Optimizing task-execution performance of a robotic system is complex. A robotic expert is required to find poorly performed task steps, analyze reason for poor behavior and identify solutions to handle the identified problems.

“In the context of manufacturing, the greatest potential is for functions that contribute to a reduction of programming and configuration requirements in deployed systems. There are clear benefits for small lot size systems in reducing the time and skill needed to reconfigure an adapt systems to new processes.”

EU’s Robotics 2020 Multi-Annual Roadmap [1]

We propose a Pipeline Optimization Framework (POF), which allows robots to improve its perception performance utilizing logged experiences and thus continuously improving their performance based on introspection.

Data splitting:
- Initialization: Single Object Samples
- Adaptation: Scene with multiple instances
- Evaluation: Scene with single object occurrence

Results

Figure 2: Flowchart of the POF evaluation

Figure 3: Results for classification task on all 9 objects

Figure 4: Results for pose estimation on 4 objects; bar plot: averaged root mean square error [mm] of detected objects; white error values: average root mean square error [mm] over all samples; right axis: object detection rate

Figure 5: Accuracy of original classifier versus the adapted one, trained with different amounts of manually labeled training data. In the cases where some of the data was automatically labeled, only the most confident, thus correctly labeled, detections were used.