H2020-NMBP-TR-IND-2018-2020 / H2020-NMBP-FOF-2019 (869963)

MERGING PROJECT

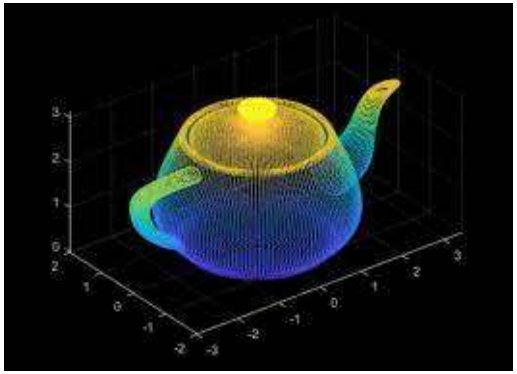
MANIPULATION ENHANCEMENT THROUGH ROBOTIC GUIDANCE AND INTELLIGENT NOVEL GRIPPERS

LESSONS LEARNED FROM COMPUTER VISION IMPLEMENTATIONS IN MERGING WORK CELLS

INTRODUCTION

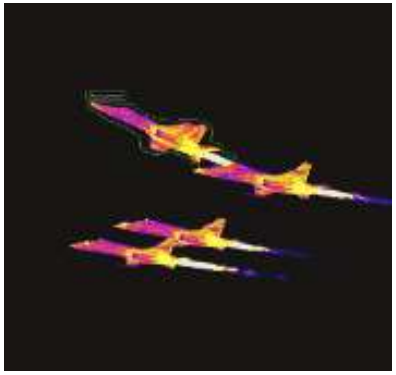
SENSORS:

- Time of Flight (ToF):
- Stereo
- Lidar
- Structural light



FEATURES:

- Resolution
- Dynamic Range
- Precision
- Working Range
- Field of View
- FPS



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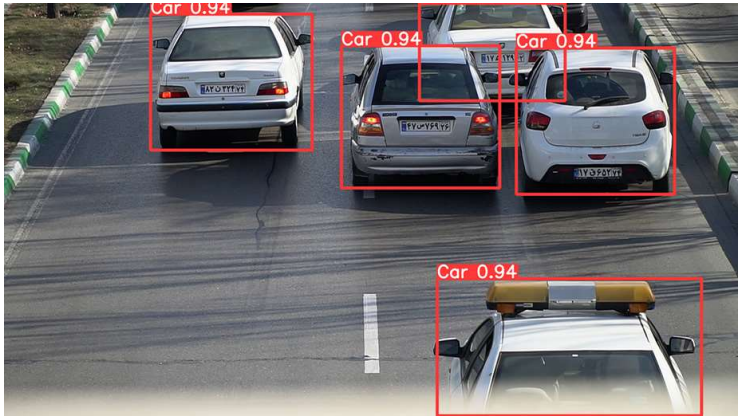
TYPES OF ALGORITHMS

- Object Detection
- Semantic and Segmentation
- Image Classification
- Transformation and Morphology Algorithms
- 3D Reconstruction Algorithms
- Feature-Based Algorithms
- Interest Point Detection



CALIBRATION

- **When?**

  If it's necessary to provide the robot with an accurate location of the detections or when we share information between the cameras.

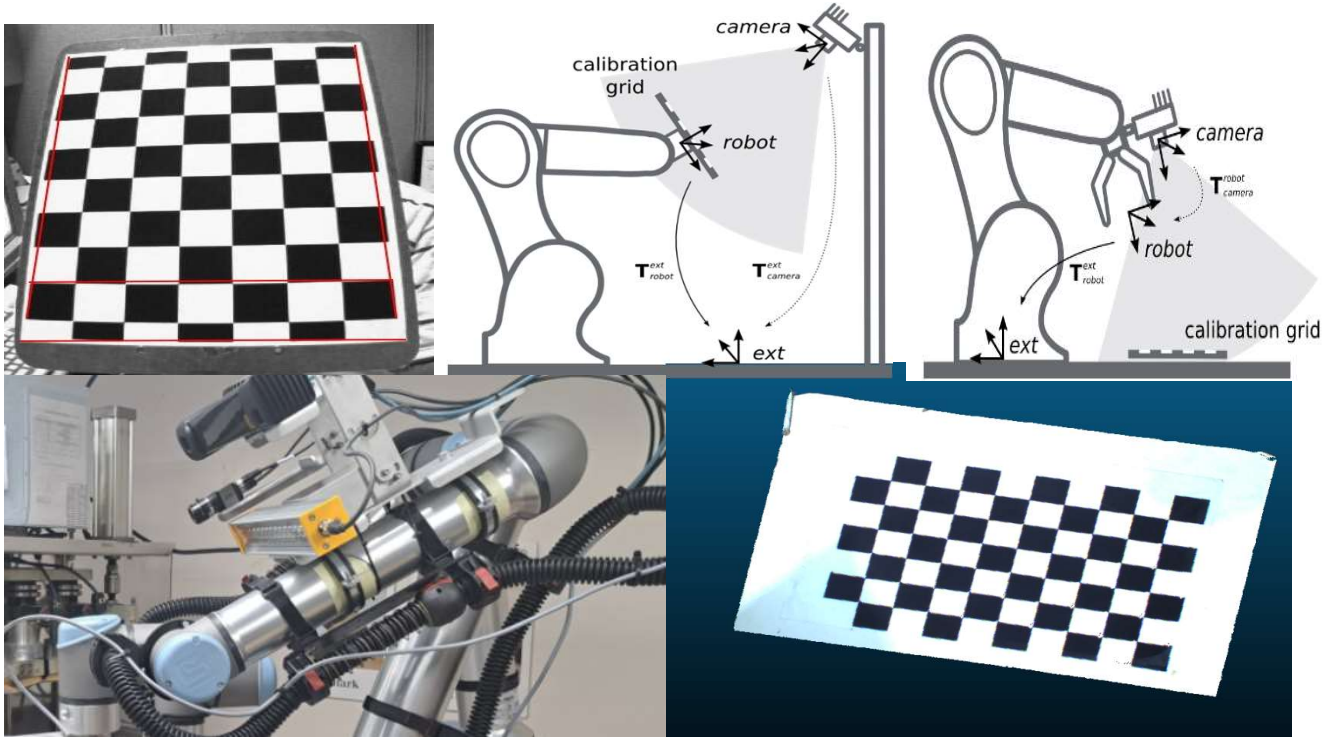
- **Intrinsic**

It corrects imperfections that arise during the lens manufacturing process and during its installation in the camera.

- **Extrinsic:**

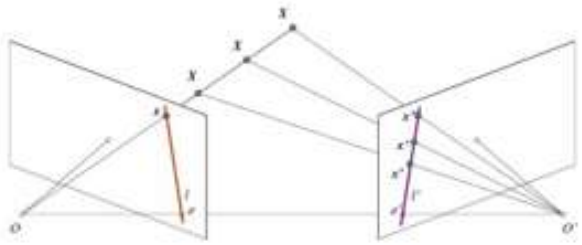
It determines the relative position and orientation between multiple cameras or between a camera and a reference system in the real world.

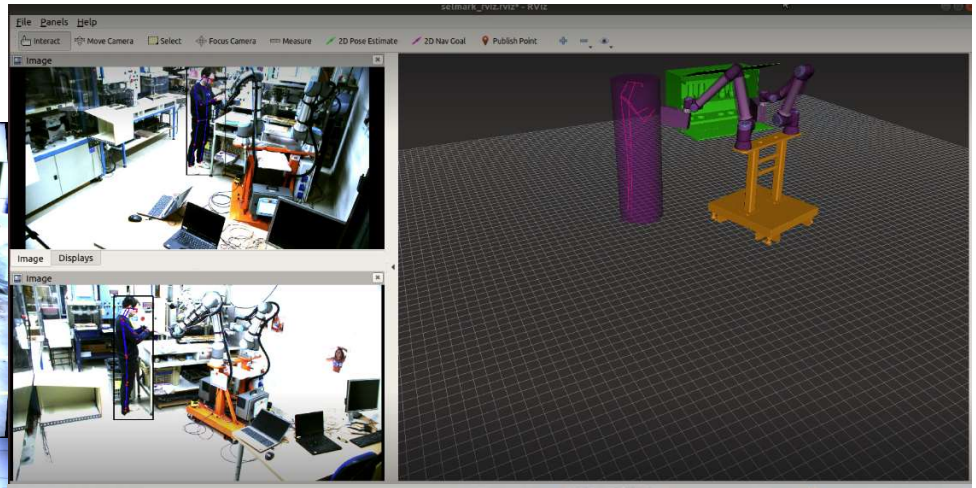
  - Eye to hand
  - Eye in hand

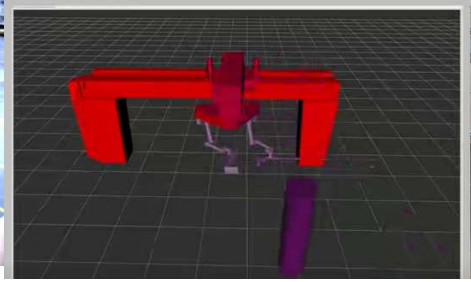


OBJECT DETECTION

- **PEOPLE DETECTION**
  - **Objective**: Detect people and locate them in world coordinates
  - **Sensors**: 2D camera, stereo vision.
  - **Calibration**: YES.
  - **Limitations**: Occlusions

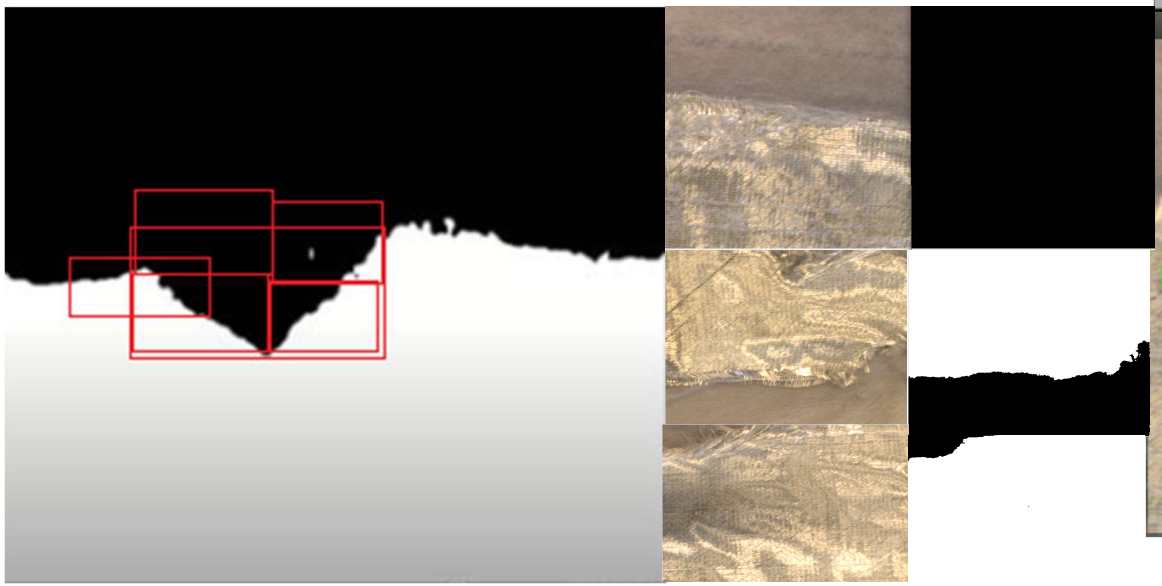


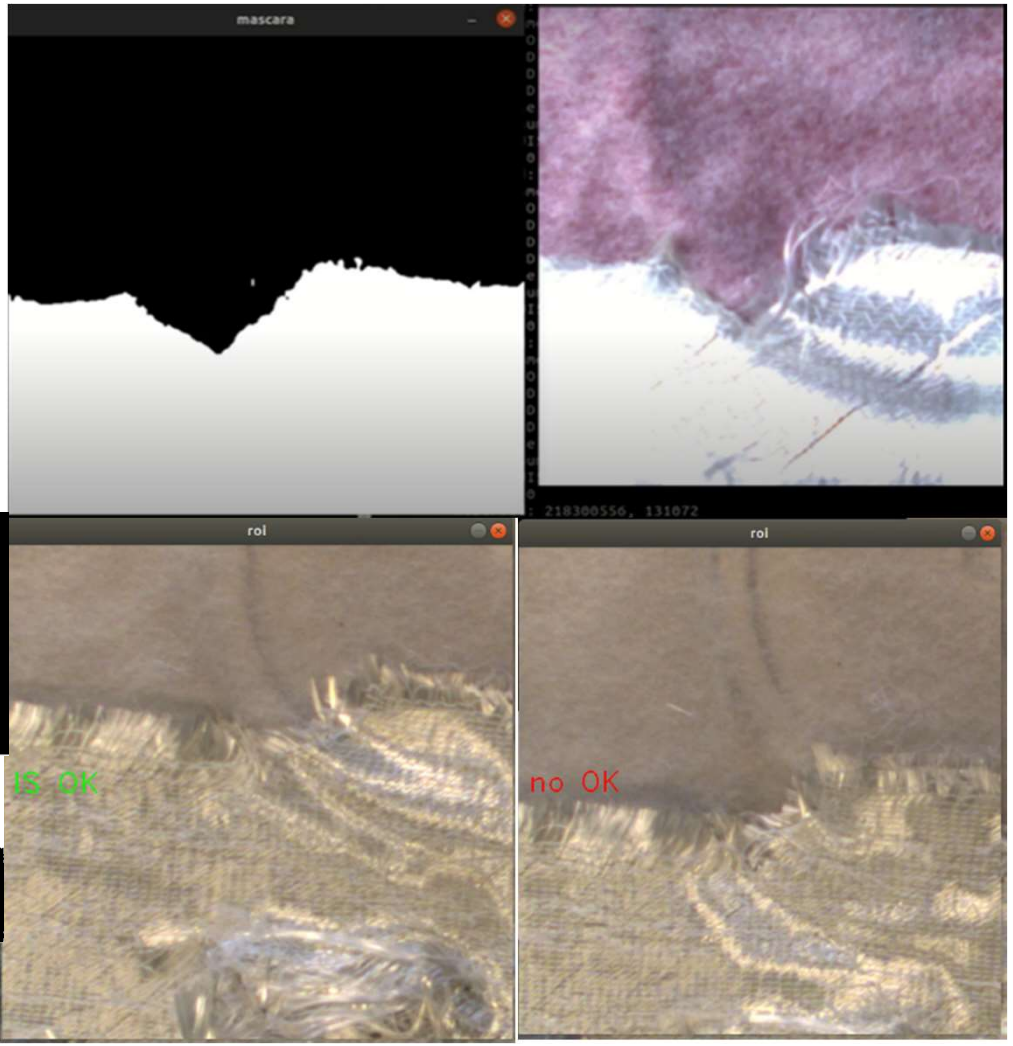




SEMANTIC SEGMENTATION

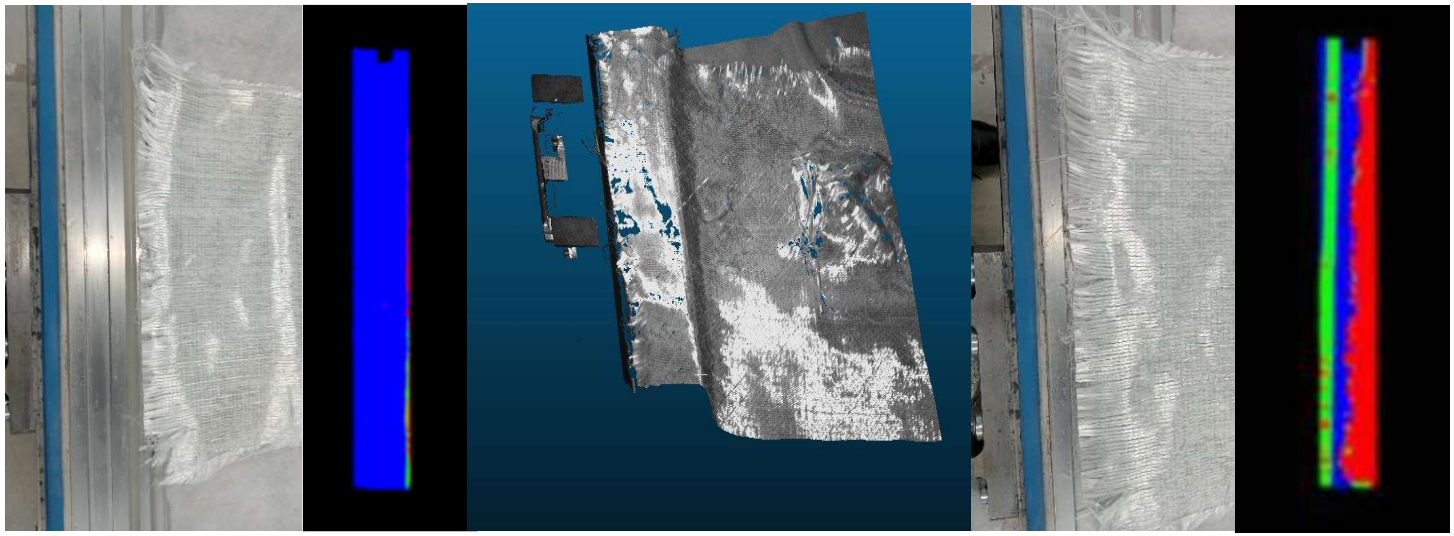
- **Check the fabric's placement.**
  - **Objective**: Verify if the fabric is in the correct position on the mold.
  - **Sensors**: 2D camera.
  - **Calibration**: no.
  - **Limitations**: Issues with changes in lighting.



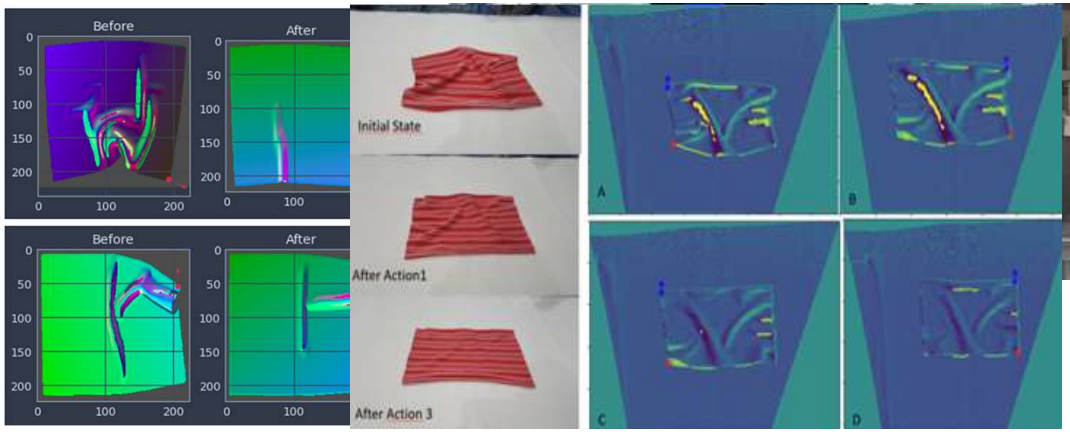


Based on 3D geometric operations

- **Edge Mold:**
  - **Objective:** Detection of fabric presence in the mold closure.
  - **Sensors**: 3D camera.
  - **Calibration**: no.
  - **Limitations:** Accuracy of up to 1 mm. Possible failures with narrower fabrics.



- **Wrinkle detection**:
  - **Objective**: Calculate the movements that the robot must perform to stretch a fabric.
  - **Sensors**: 3D camera.
  - **Calibration**: yes.
  - **Limitations**: problems with non plain fabric patterns



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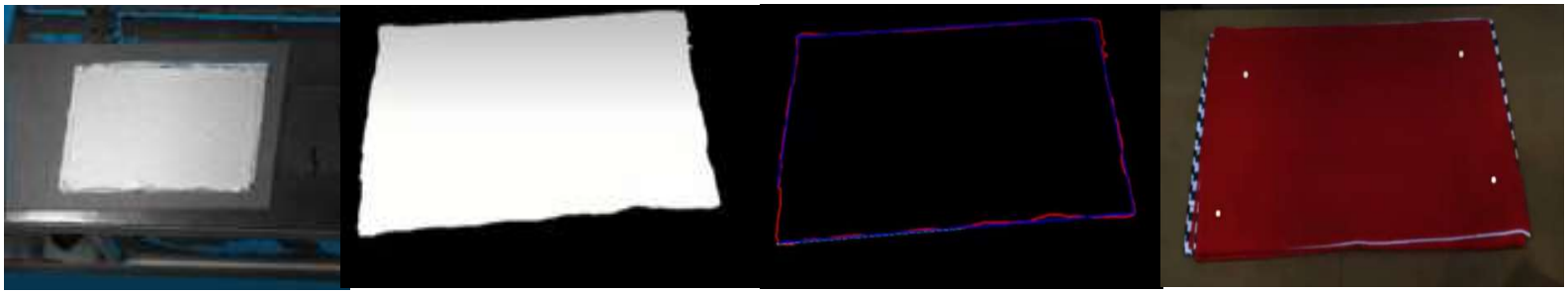
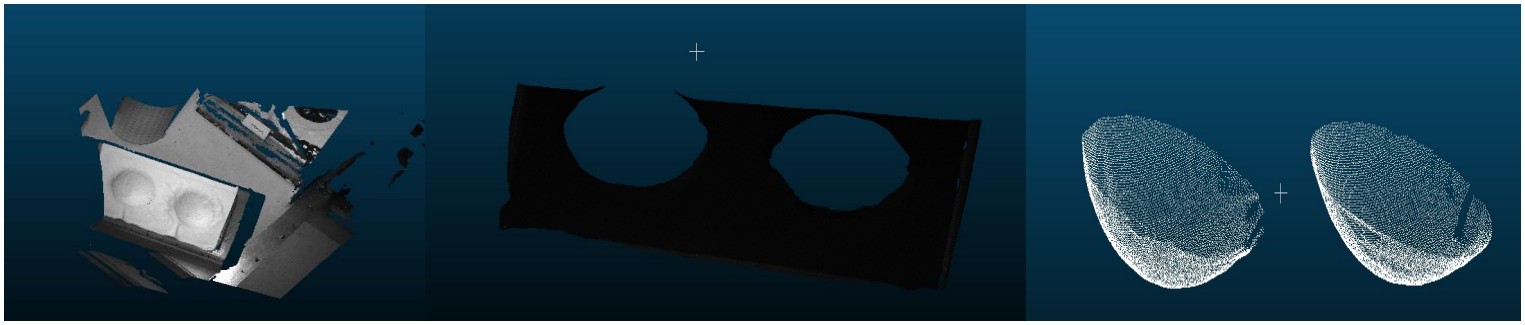
Based on 3D geometric operations

- **Stack**
  - **Objective:** Identify the grip points of the top fabric in the stack
  - **Sensors:** 3D camera
  - **Calibration:** yes.
  - **Limitations**:Accuracy of up to 1 mm. Possible failures with narrower fabrics.



- **Quality control**:
  - **Objective**: Determine the depth of the bra cups to ensure it is correct for the size.
  - **Sensors**: 3D camera.
  - **Calibration**: no.
  - **Limitations**: wrinkles on the cups.



Based on geometric operations

- **Pouches detection**
  - **Objective:** Identify the grasping points and the orientation of the pouches
  - **Sensors:** 2D camera
  - **Calibration:** yes.

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CONCLUSIONS

Not always the most popular solution is the one that fits the problem.

- **Objective of the problem**
- **Execution frequency**
- **Available hardware**
- **Accuracy rate**