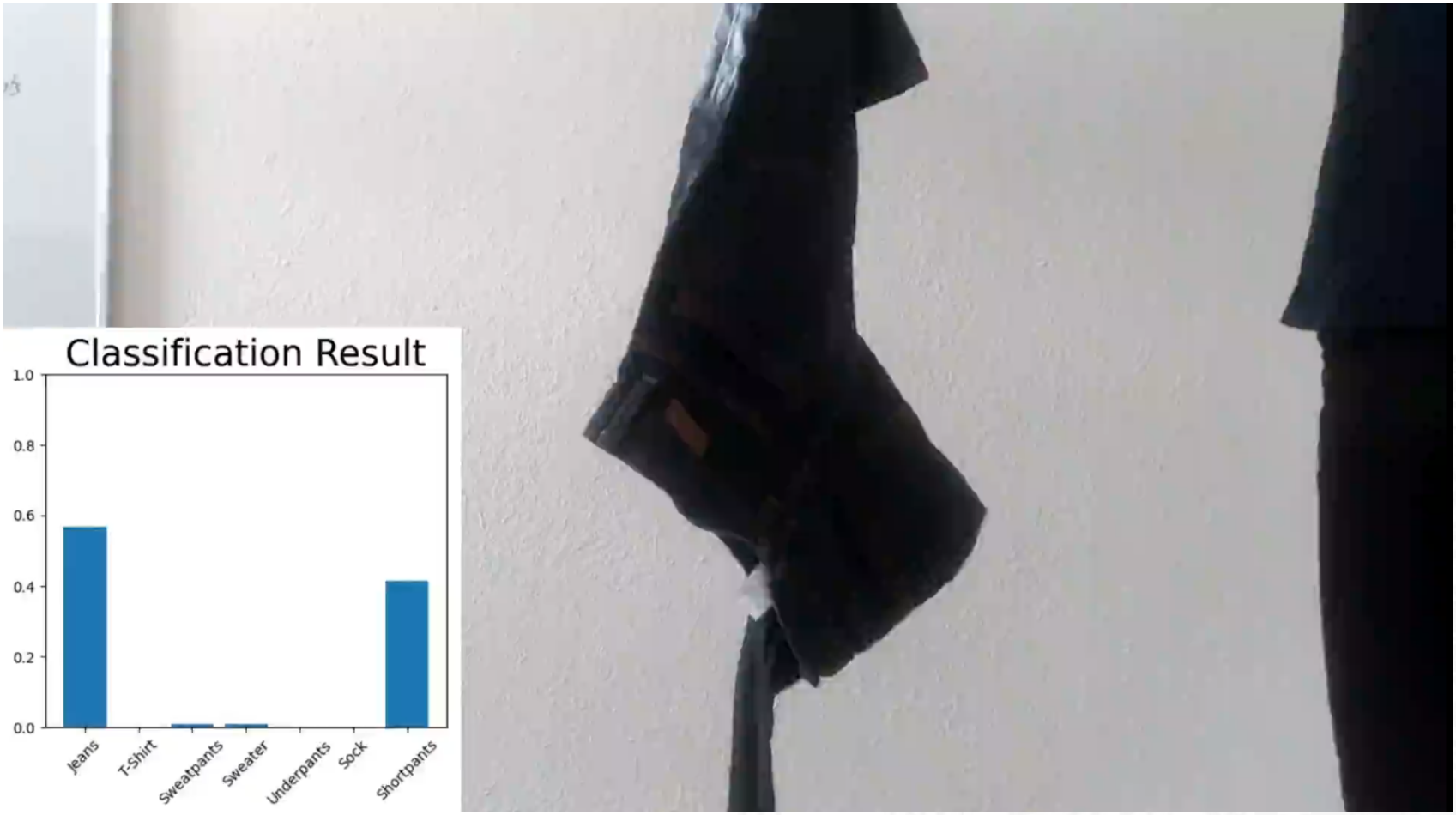
Future Plans

Deep Learning Based Classification of Clothes using Point Clouds

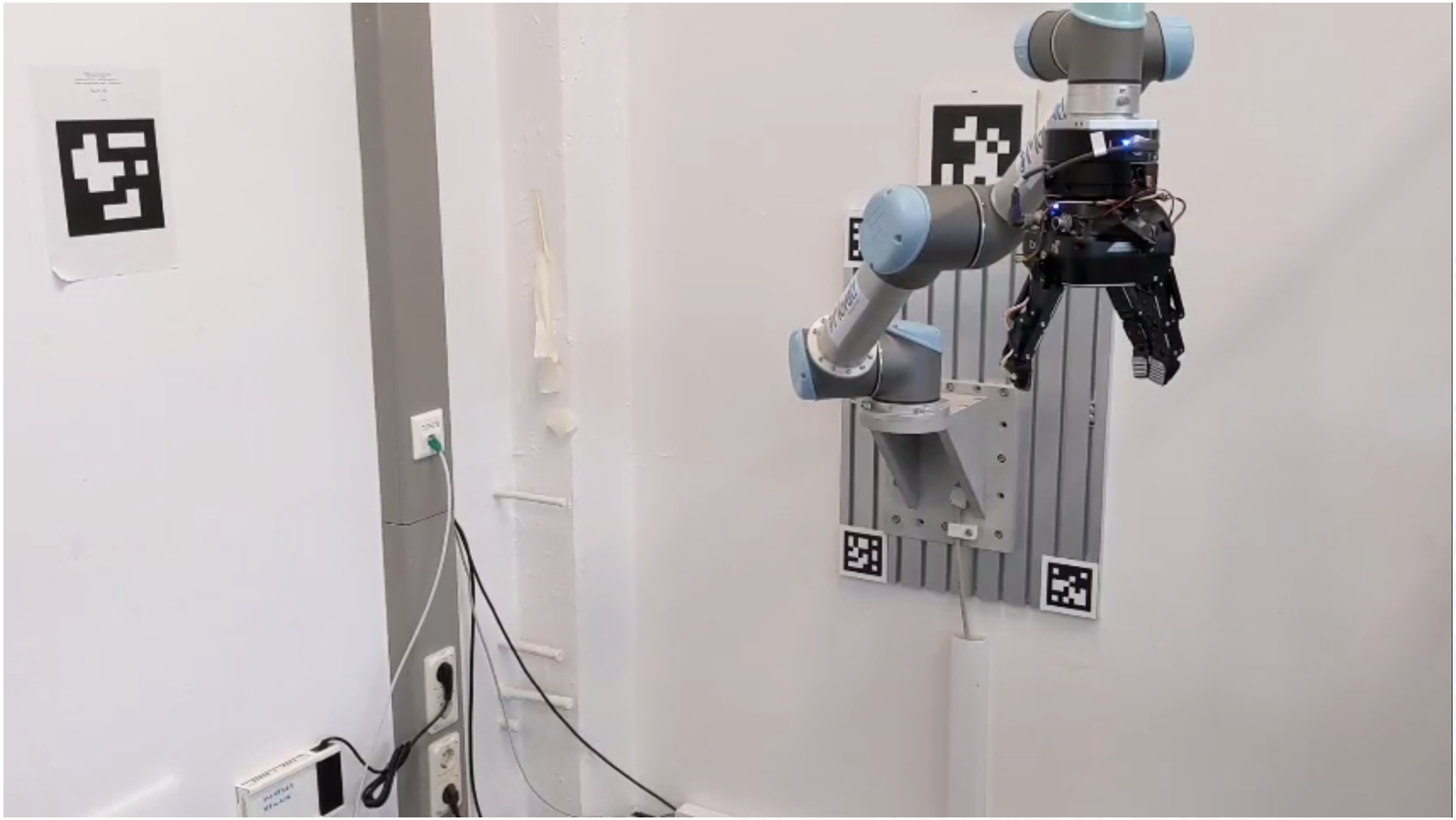
- 7 classes of clothes
- Point cloud input
- Non-rigid (highly flexible) objects
- PointNet as classification architecture
- Experiments analyzing strengths and weaknesses of PointNet

- PointNet is usable as a live-classifier for non-rigid objects such as clothes
- 74.4% classification accuracy
- An input of 1024 points works well
- The inclusion of point normals in the input data shows significant improvements in classification accuracy but lead to overfitting
- The neural network focuses on the silhouette of the point clouds
- Using a method which utilizes local features could yield significant improvements

Master Thesis - Results



Progress upon Thesis



- Automated data collection

Progress upon Thesis

- Automated data collection
- Chose samples and classes for new dataset
- New dataset recording in progress
- Training pipeline cleanup
- DGCNN integration (not optimized)

Future Work

- Further data collection
- Optimization of hyperparameters for both architectures
- Analysis of strengths of the architectures
- Perform similar experiments as in master thesis
  - With optimizations
  - Two architectures
  - More diverse dataset
- Comparison to image based approach

Recent Work

Current Work

Clothes Classification

Fabric Classification

Future Plans

Cooperation with KTH

Multimodal classification of fabrics using stretching and swiping

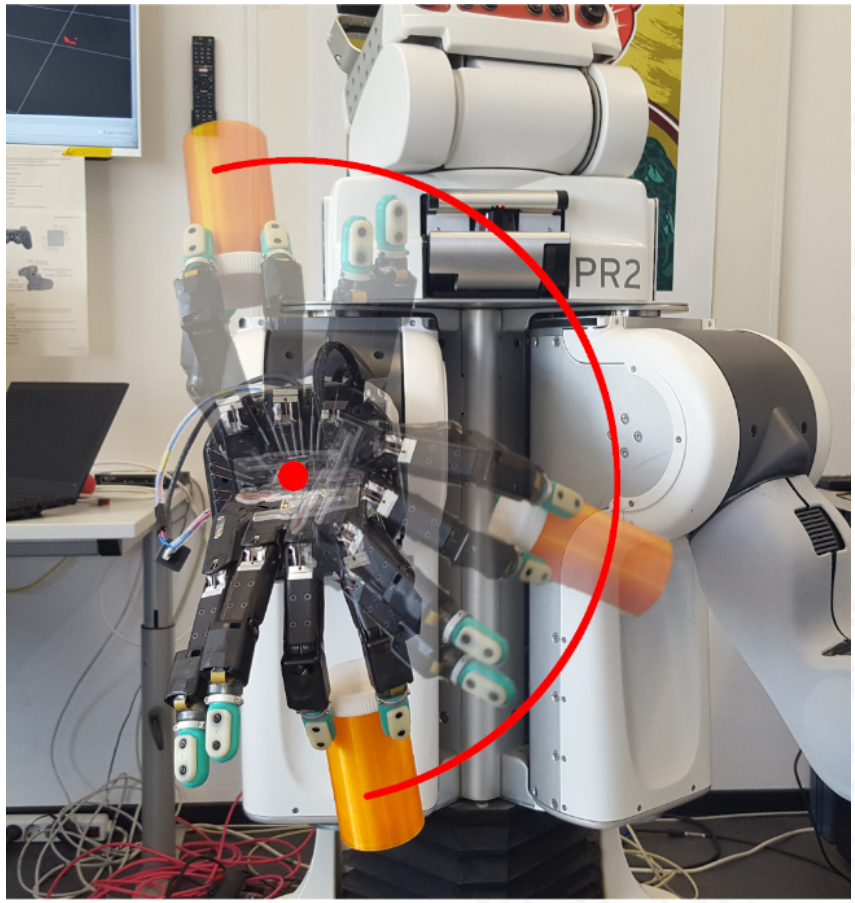
Force Data

Longhini, A., Welle, M. C., Mitsioni, I., & Kragic, D. (2021). Textile Taxonomy and Classification Using Pulling and Twisting. In International Conference on Intelligent Robots and Systems (IROS). IEEE.

Cooperation with KTH

Multimodal classification of fabrics using stretching and swiping

Tactile Data



Cooperation with KTH

Multimodal classification of fabrics using stretching and swiping

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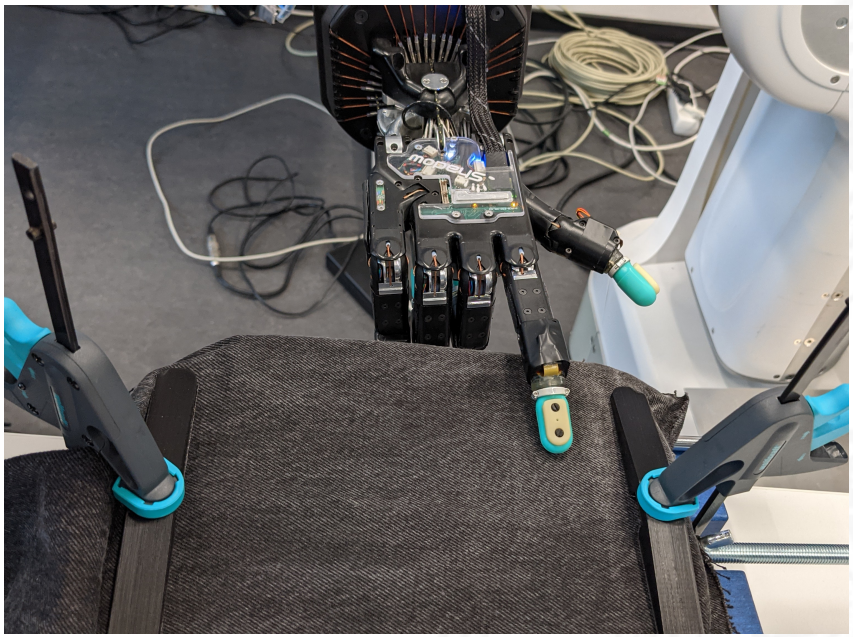

Cooperation with KTH

Multimodal classification of fabrics using stretching and swiping

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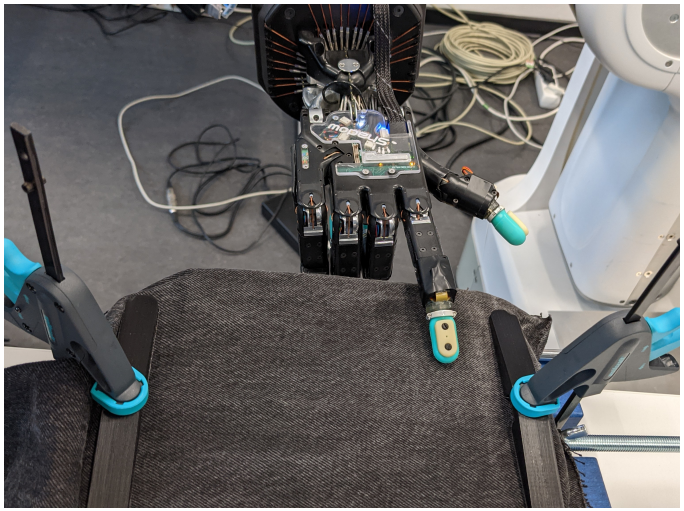

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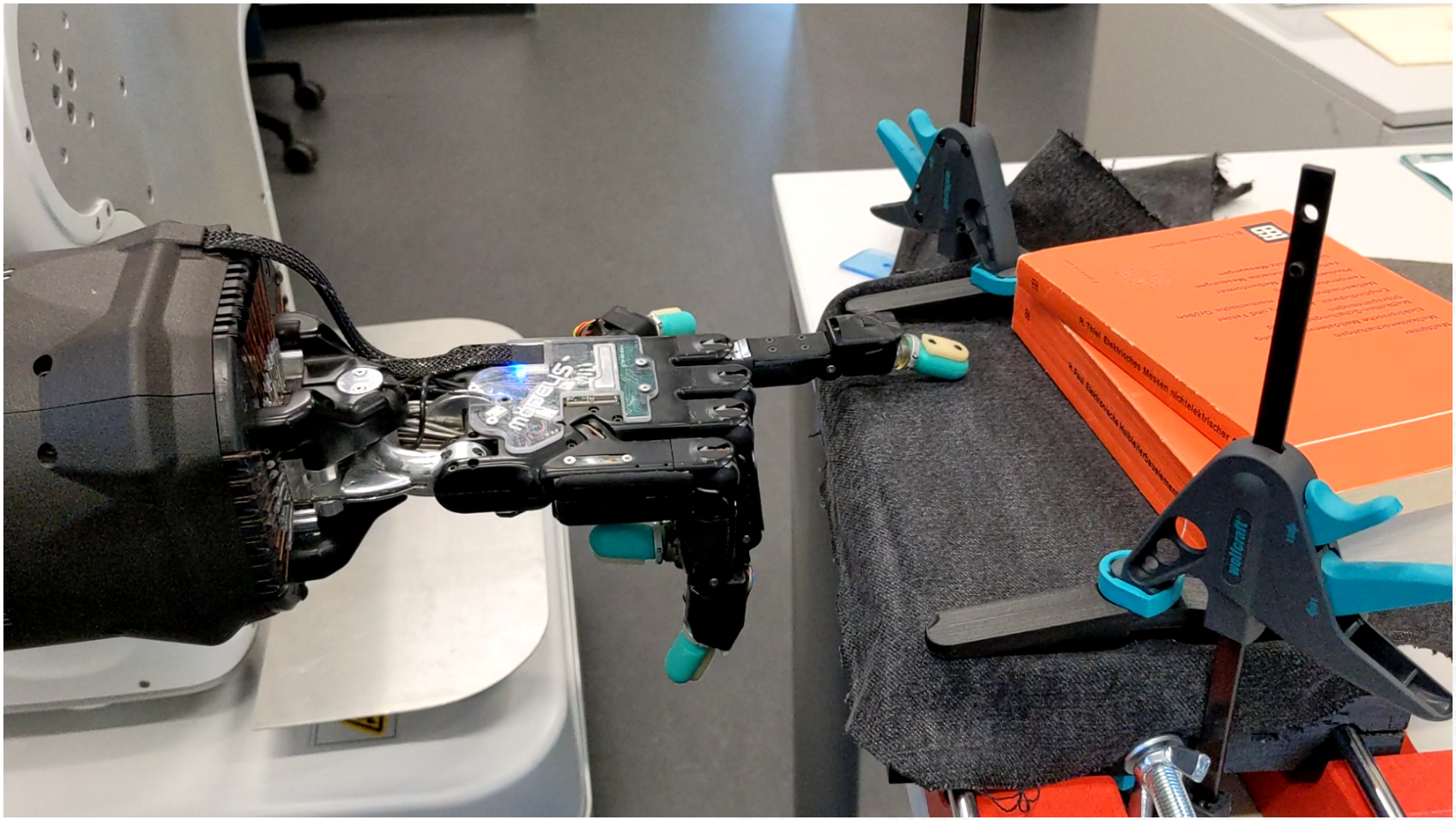
Force Data

Current State

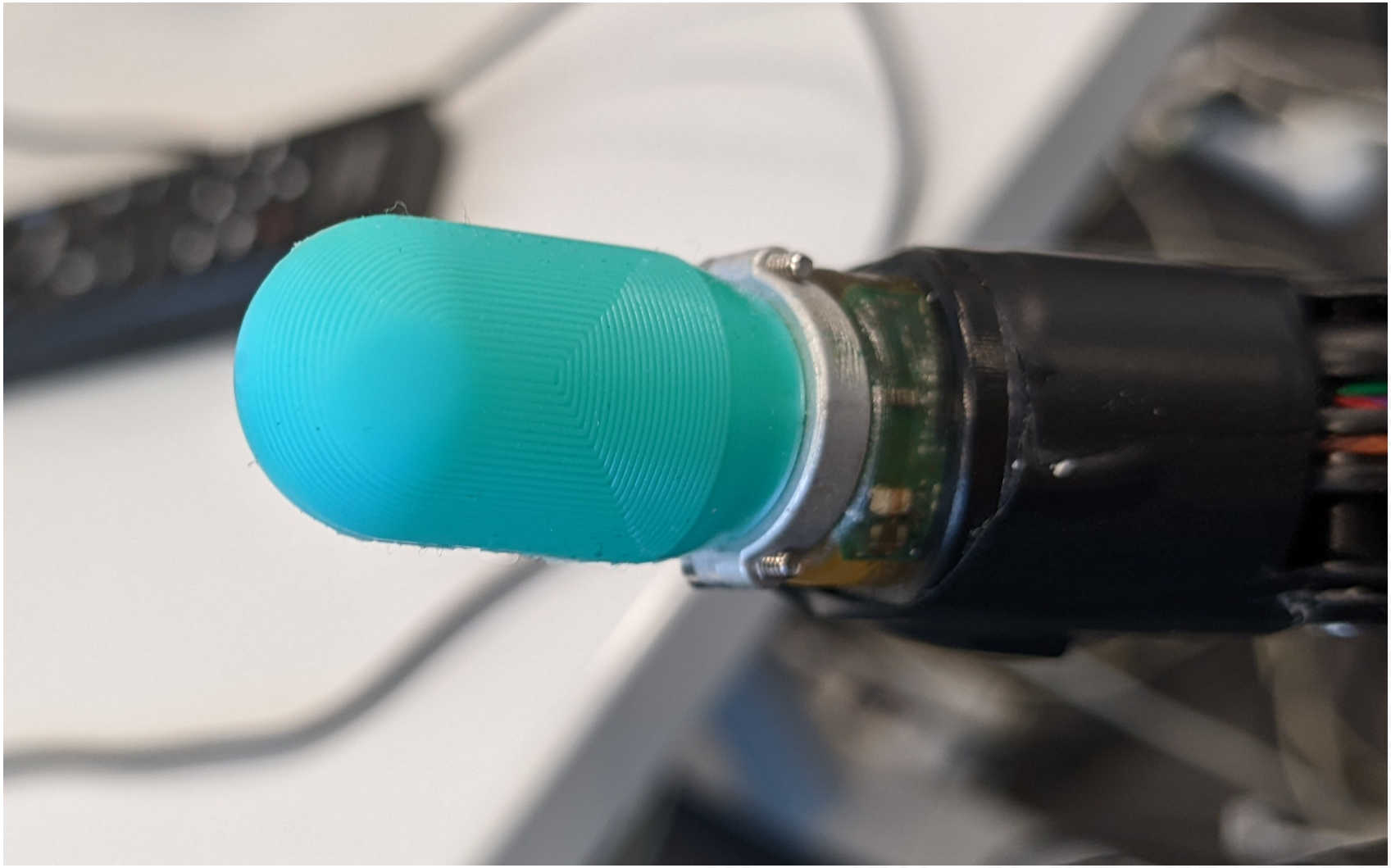


- Automated data collection

Current State

- Automated data collection
- 3 fabric types
- Tactile data based classification performance: 82% accuracy
- Chose samples and classes for new dataset

Current Issue



- Multimodal network
- Classification based on both tactile and force measurements
- Integration of DIGIT sensors and measurements
- Investigation of multimodal approaches

Recent Work

Current Work

Future Plans

Future Plans

- Multimodal clothes classification using DIGIT sensor
- Segment parts or features of clothes
- Recurrent Deep Neural Network processing of point clouds
- Fabric manipulation

Interested?

Please contact me

niklas.fiedler@uni-hamburg.de