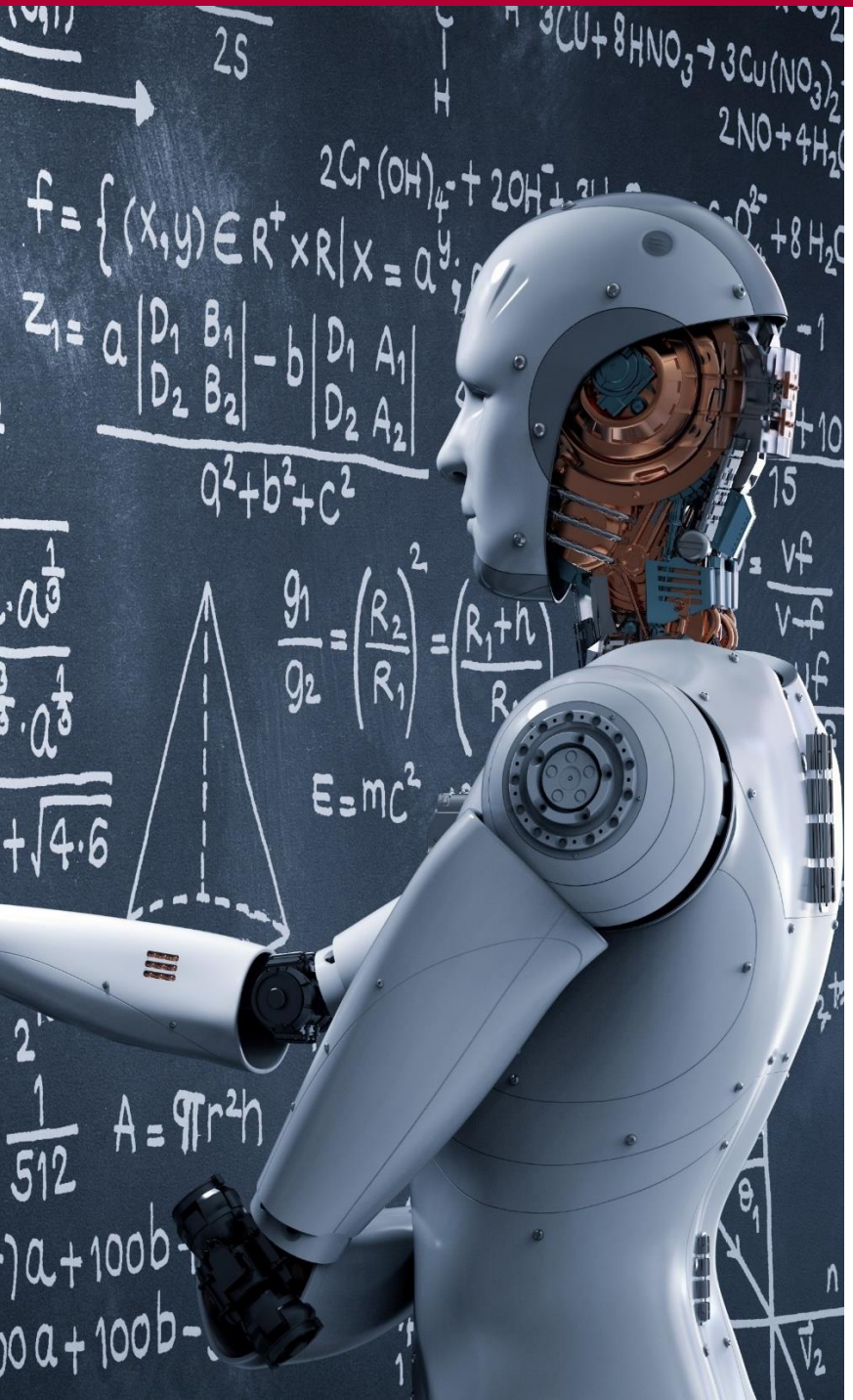

Research Center for
Information Management

Fraunhofer
FIT

Smart Sustainability Simulation Game

Case 3: Quality Management- Unit 1
04.06.2024

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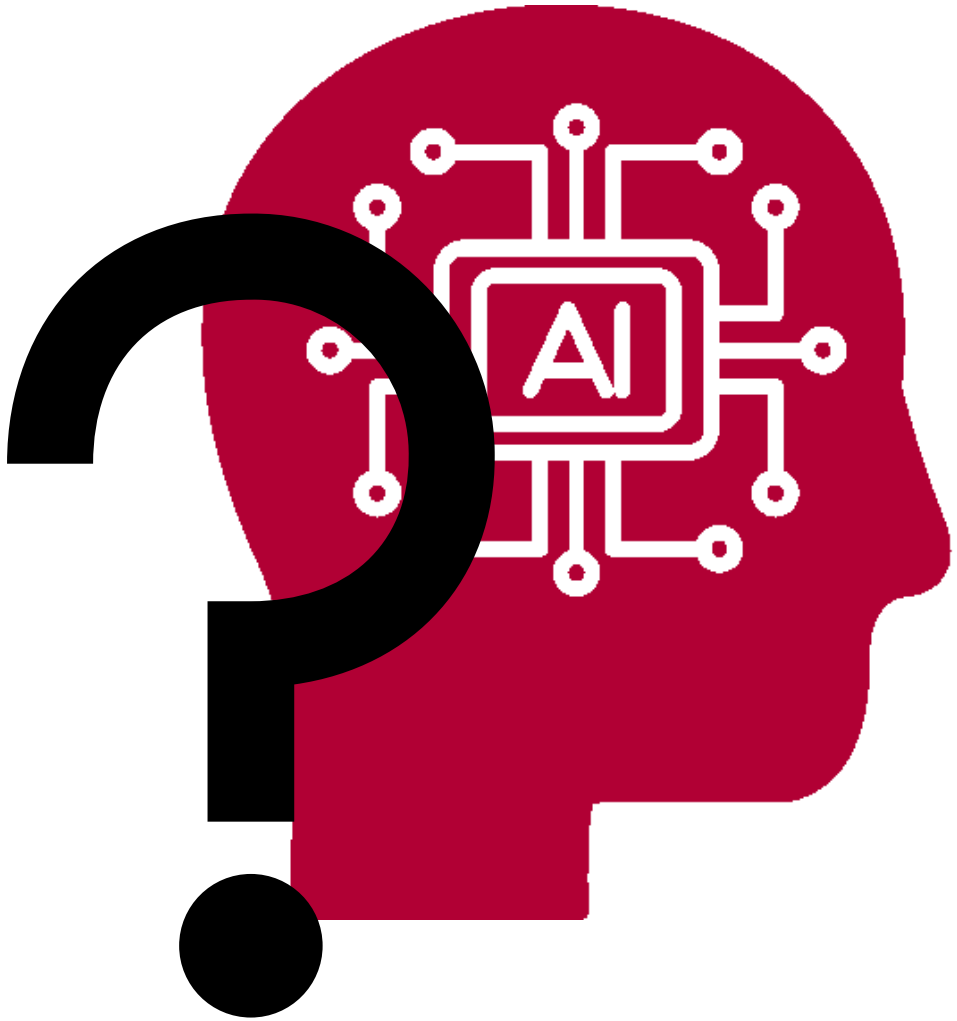
01

Organizational information

Time for Feedback

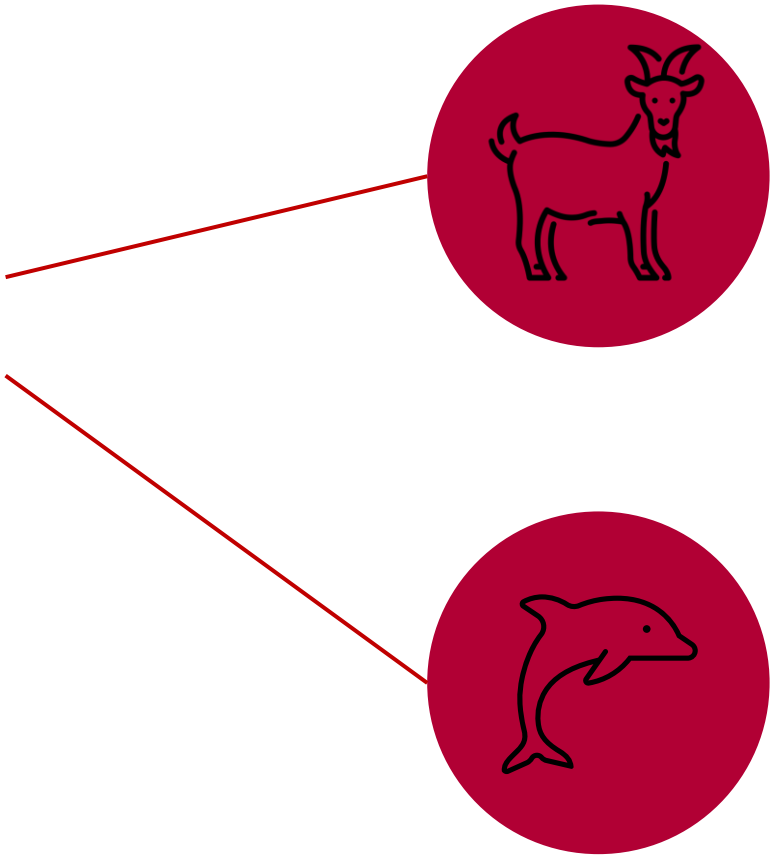


How was the second case?

Any questions?

02 Case 2: Your results

Case 2: Presentation of results



03

Case 3: Quality Management - Unit 1

Overview of the cases

Case 1: Material procurement

- What materials should I buy and when?
- Value chain level: Procurement

→ Time Series Analysis

Case 2: Predictive Maintenance

- How often and when should I maintain my machine?
- Value chain level: Operations/production

→ Predictive Analytics

Case 3: Quality Management

- How to ensure good quality?
- Value chain level: Operations/production

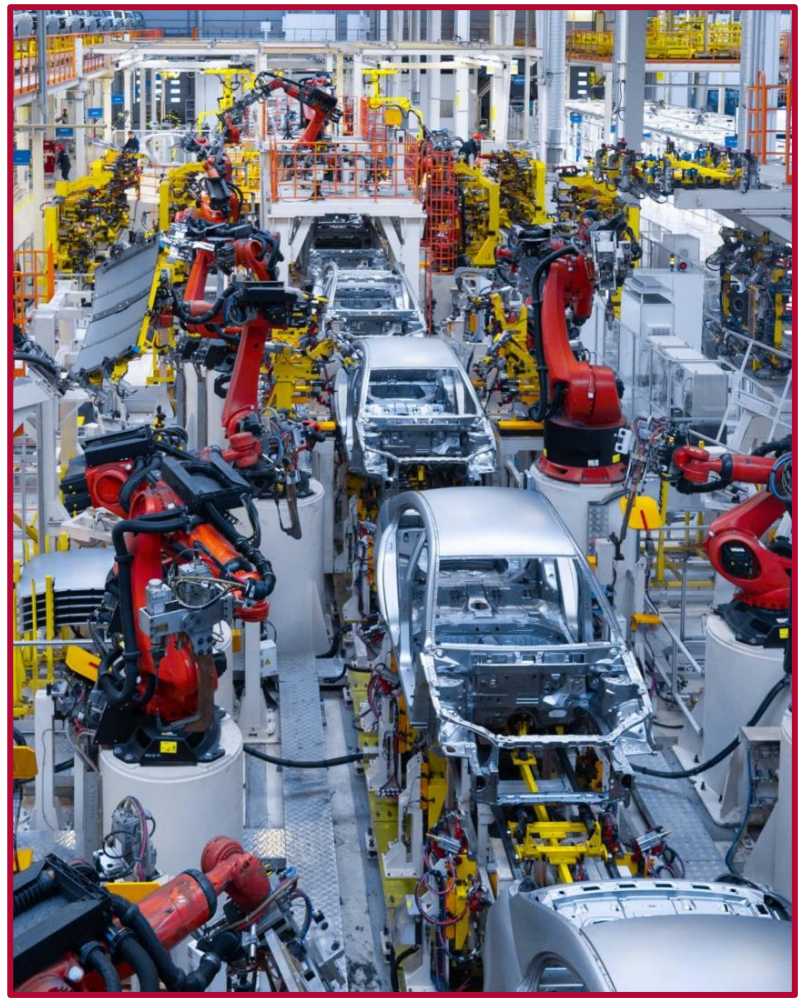
→ Computer Vision

Case 4: Recycling

- How much effort do I put into recycling?
- Value chain level: After-sales-services

→ Process Mining

Case 3: Quality Control of Edison Cars AG



Change in demand

- Increasing end-consumer demand for high quality low-emission vehicles
- Growing competition from China leads to a need for a zero mistakes policy

New product

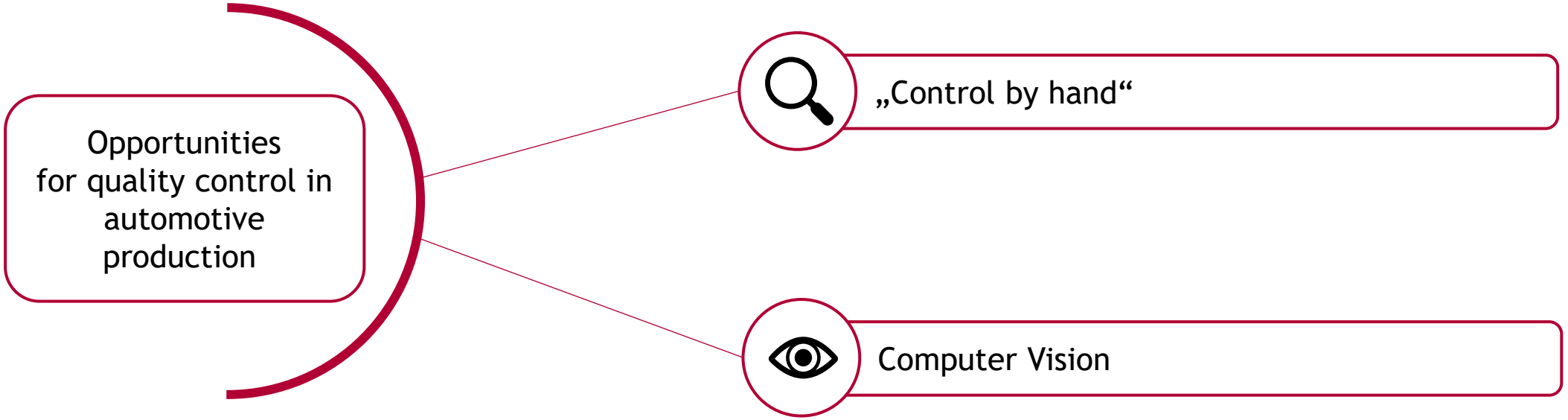
- Board of Edison Cars AG made the strategic decision: Abandon current combustion-engine-based cars
- New product lines tend to show more errors in production

Transformation of production

- Currently, the company is putting a lot of effort in transforming their production to become leaner and more agile
- Development of new production lines with high requirements

Quality Control as a Part of Production

Automotive manufacturers have an inalienable responsibility to deliver high-quality products. General manufacturing Quality Control (QC) is an effort that reviews product quality intending to identify and eliminate defects. Discovering and fixing the defects should typically happen before the products reach the consumer.



Introduction to Computer Vision and Object Detection

What is computer vision?

- Computer vision is a part of AI
- Enables possibility to retrieve information out of digital images, videos and other visual impacts
- Possibility to check thousands of products during a production process
- Mostly implemented through deep learning, machine learning or neural networks

What is object detection?

- Computer vision technique for locating instances of objects in pictures or videos
- Typically implemented through machine or deep learning models

Case 3: Quality Management of Edison Cars AG – Task

Goal of the task of case 3 is to develop an algorithm for the **quality control** of an e-car production. This algorithm should **detect scratches** on the back side of a car and decide whether it is more efficient to **exchange the part** with the scratch or **correct it**.

The company management wants you to implement their quality control system

How to implement a working object detection

1

Select an algorithm and a pre-trained model

Do not start from scratch. We recommend using YOLOv8 since it is commonly used, easy to implement and backed by a vast amount of tutorials online.

2

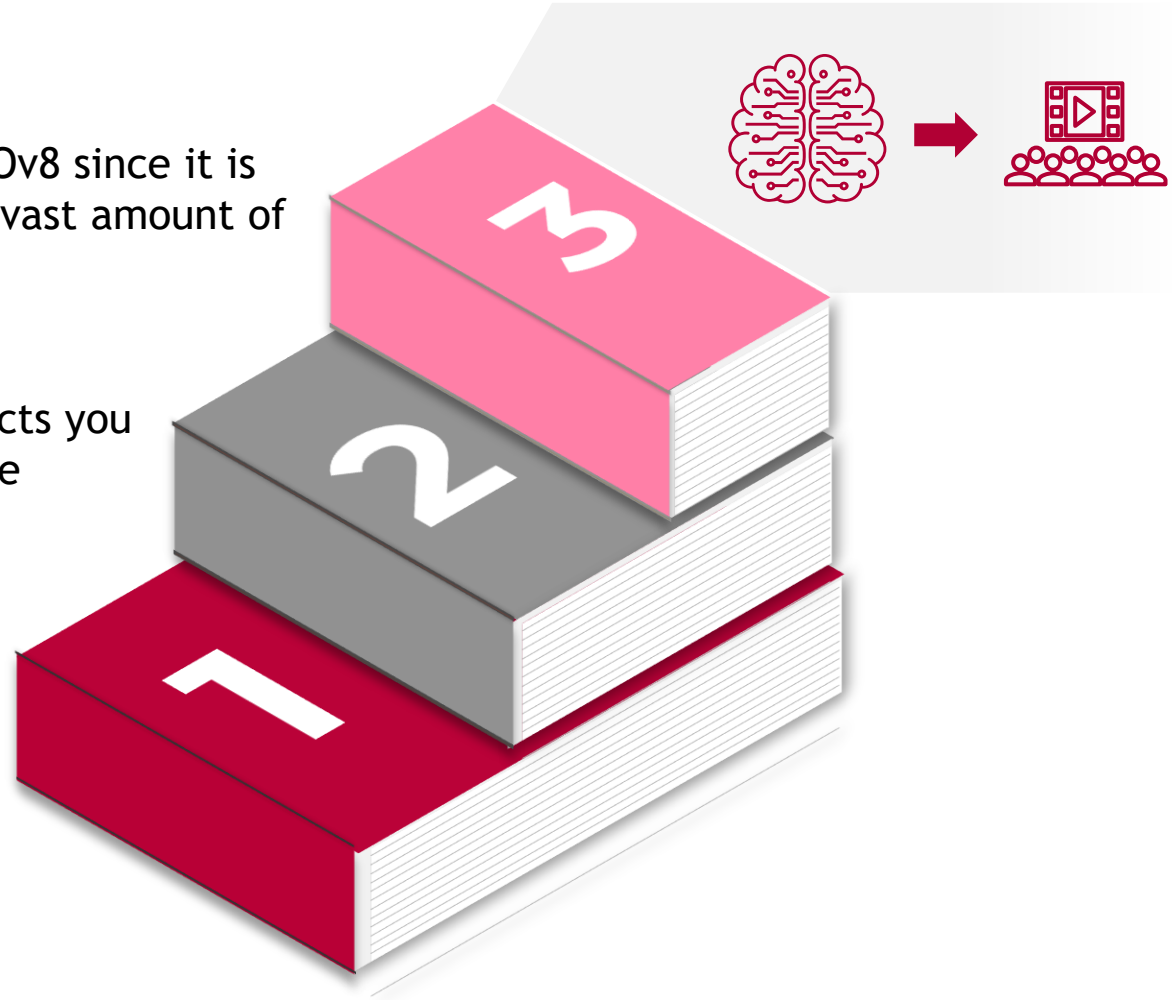
Select and label your data

Continue with labeling your input data with the objects you would like to detect and export as needed. Using free software like Roboflow is helpful for labelling.

3

Train your model and run the inference

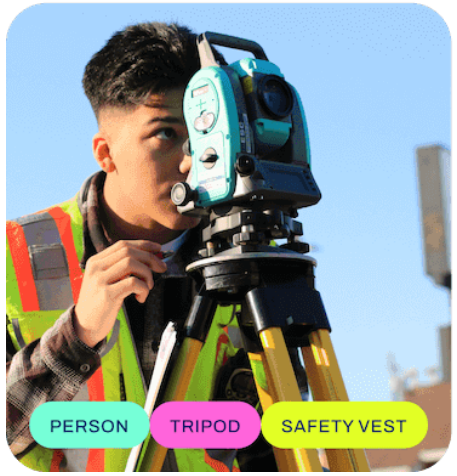
Use your labeled data to train your custom model. After that, you might evaluate the performance of your model, improve your labelling, and continue training.



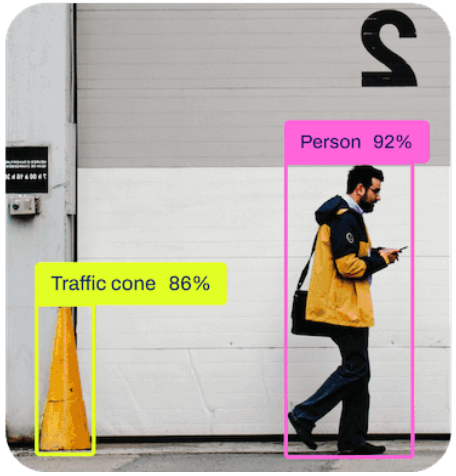
YOLOv8 as a starting point for your object detection

YOLOv8 is a computer vision model that enables you to classify, detect, segment, and track objects. Further, you can use YOLOv8 for human pose estimation, e.g., in sports.

Classify

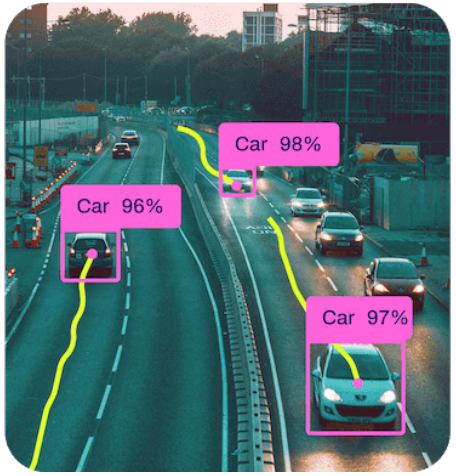


Detect



Segment

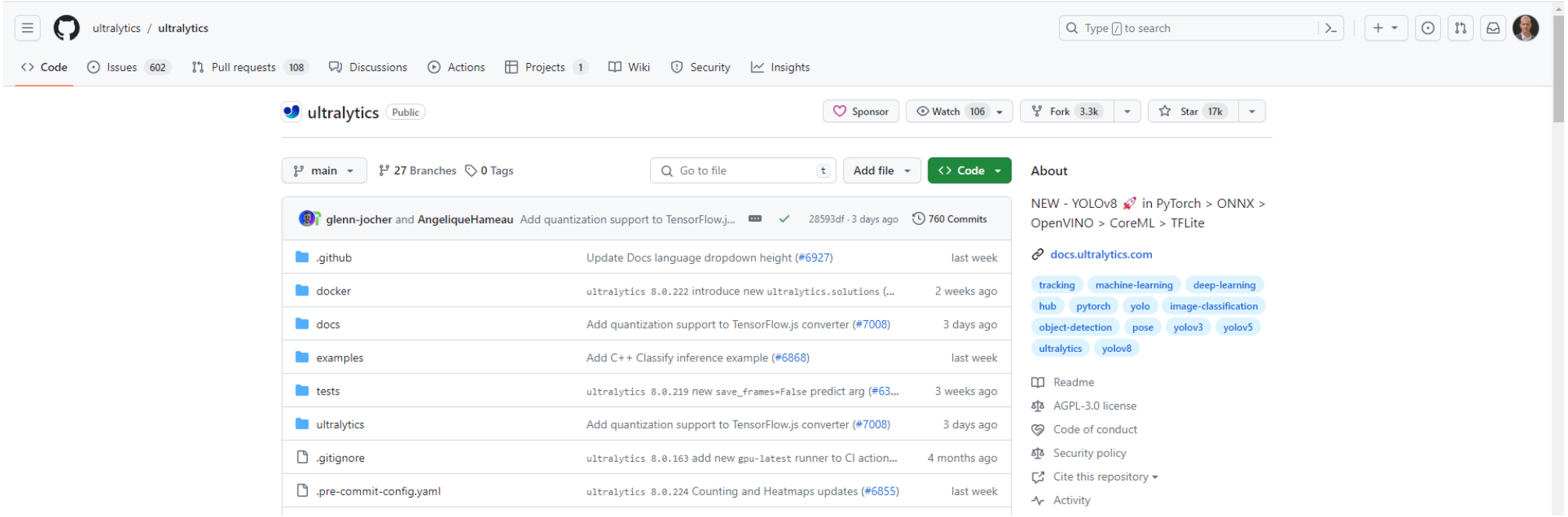
Track



Pose

YOLOv8 as a starting point for your object detection

You can find helpful documentation on the installation and use here:
https://github.com/ultralytics/ultralytics



Jupyter Notebook

Use our Jupyter Notebook as a starting point for this week‘s task

1. Installation und Dependencies

In [ ]:
```
!pip install torch torchvision torchaudio
```

In [ ]:
```
!pip install ultralytics
```

In [1]:
```
import torch
from matplotlib import pyplot as plt
import numpy as np
import cv2
from ultralytics import YOLO
```

2. Loading the model

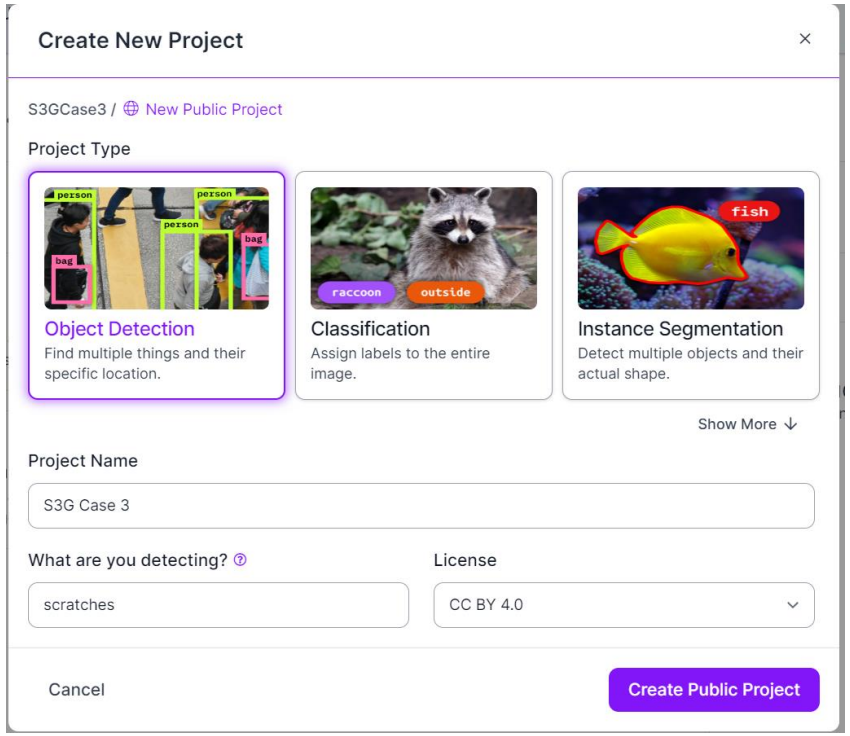
In [2]:
```
model = YOLO("yolov8n.pt")
```

3. Make detections

In [3]:
```
img = "https://media.npr.org/assets/img/2010/08/23/trafficjam-695199b627097a111557672a2520e2b222f48ffa-s1100-c50.jpg"
```

Image annotation using Roboflow Annotate

Create a project for object detection



Label the scratches: Work as precise as possible to achieve best results

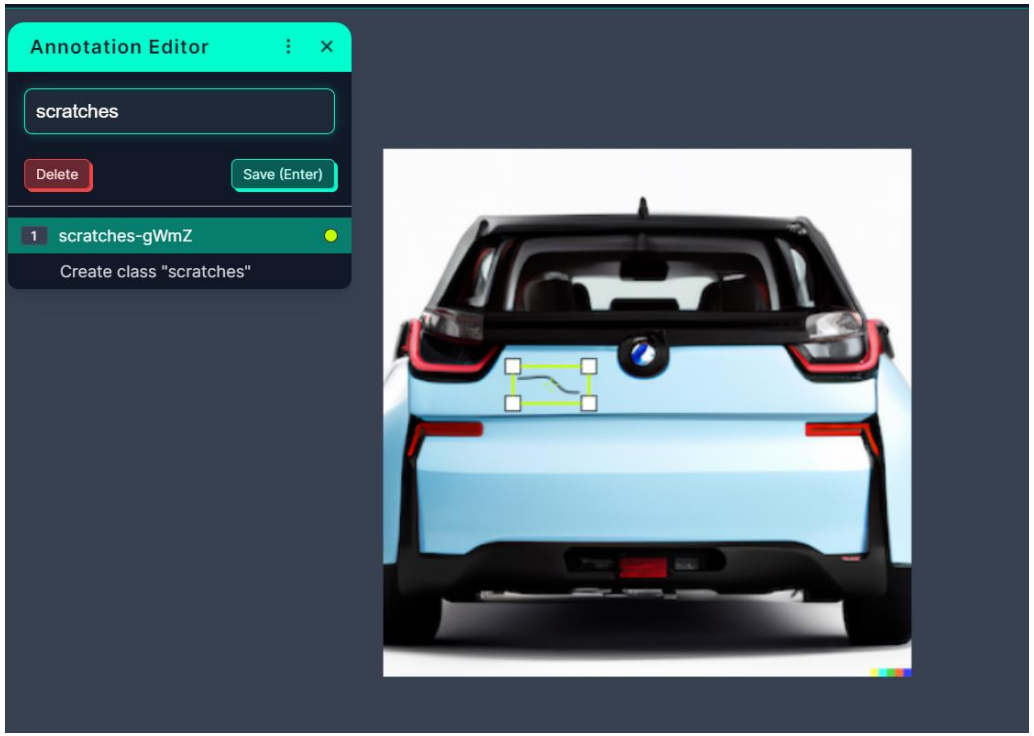


Image annotation using Roboflow Annotate

Generate your training data, including preprocessing and augmentation

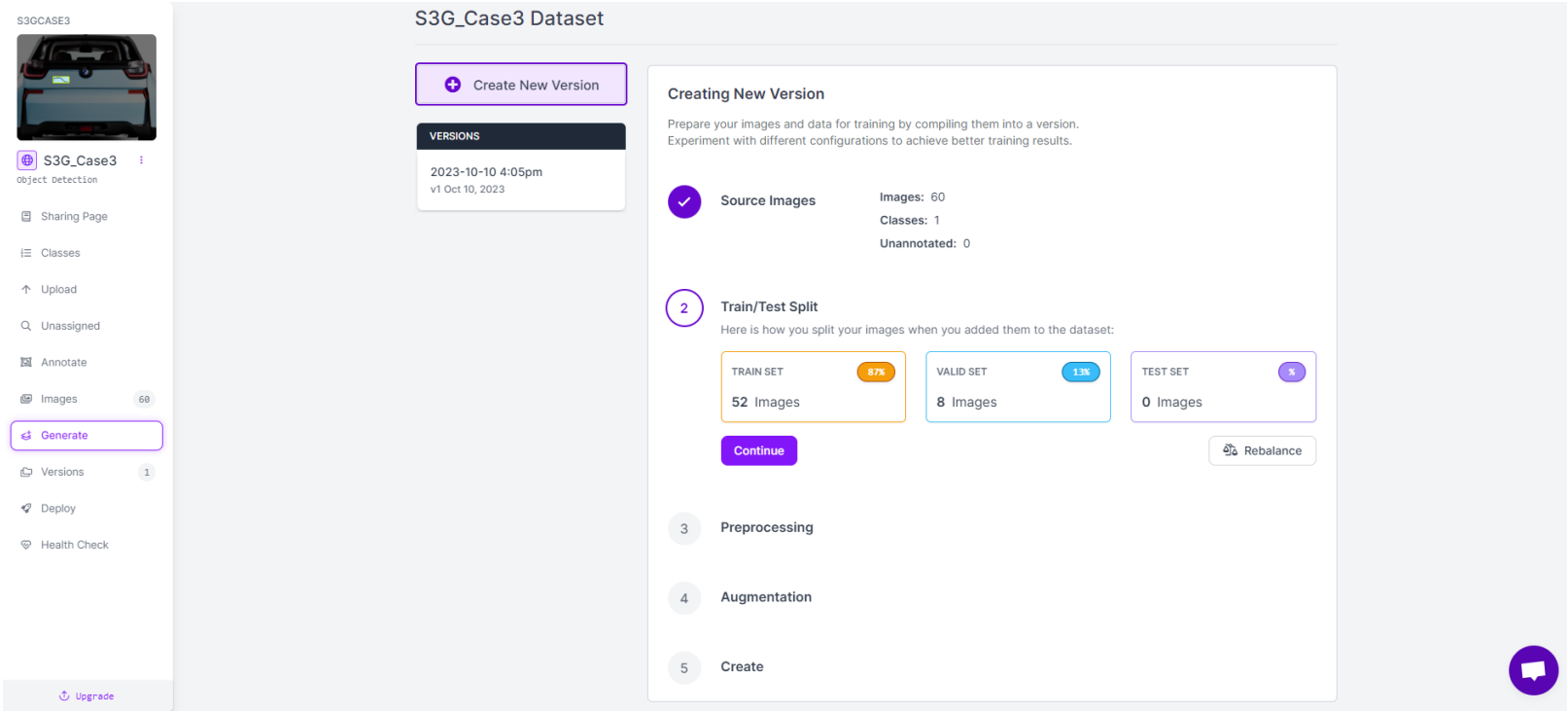
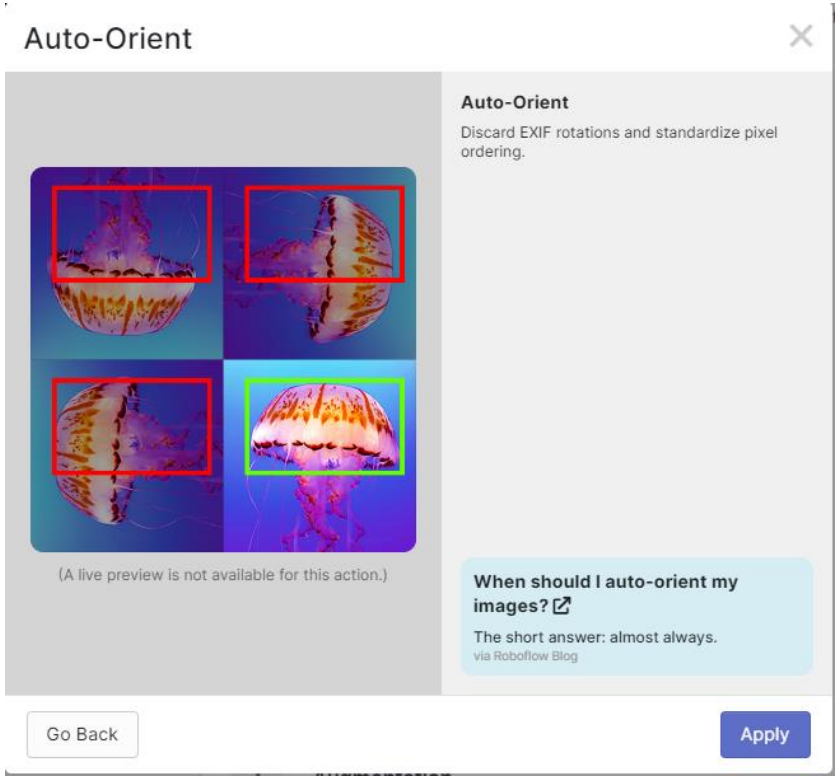


Image annotation using Roboflow Annotate

Especially with small datasets, preprocessing and augmentation might lead to better results



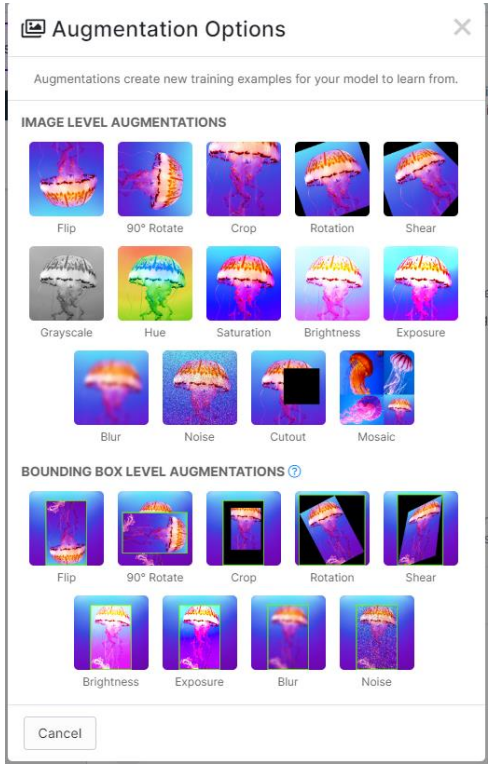
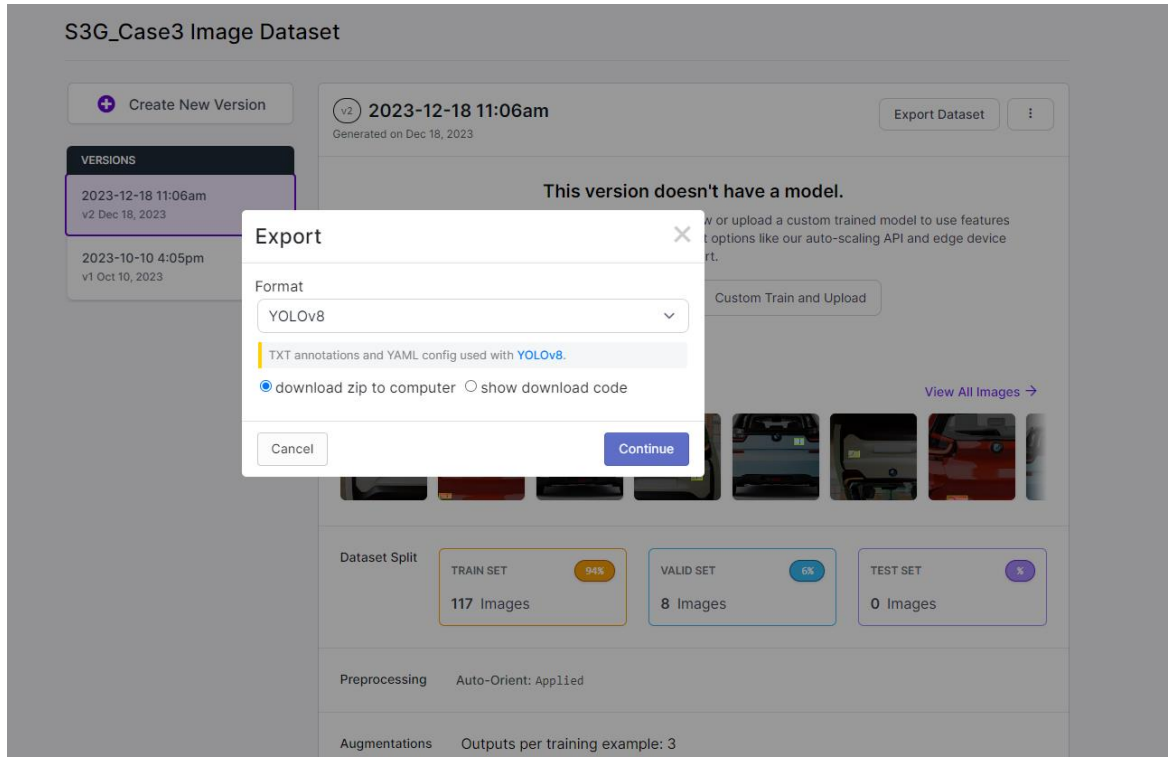
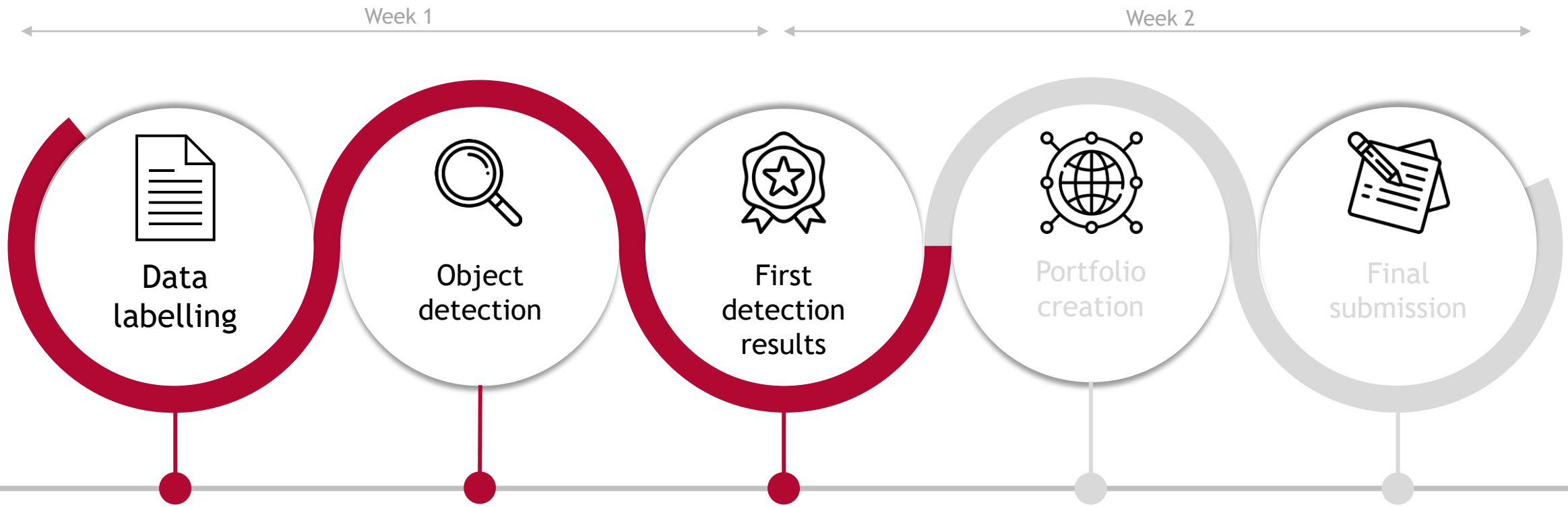


Image annotation using Roboflow Annotate

Export your dataset to the desired format



Case 3: Time schedule



Label your data according to the worksheet

Implement your object detection and show your first results

Submission of the implementation and presentation of the developed approaches

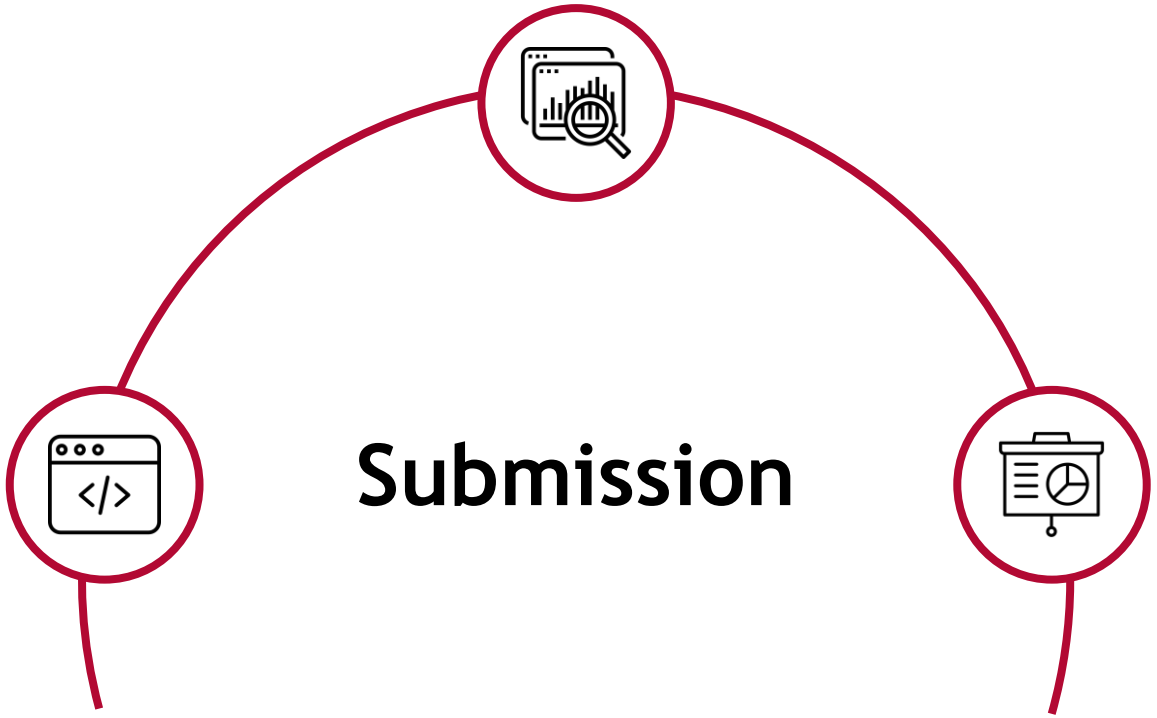
Implementation of a localization algorithm and a decision algorithm whether a car part should be exchanged

Submission of the final results

Case 3: Submission

The following documents must be emailed to **s3g@fim-rc.de** as one zip folder by **10:00 AM** on **10.06.2024:**

Model
Exported as described in the worksheet

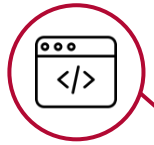


Code
for the object detection incl. description of additional packages for the setup as well as version information of used packages and libraries

Presentation
Explaining your approach to the object detection

Case 3: Evaluation criteria

Code Quality
Is the code executable, readable and contains comments?

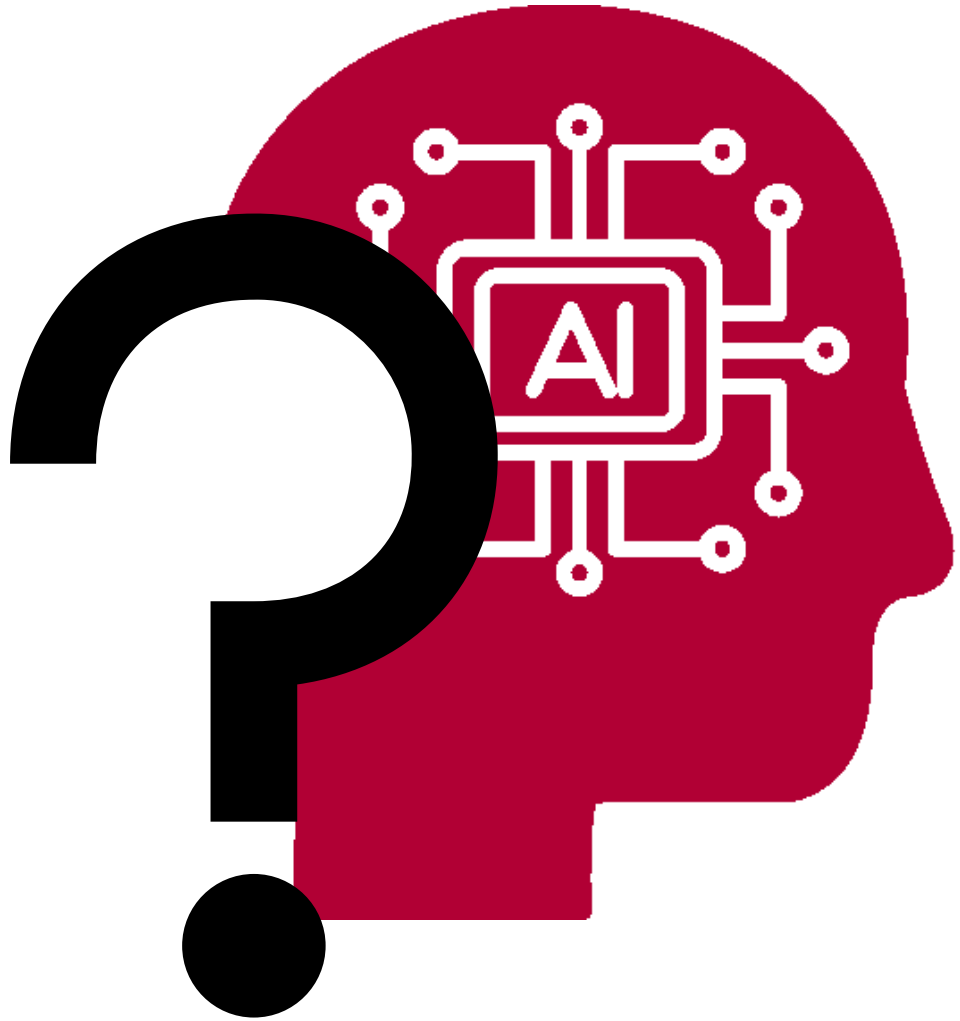


Prediction Quality
How closely do the predictions match reality?

Explanation
Is the selection of the approach presented in a comprehensible way?

Bonus
The best prediction (based on the average accuracy) receives a bonus

Case 3: Any Questions?



Any Questions?