We will ride railways into the future  $\rightarrow$  One system for each track





## Challenge

# Bring preventive maintenance to the railway infrastructure industry to assure ride safety

# We face this challenge with technology, **know-how**, data analysis and the **right partners**





# **Opportunity**



Working with Metro de Barcelona (TMB) we have access to the vehicle and the infrastructure  $\rightarrow$  An ever growing database

# Workflow



- Creation of historical records
- Allowing preventive maintenance

#### **Technical assessment - Workflow detailed**



#### **Data Capture**





- $\checkmark$  Using data of all subscripted customers  $\rightarrow$  More robust system
- $\checkmark$  Fast region-dependent response.
- ✓ Report image with bounding boxes and confidence prediction for each defect.



#### Data processing



# Data product: Analytics + Status + Alarms + Presentation layer



# Results for identification of different elements (1)



# Results for identification of different elements (2)



# Status of the mock up - Our roadmap

\_ \_ \_ \_ \_ \_





# New technical possibilities

- More defects
- ✓ Feature matching for detecting lateral movements in consecutive images.
- **Visualizations**
- ✓ Railway reconstruction using the feature displacements.
- Integrate CV and IMU data
  ✓ Dynamics ↔ Track status
  ✓ Rolling stock maintenance
- $\checkmark$  Evaluate root cause of damages





# Technological challenges and tools

- Cupy, cudf and matplotlib for data organization and exploratory analysis using GPU.
  ✓ Highly unbalance data.
- Select state-of-the-art DL algorithm from literature.
  - $\checkmark$  Translate the model to a fixed framework for inference: Onnx runtime.
  - $\checkmark$  Currently using yolov5 for PyTorch.
- Al training in python, and inference in C++.
- Web app using python and Django.
- The capture device can be located anywhere, but data will be stored in European data centers.
- Use LabelMe and VM admin tools to increase the dataset and perform periodic updates of the DL models.