Using AI for automatic hail damage assessment

Paola Bianchi
Data Scientist at Zühlke Engineering AG

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Our client: PDR TEAM

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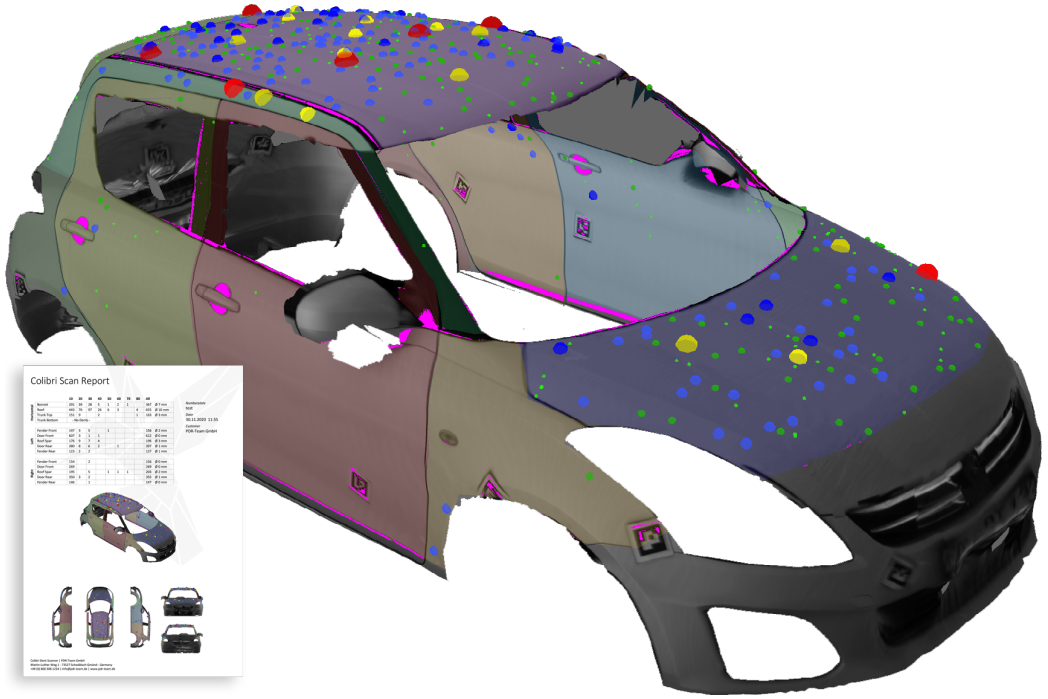
PDR-Team Requirements

Automate manual inspection

- Estimate number and size of dents per car part
- 90% accuracy
- Process time within 5 minutes
- Project time: 3 months



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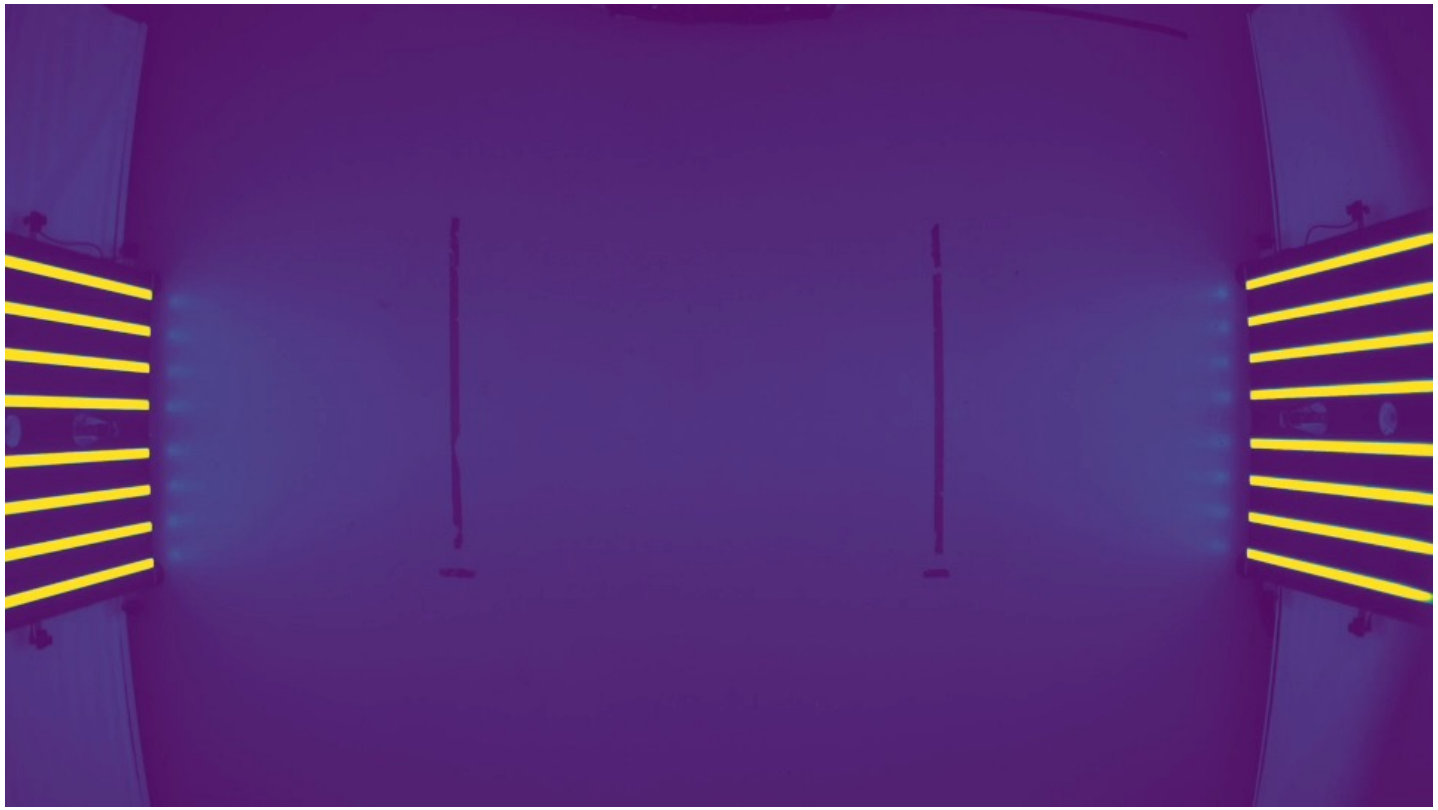
PDR-Team Vision

Colibri arc



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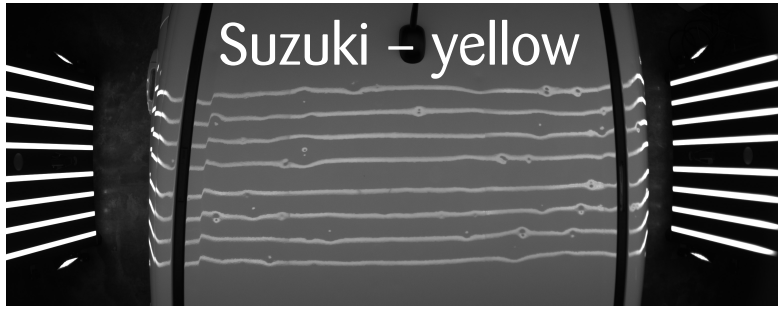
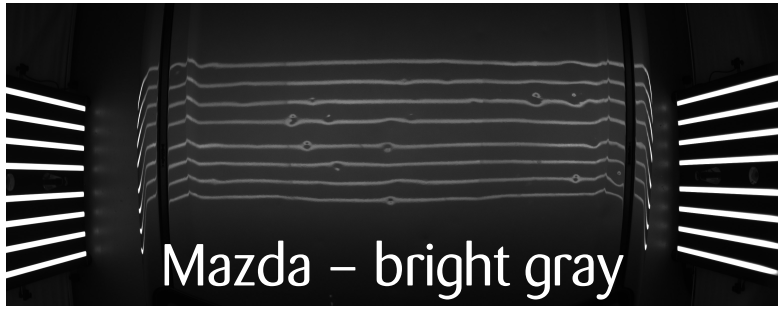
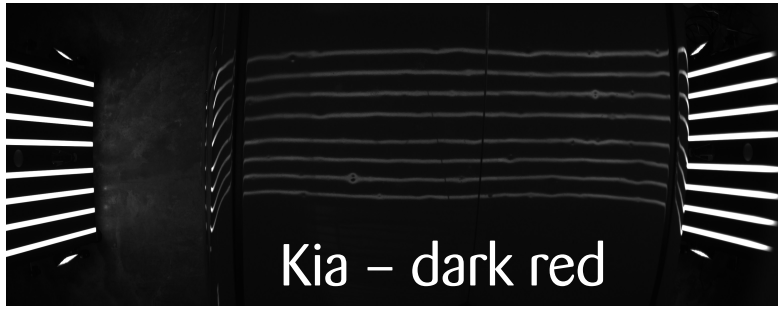
Initial Data

One passage per car







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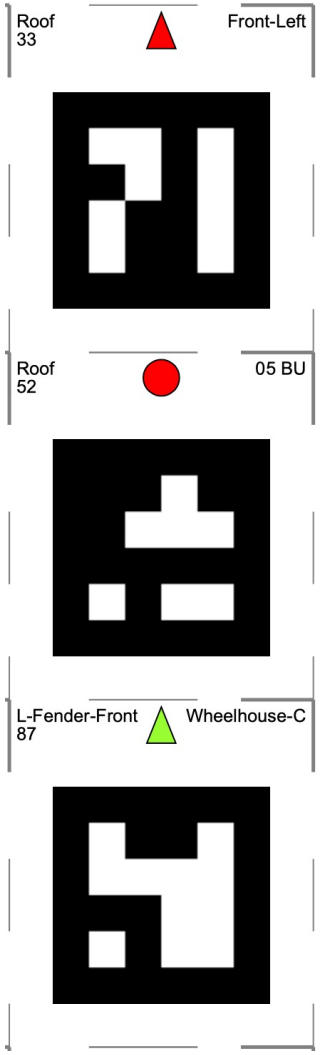
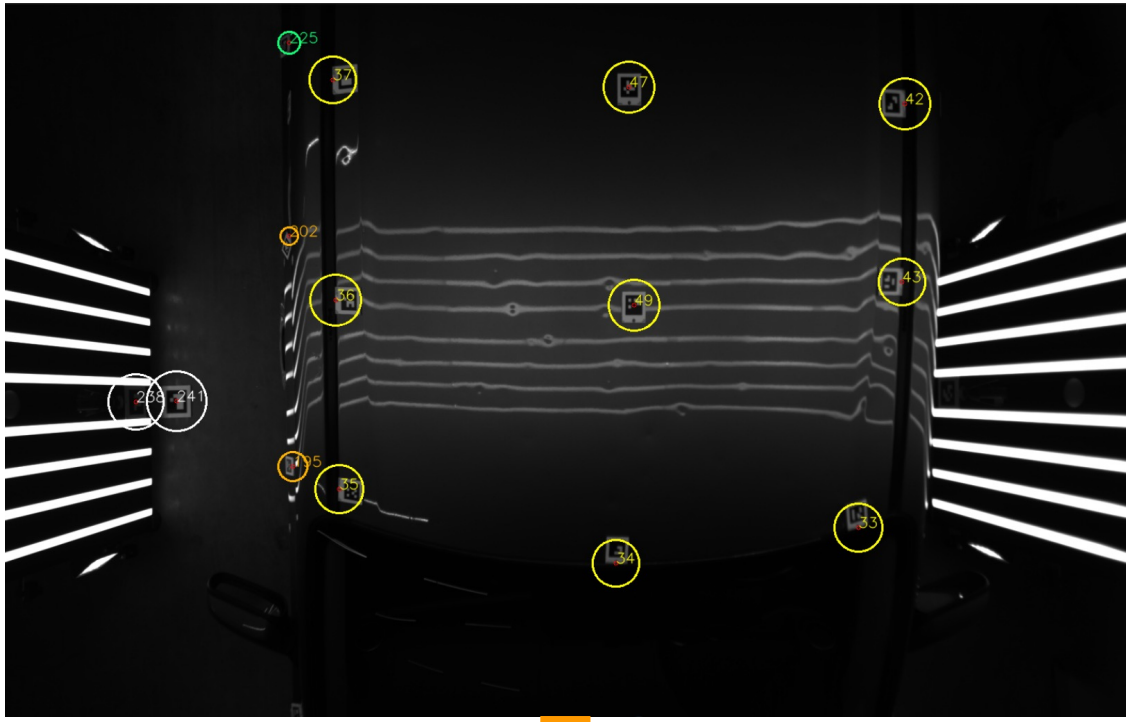
ArUco markers





.json

Marker id
Position of corners
Orientation

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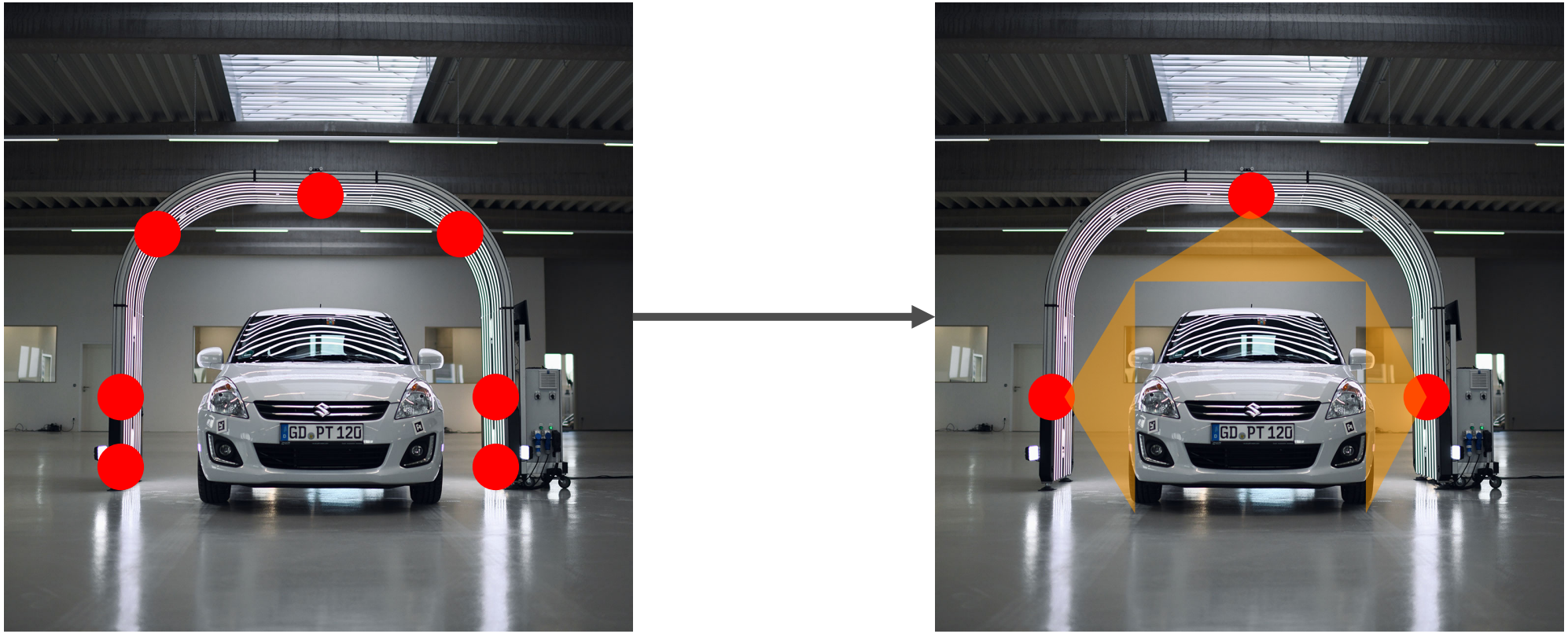
Cameras

Use only 3 cameras + assign car parts to cameras unambiguously



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Labeling

Work with partner INFOLKS GROUP | A knock to the future

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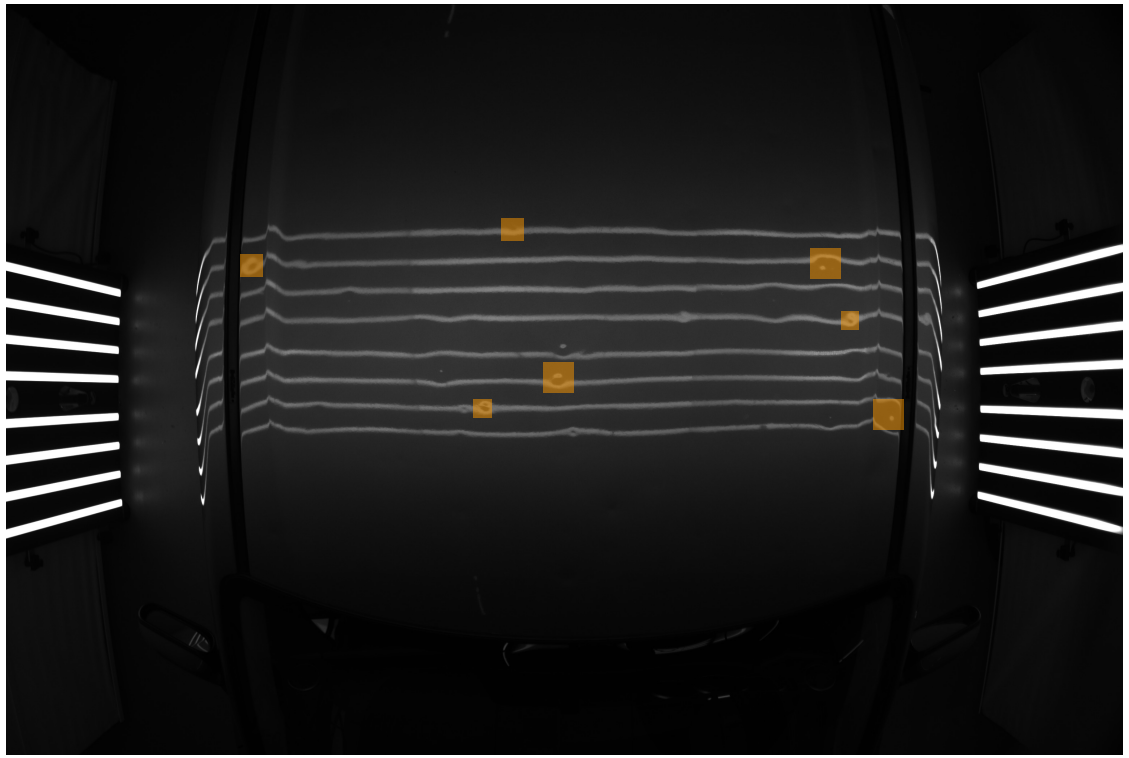

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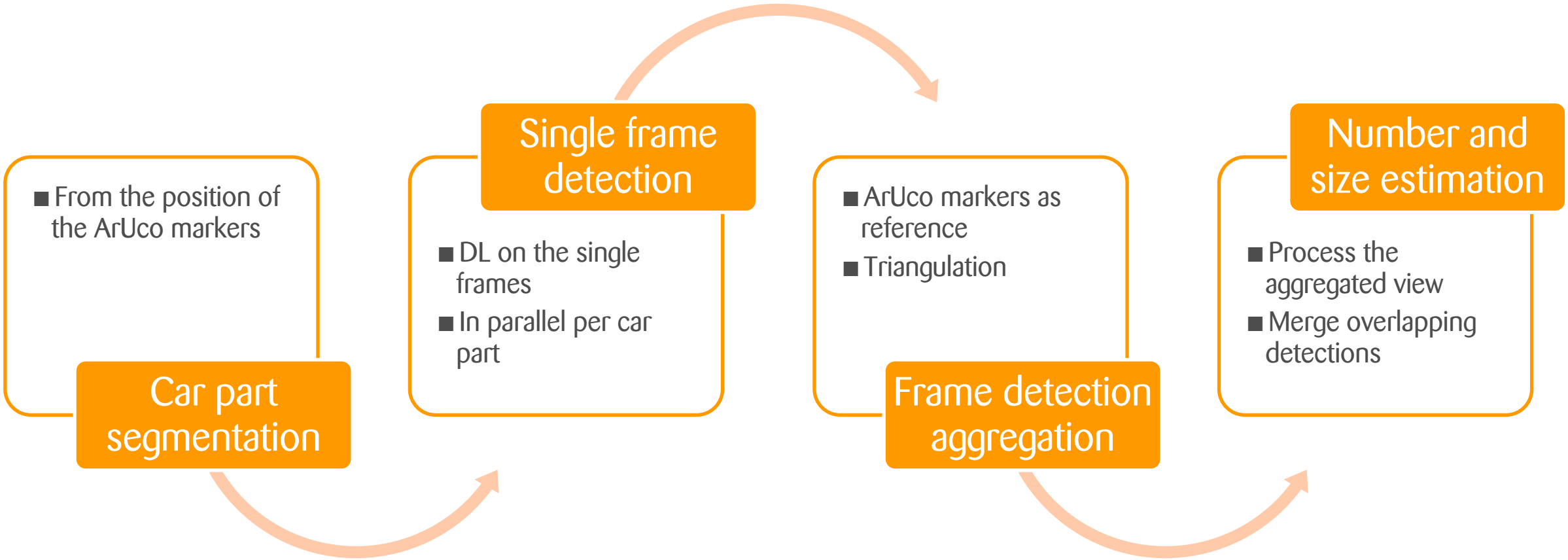
High-level solution



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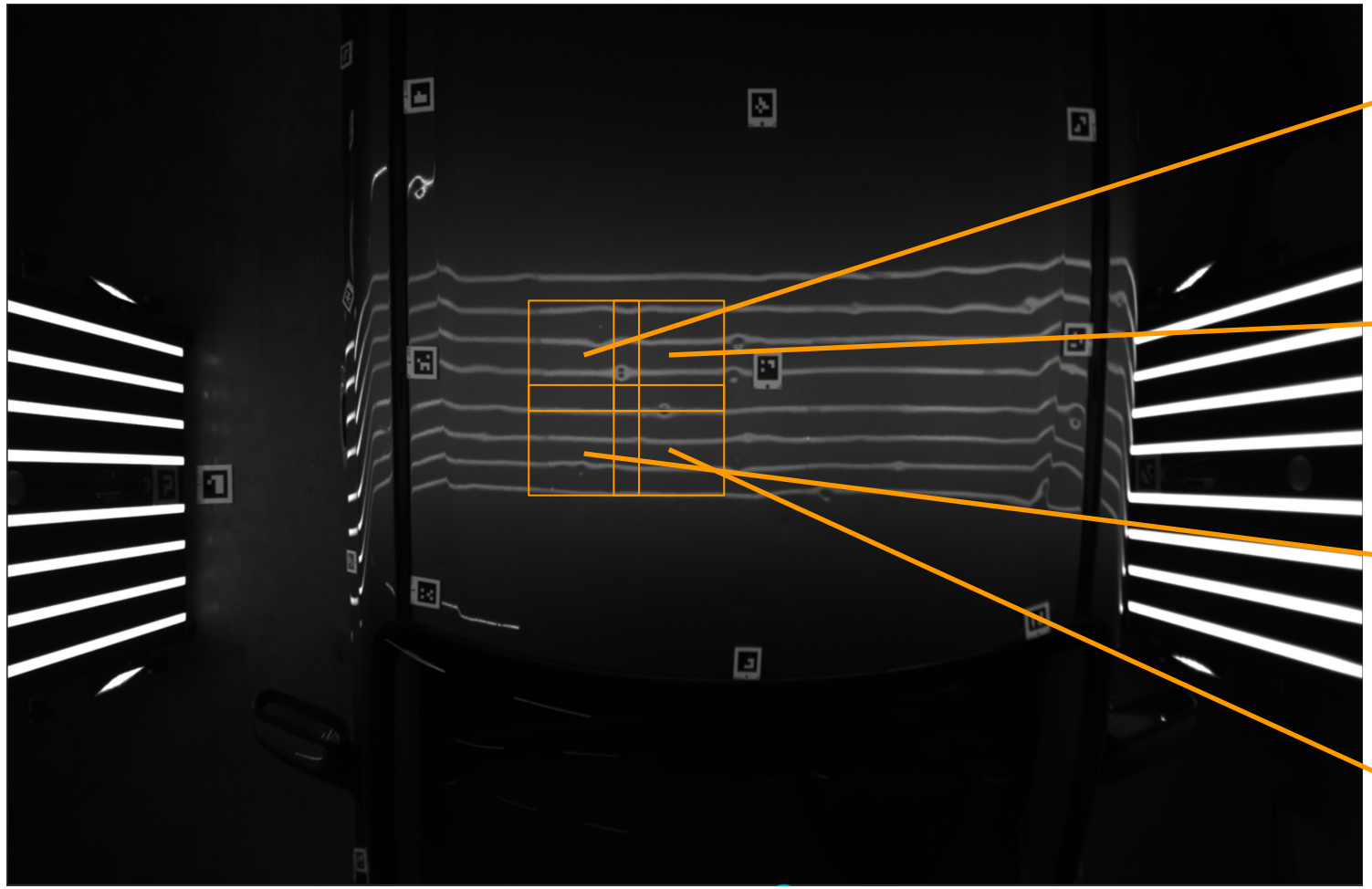
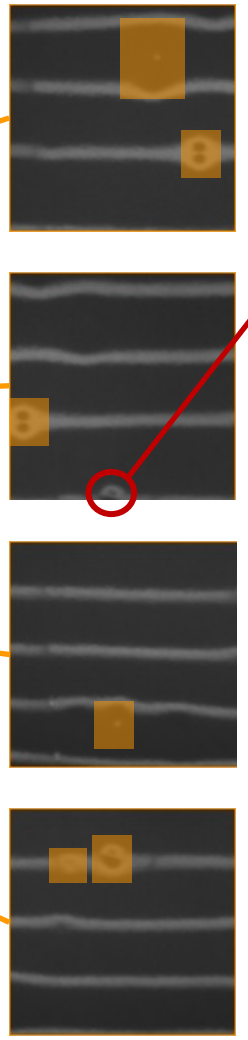
Single frame detection

Fine-tune a pre-trained Faster-RCNN



512x512



Exclude labels on the border

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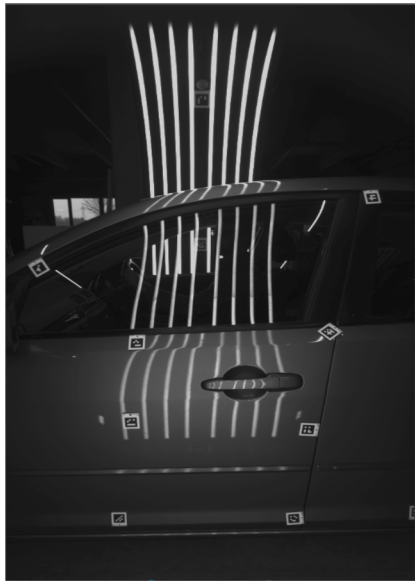
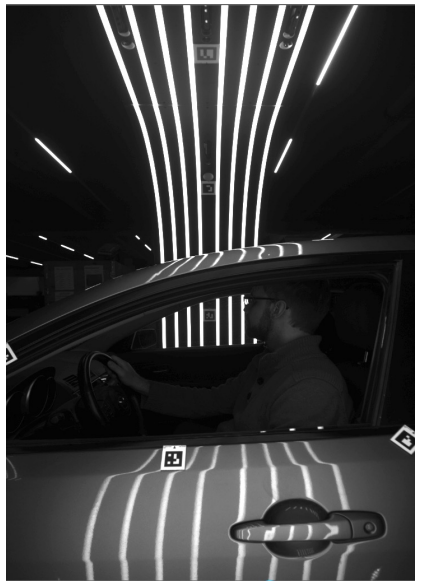
Object Detection Model Evaluation

Challenge: one video per car



Train



Test

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Object Detection Model Evaluation

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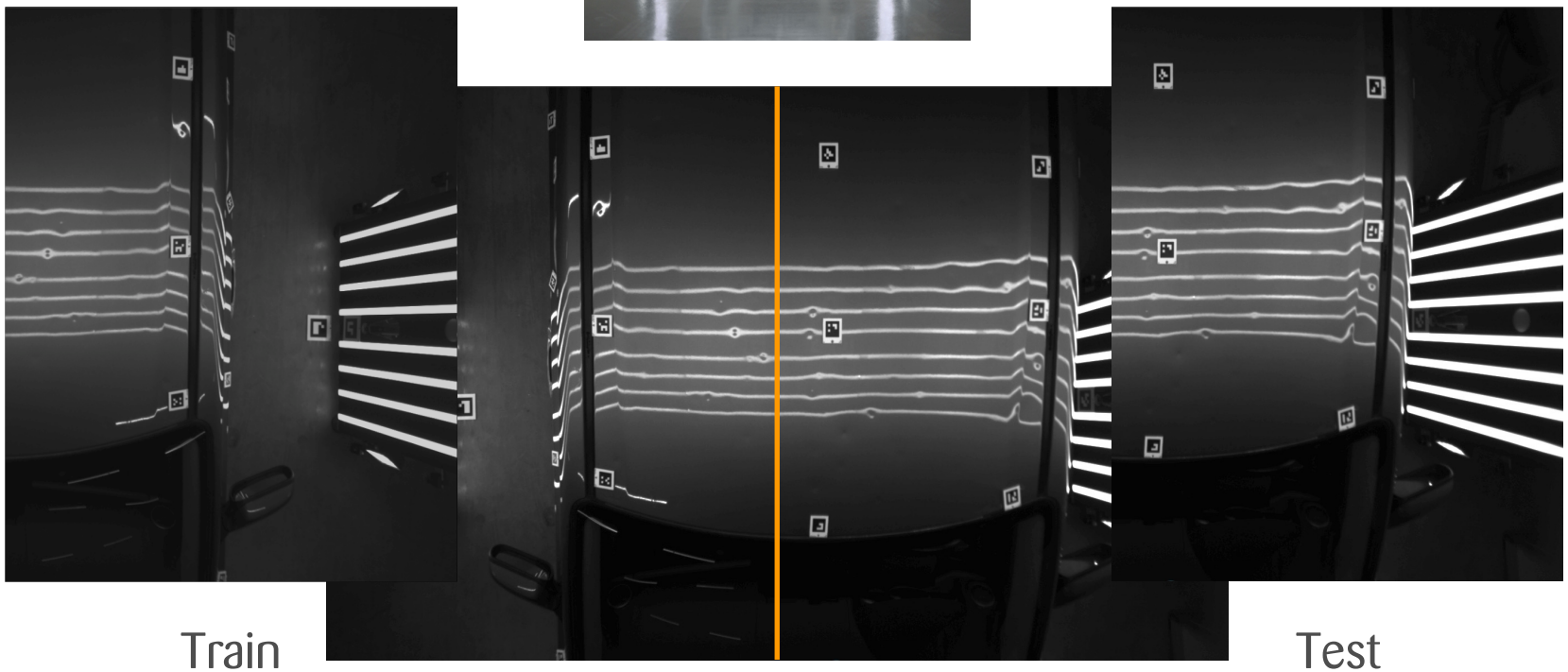
Challenge: one video per car



Train

Test

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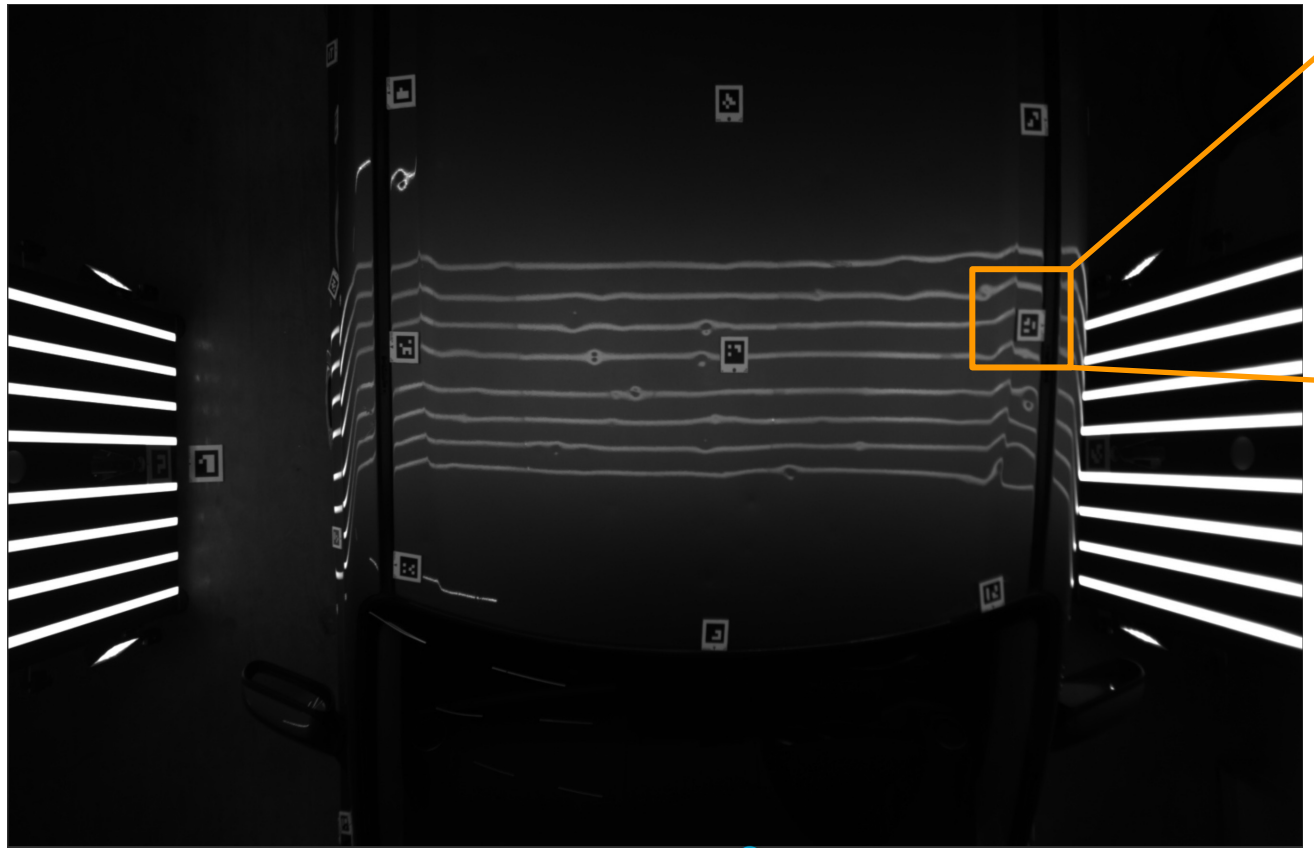
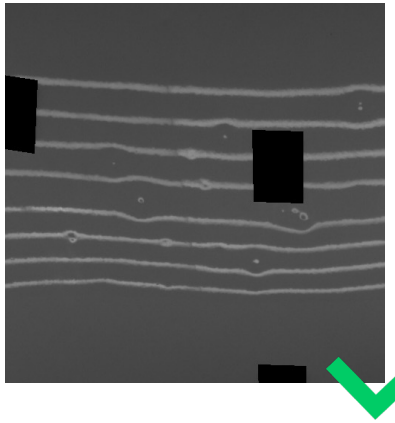
Chunks for training

ArUco markers





Data augmentation:

- Jitter (brightness/contrast/saturation)
- Rotation
- Flip

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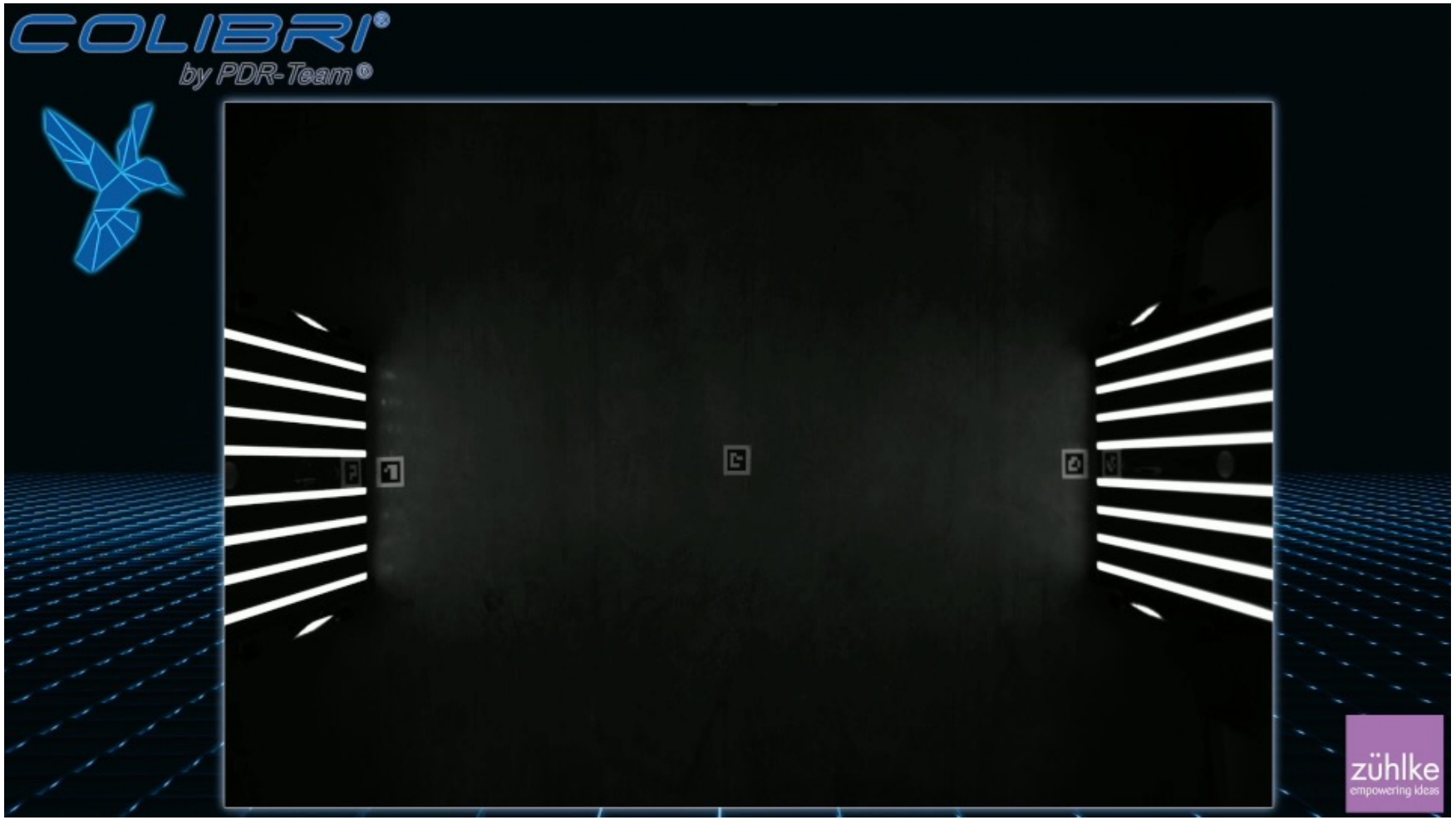
Frame detection output



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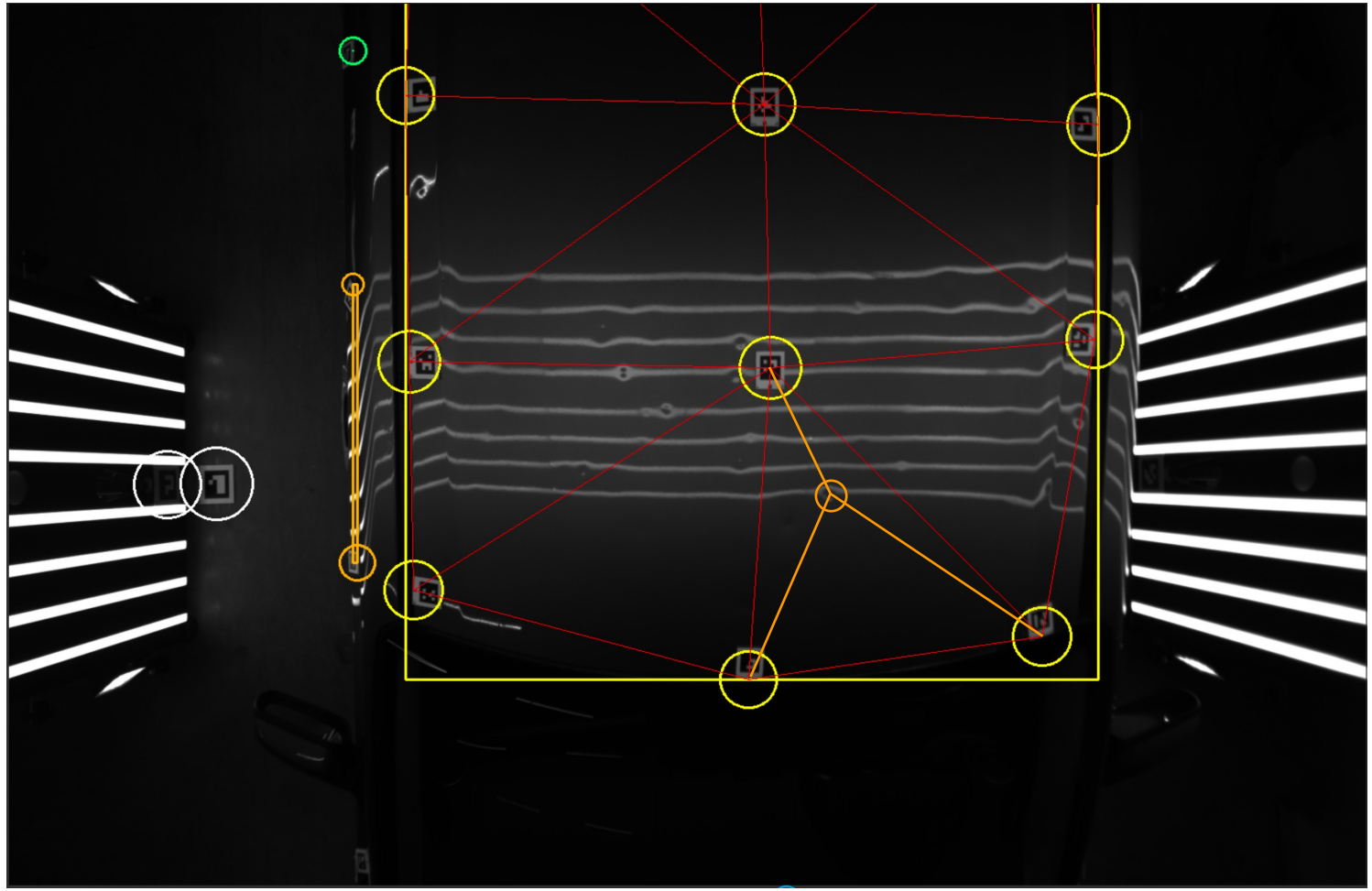
ArUco Markers

Triangulation + distance estimation



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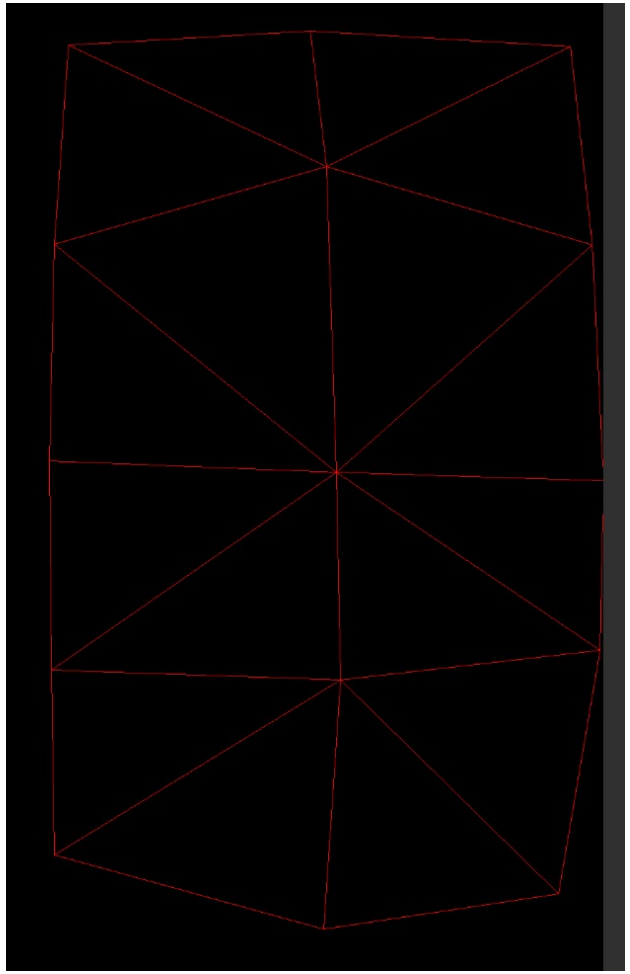
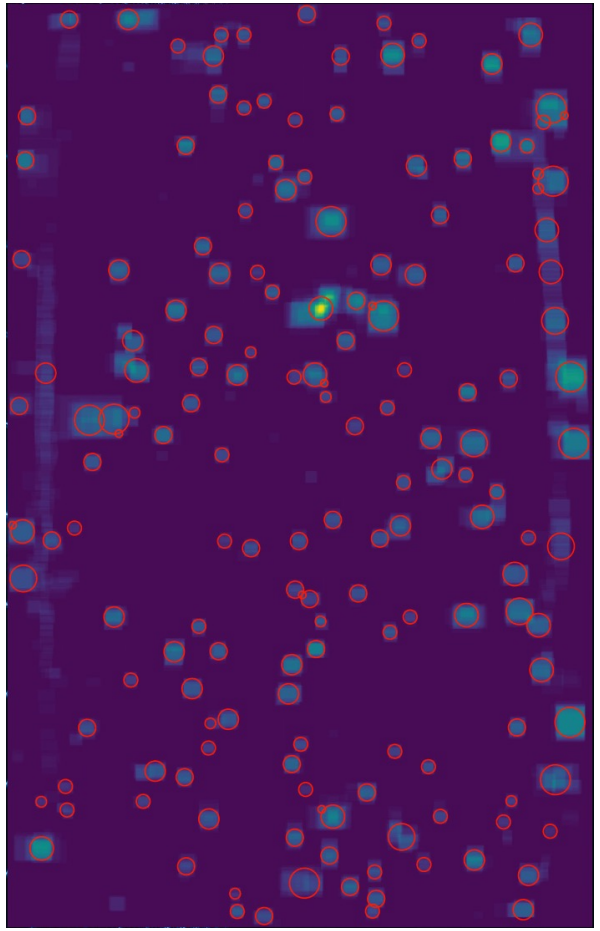
Dent aggregation



Density matrix

Fit blobs



dents estimation: # blobs

dent size: f(size of blobs, size of markers)

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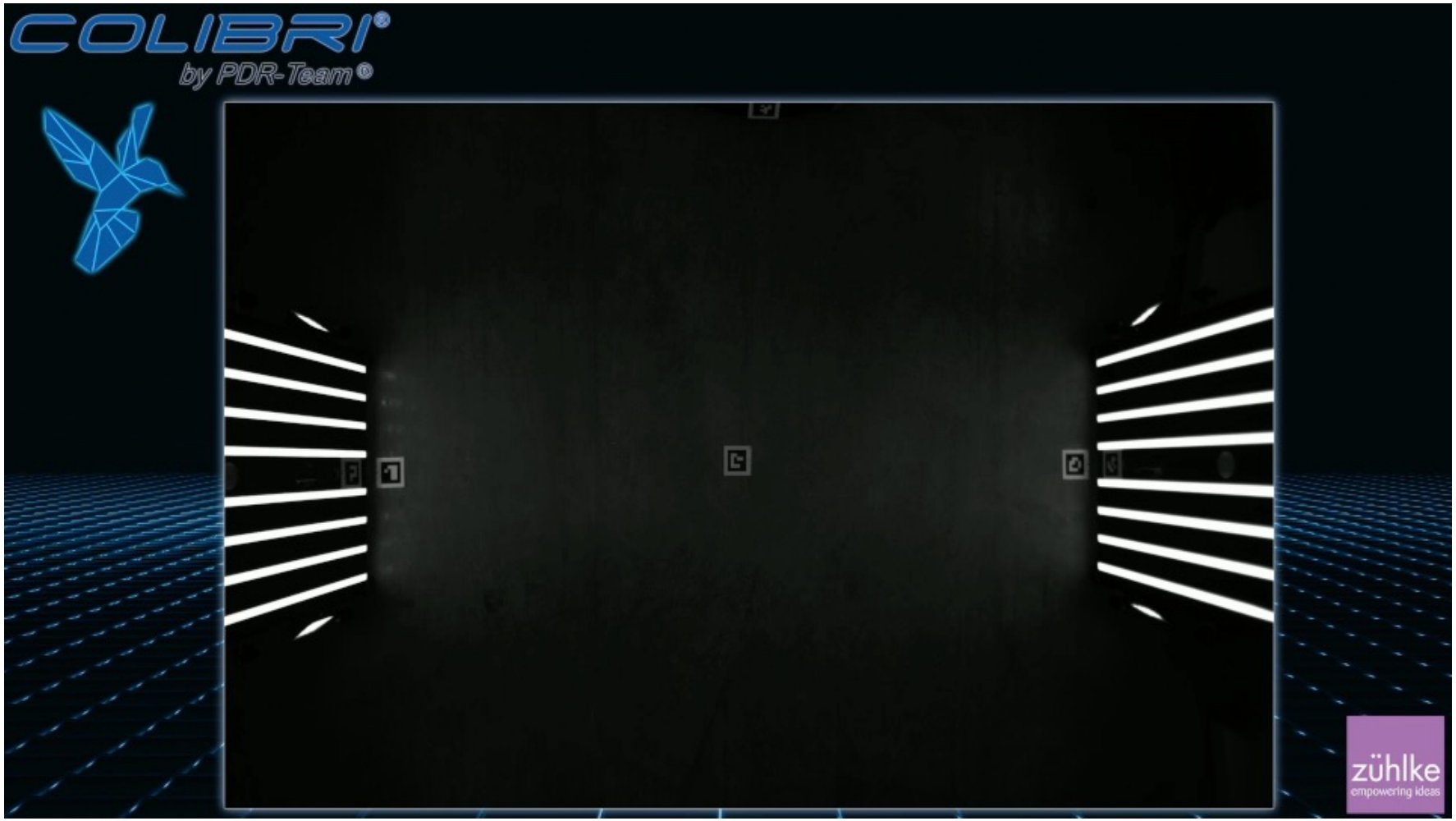
Detections in global coordinate space



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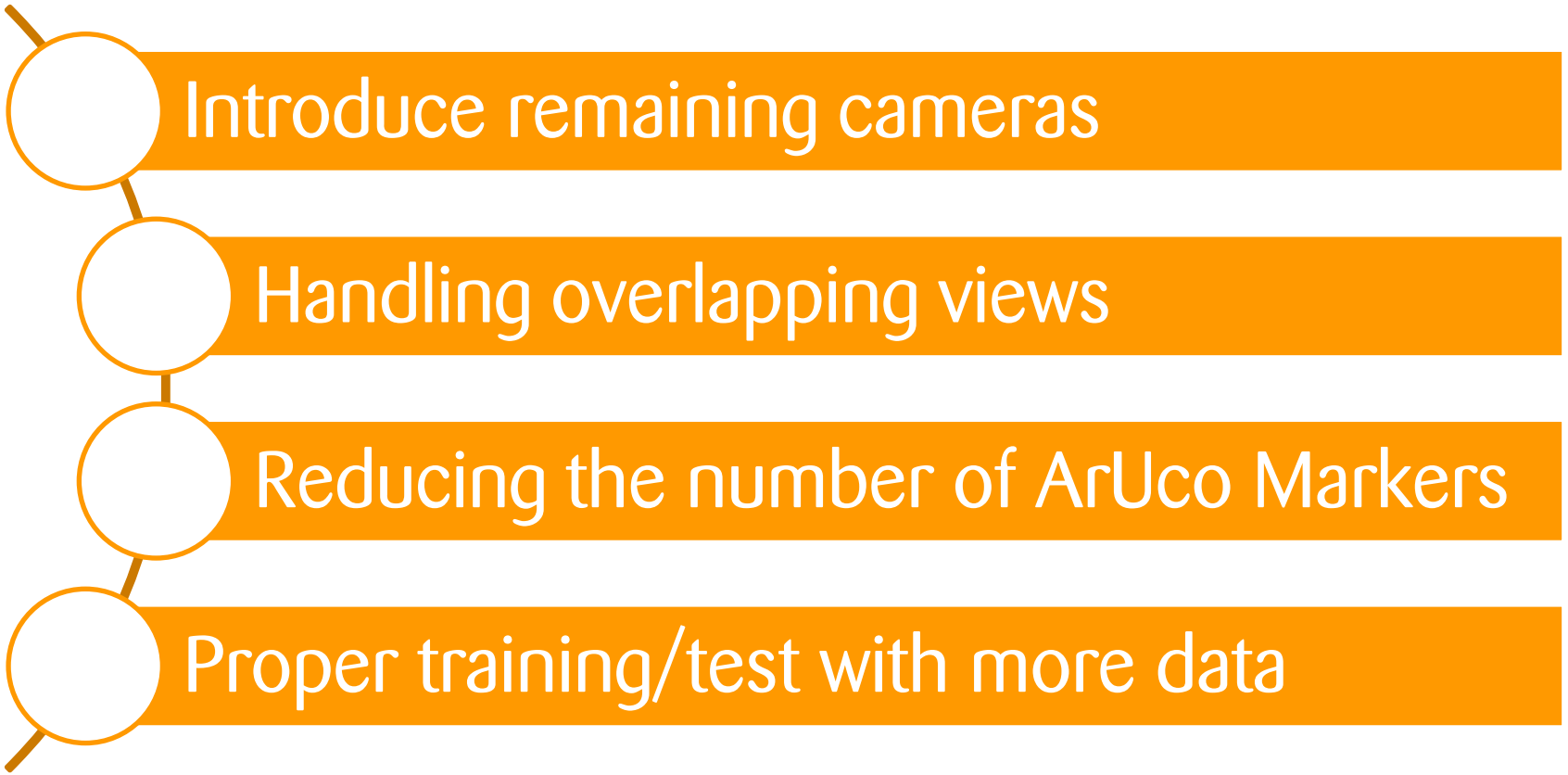
The road ahead…



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Time is key

20 GB of image data per car, 30.000 single images potentially relevant
-> time goal of **5 minutes** to handle **12 cars/hour**

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Complexity can be key

Docker + REDIS = Excellent component testability & scaling potential

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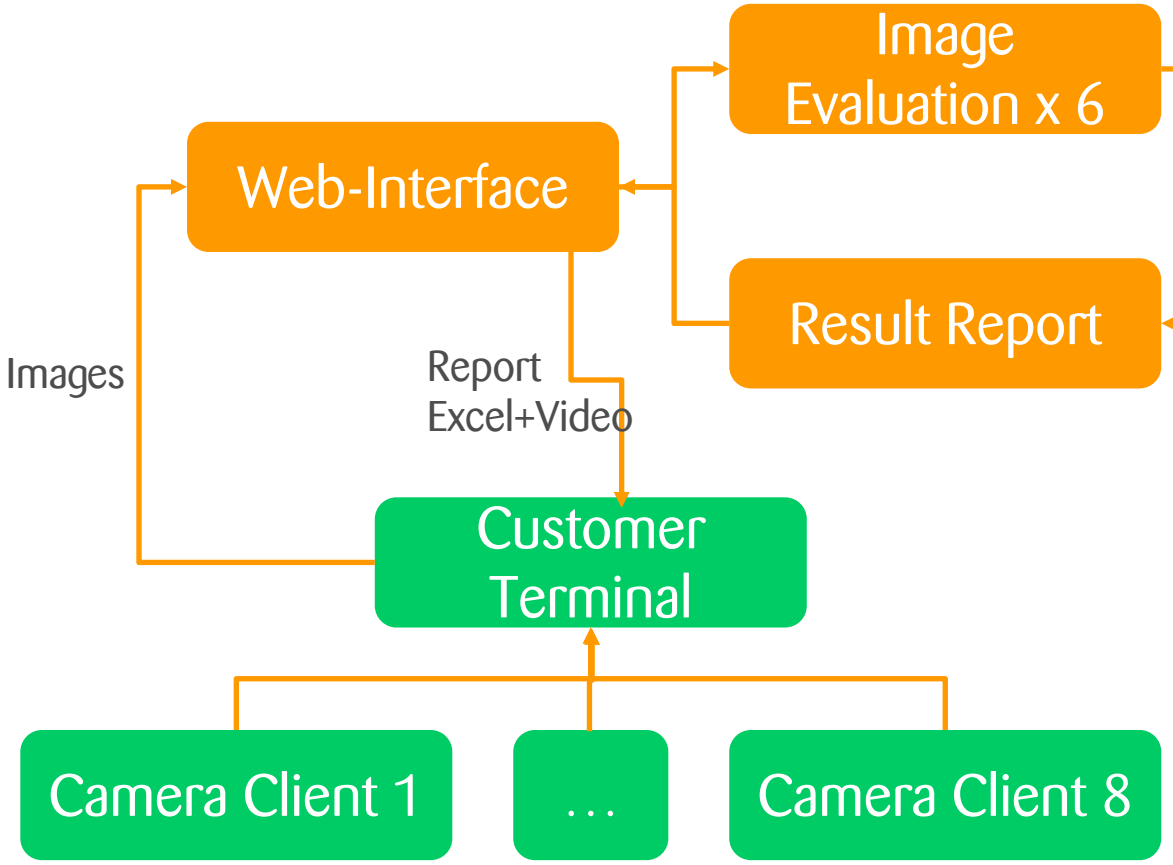

redis

docker compose

docker

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Visualization of aggregated dents

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