



# AISA project

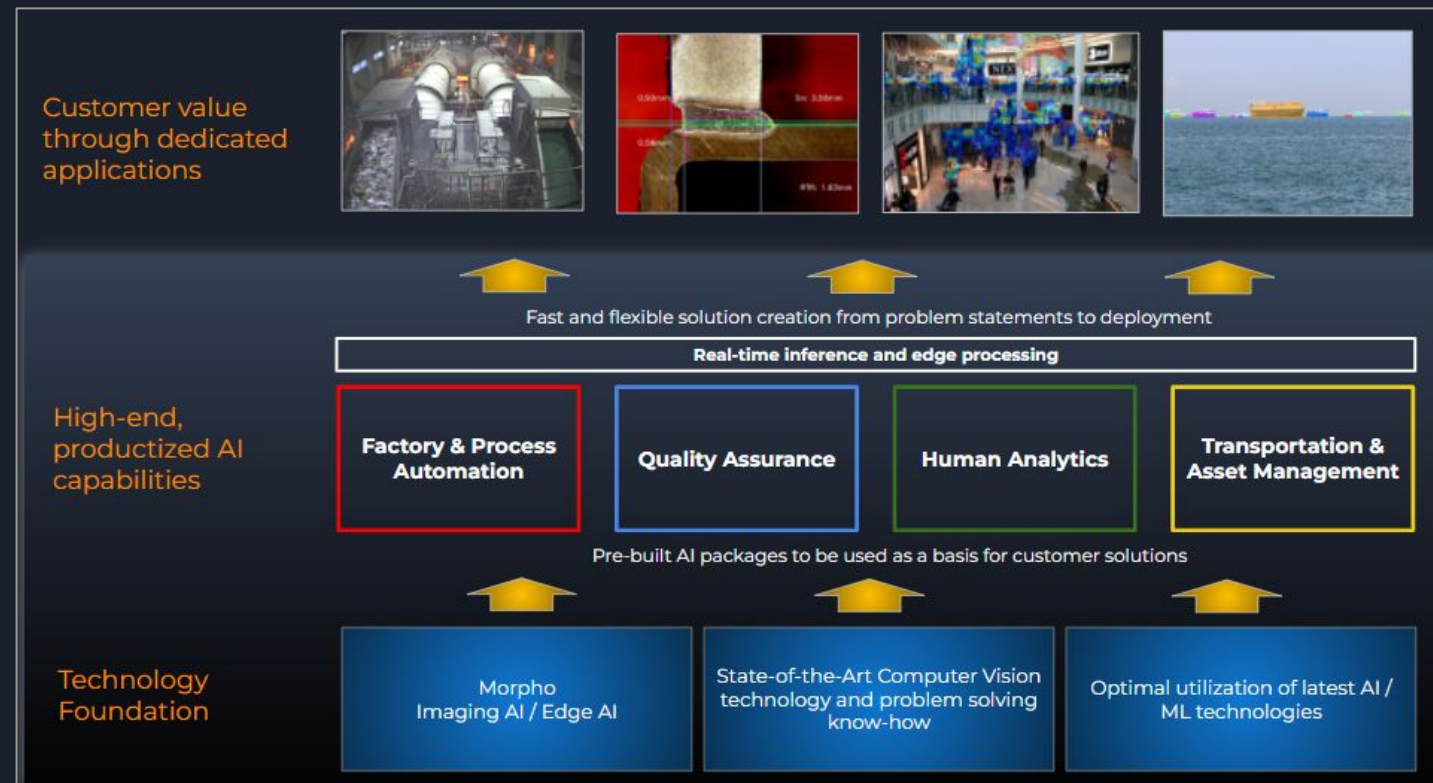
FIF event with AISA project

November 21st 2024

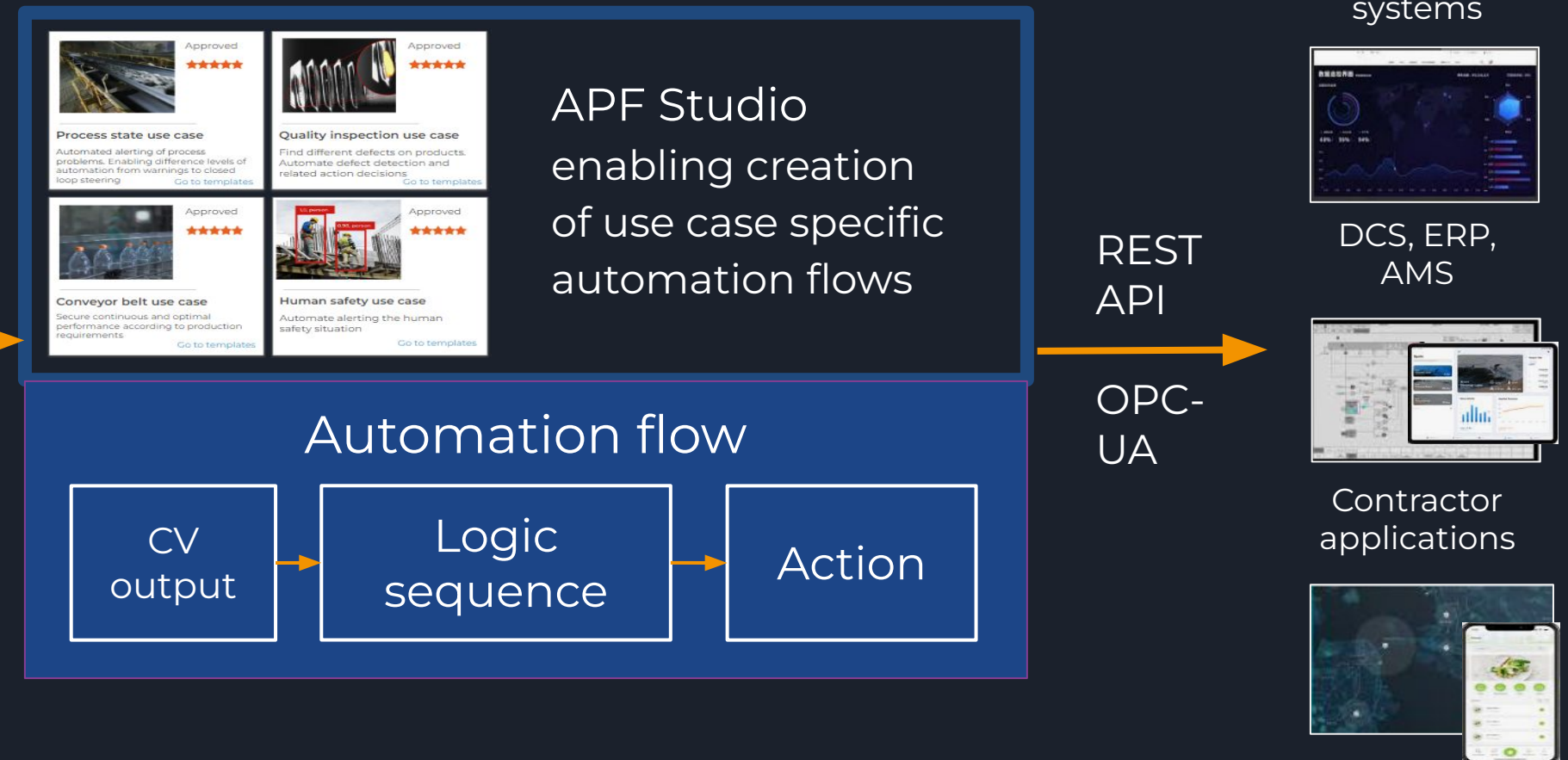
Otto Pulkkinen, Kseniia Khakalo

# Extending the computer vision based automation

## Computer Vision Application Framework



## Action Proposal Framework

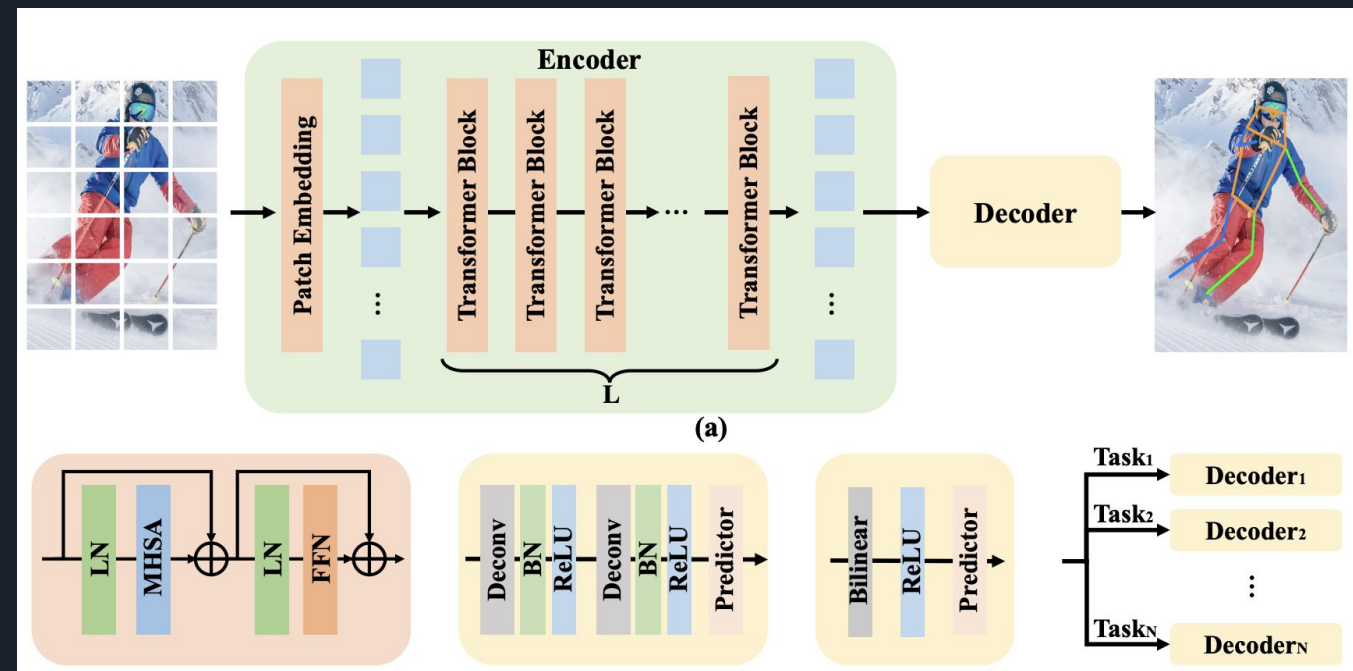


## Technology foundation that enables setting up, operating and maintaining decision automation flows

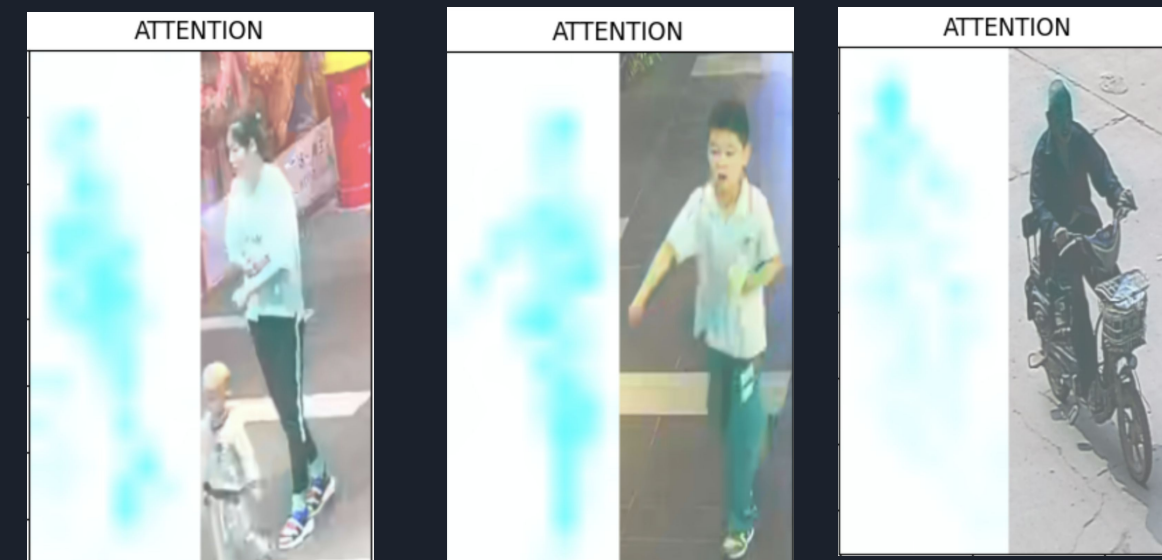
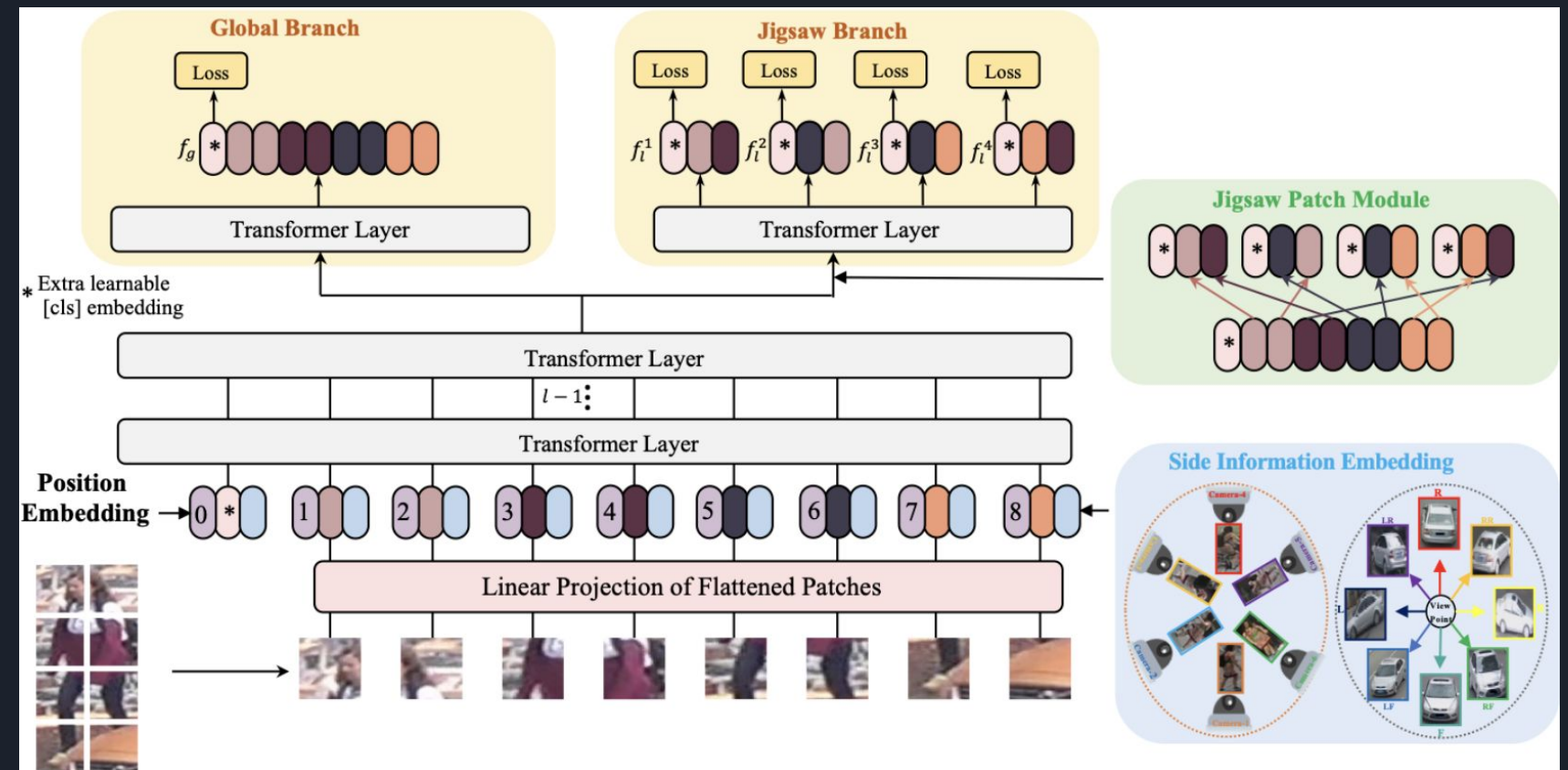
- Primary approach is to extend Computer Vision applications with configurable decision logics
  - E.g. Problem detected by CV application → right action is derived → action proposal is sent to target system
- The overall value will be in providing a solution to build industry specific automation flows in reliable, configurable and scalable manner
- We are collaborating with key customers to steer the development towards verified value creation

# CVAF and Research: Transformers for CV tasks

- ViTPose: SOTA on MS COCO dataset for human pose estimation



- Metric learning for re-identification/ image retrieval

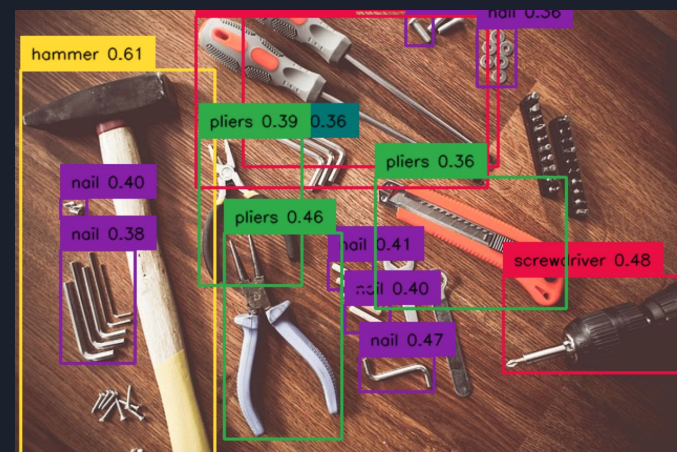
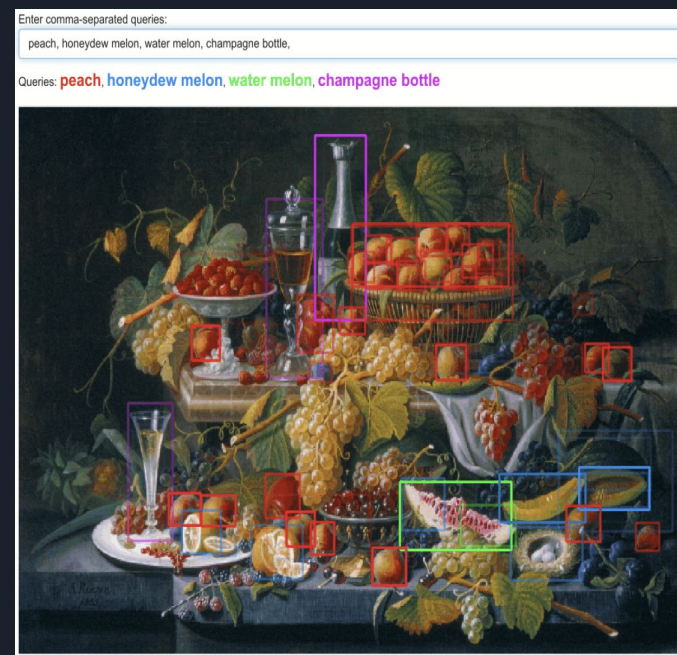


<https://arxiv.org/pdf/2204.12484.pdf>  
<https://arxiv.org/pdf/2304.05884v1.pdf>  
<https://arxiv.org/pdf/2102.04378.pdf>

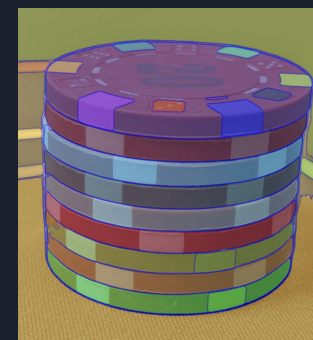
# CVAF and Research: Foundation models

Foundational models are large ML model trained on a vast quantity of data at scale (often by self-supervised learning or semi-supervised learning) such that it can be adapted to a wide range of downstream tasks.

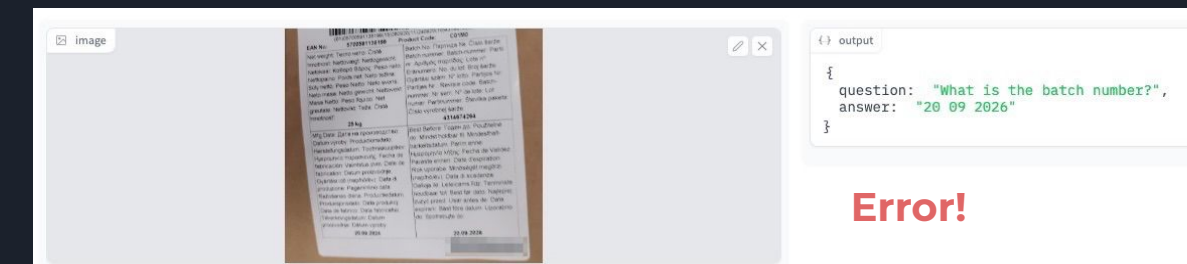
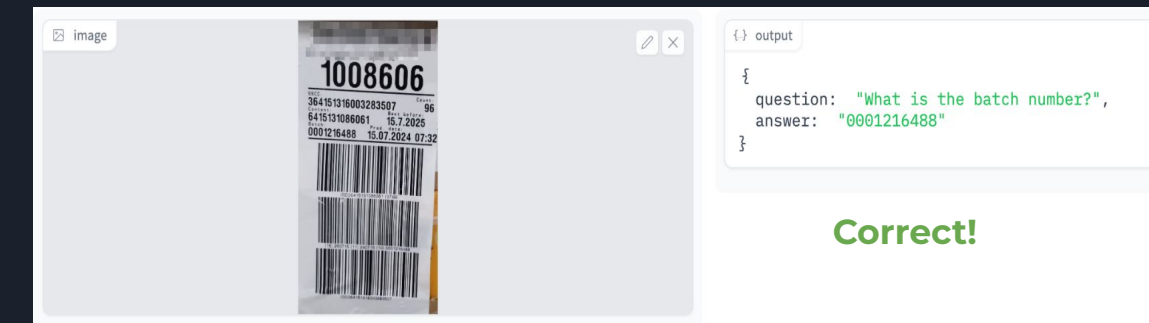
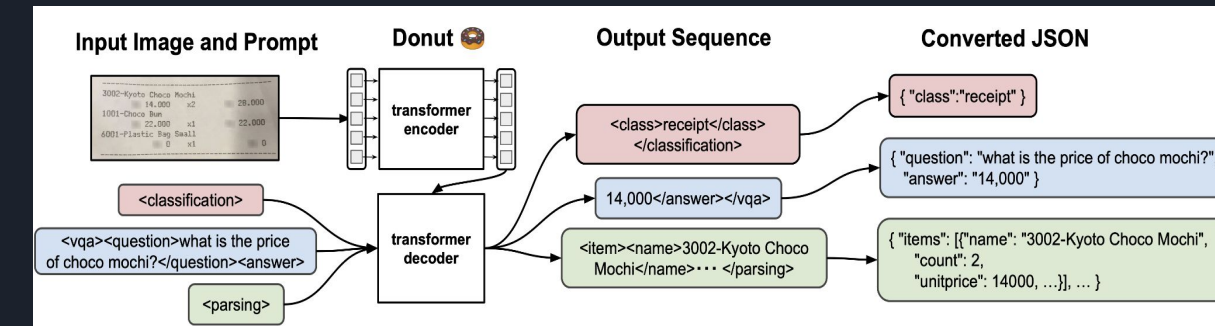
## Open vocabulary object detection: OWL-ViT, Grounding DINO



## Segment anything:

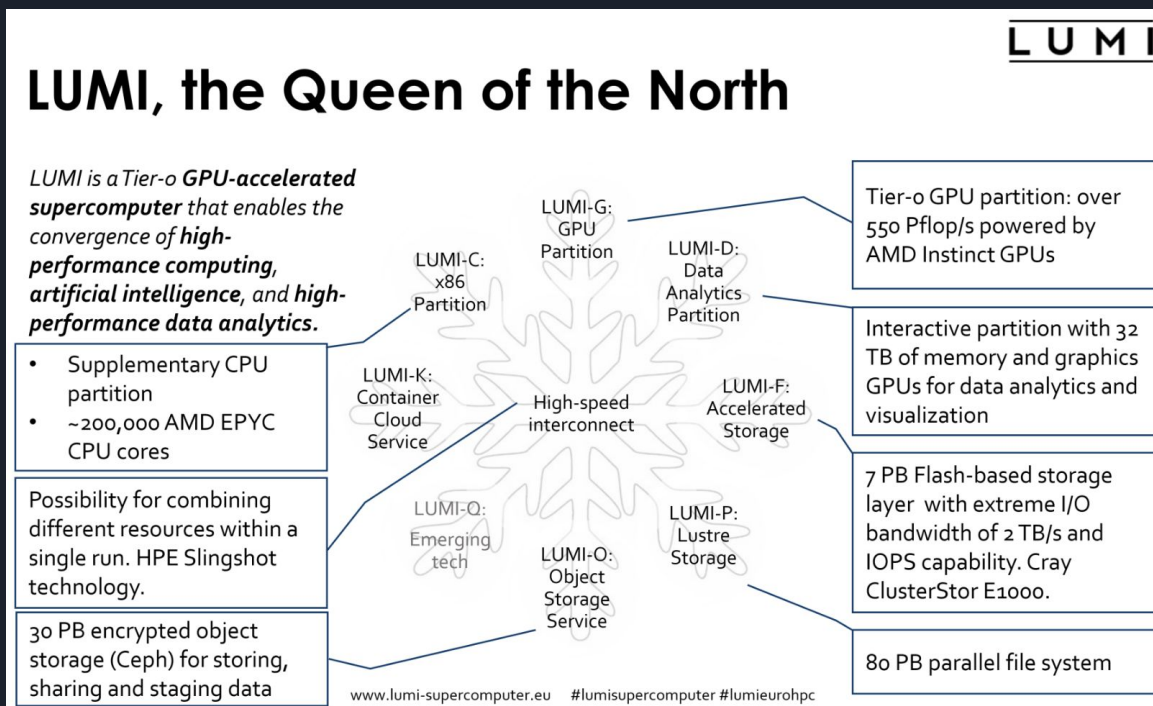


## Document understanding transformer: Donut



- <https://arxiv.org/pdf/2303.05499.pdf>
- <https://arxiv.org/pdf/2304.02643>
- <https://arxiv.org/pdf/2111.15664>

# Experimenting LUMI in ML development



LUMI is a petascale supercomputer located at the CSC data center in Kajaani, Finland.

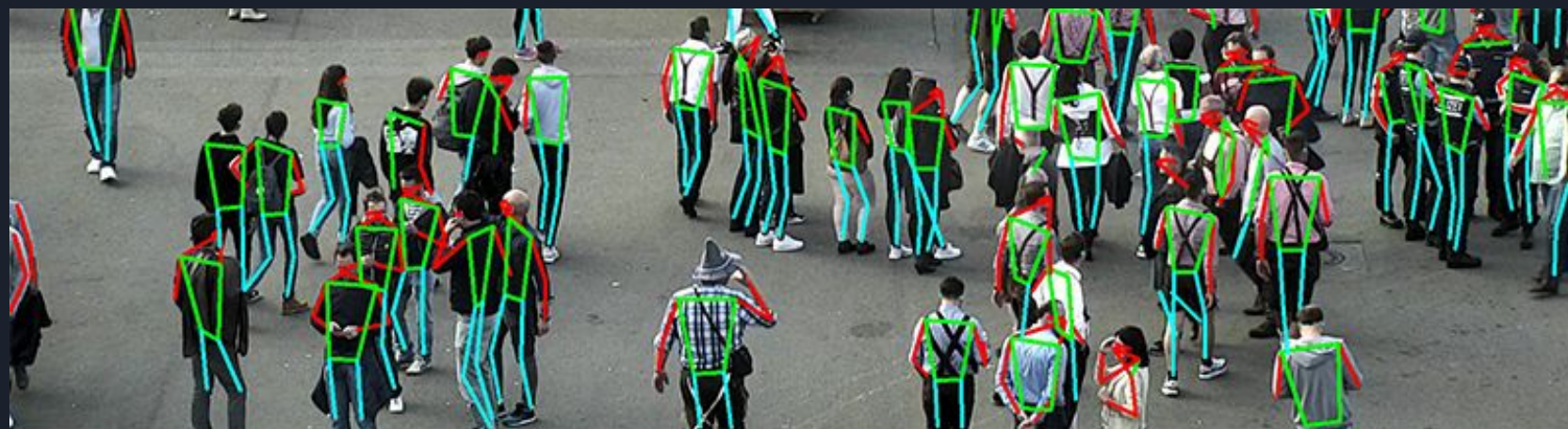
Outcomes:

- Studied how LUMI works
- Outsource tasks which would benefit from massive parallelization
- Run tasks which require running on multiple GPUs in parallel



**Top Data Science received an exciting opportunity to use the LUMI supercomputer**

Use case : Human pose estimation



- For some projects we need to pre-process videos and extract human pose estimation skeletons for further processing
- Having many video clips, this task is easy to parallelize, so Lumi is a good fit for it

<https://csc.fi/en/story/top-data-science-received-an-exciting-opportunity-to-use-the-lumi-supercomputer/>

# 2nd year demo in collaboration with Nokia and Valmet

## Objective:

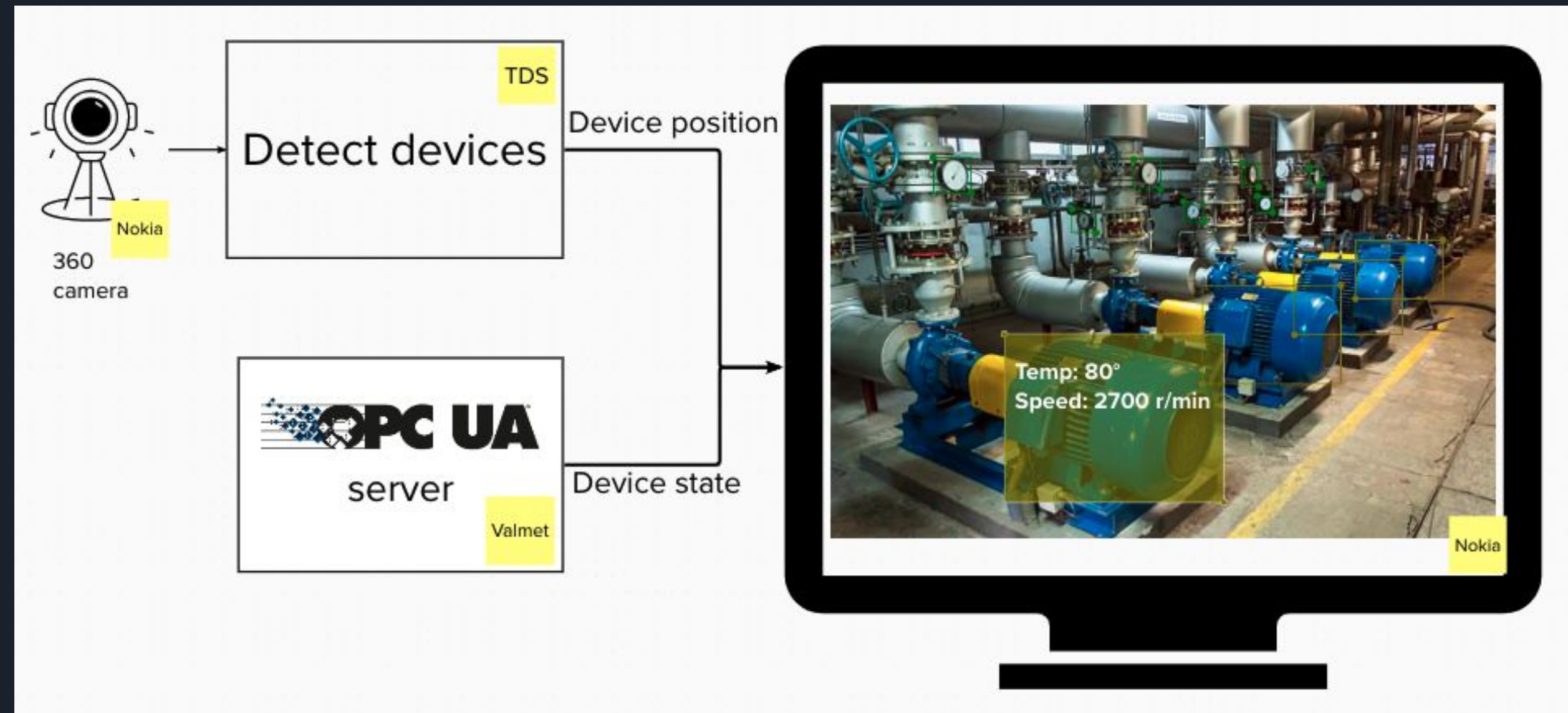
Augment 360° video stream with devices' state info coming from OPC-UA server

## Steps:

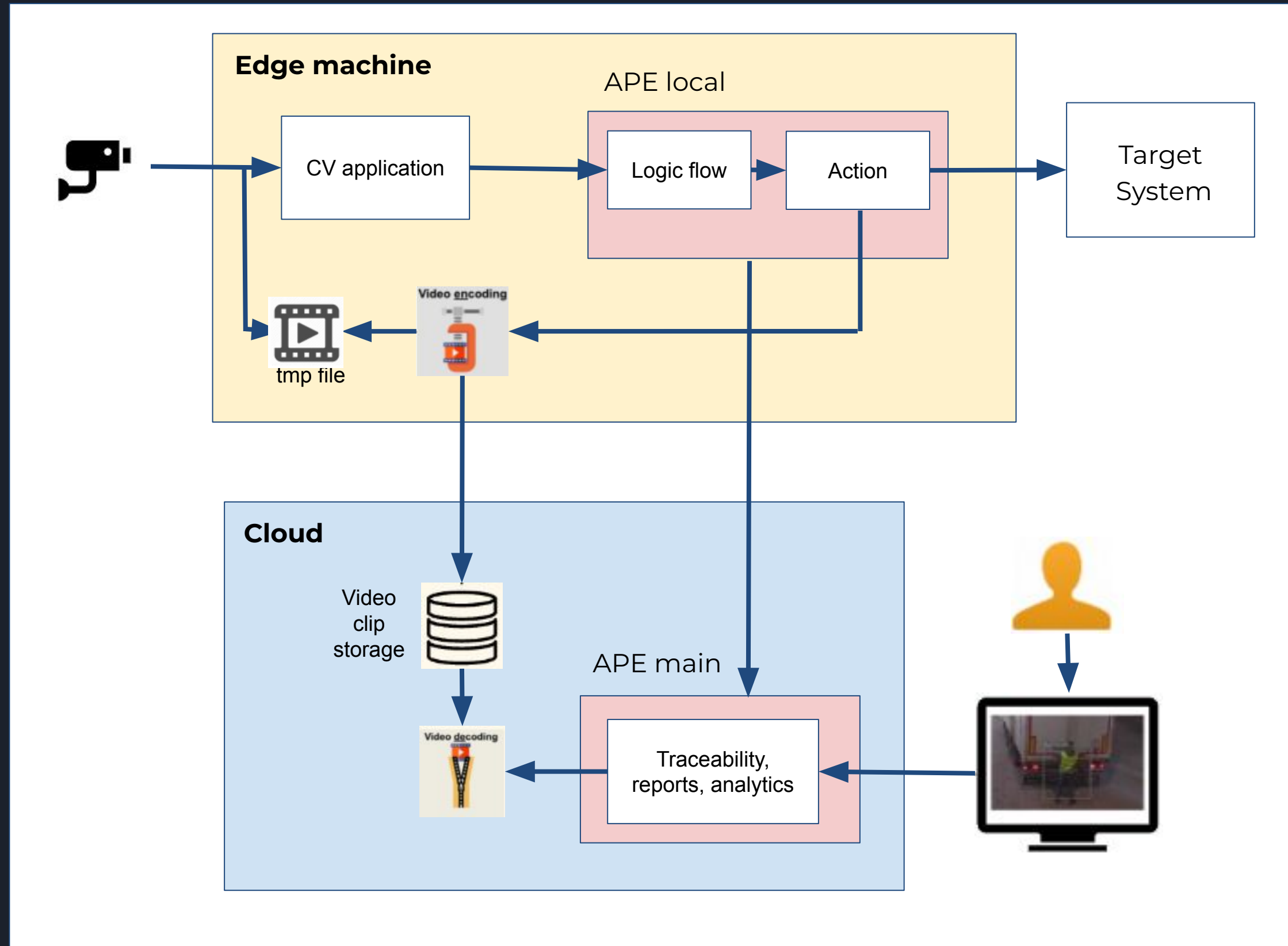
- Detect devices
- Map devices with OPC-UA IDs
- Visualize devices' states

## Our scope and outcomes:

- Computer vision based objects detection
- 360 video videos support
- Package and deploy the solution as a docker image



# 2nd year: co-innovation with Tampere University UVG



## Optimizing the data storage and data transfer while enabling traceability

- Utilizing Region-of-Interest encoding
  - Only data that is relevant will be stored and used
- Storing video clips when an action is triggered
  - Most of the time "nothing is happening"
  - Revert back the video → store a video clip preceding triggering event
- Automation is run locally, but the event analysis based on action & video data is done centrally, and in the cloud

## Benefits:

- Costs savings in data storage and transfer
- Faster event analysis based on only relevant data
- Support for operations development

# 3rd year demo: unsupervised quality assurance

## Objective:

Automated, unsupervised anomaly detection with affordable hardware and straightforward setup

## Steps:

- Camera perspective correction
- Object segmentation
- Object diameter measurement
- Anomaly detection

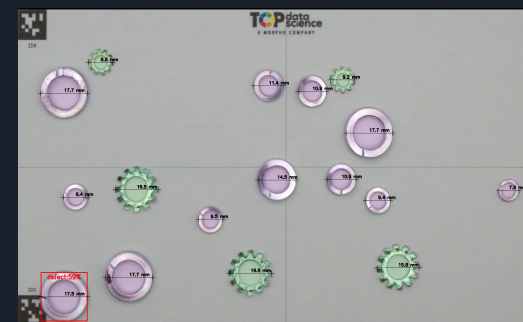
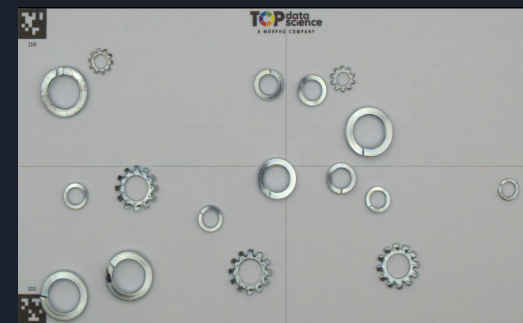
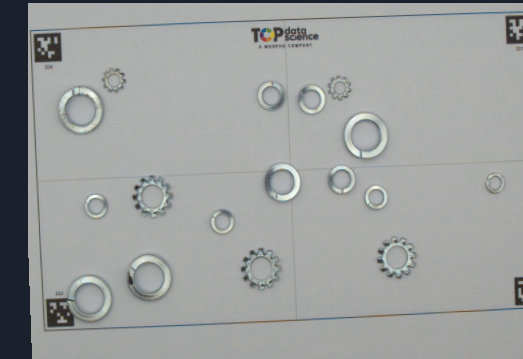
## Scope and outcomes:

- Robust, real-time anomaly detection
- Inexpensive industrial camera
- Edge computing platform
- Annotated video stream output



BASLER  
INDUSTRIAL  
CAMERA

Video processing



Computer vision  
algorithm  
pipeline

Standard interfaces

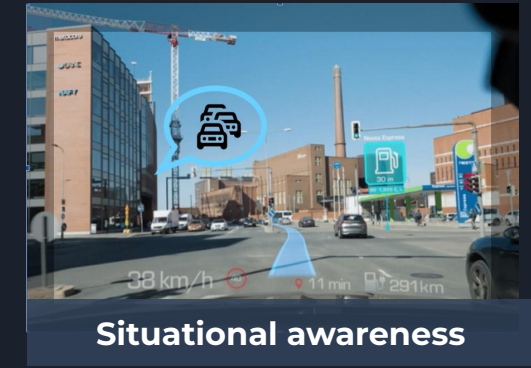
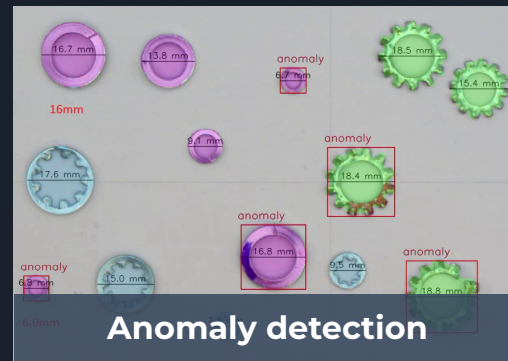
Visit the demo stand to see more!

JETSON ORIN EDGE COMPUTER



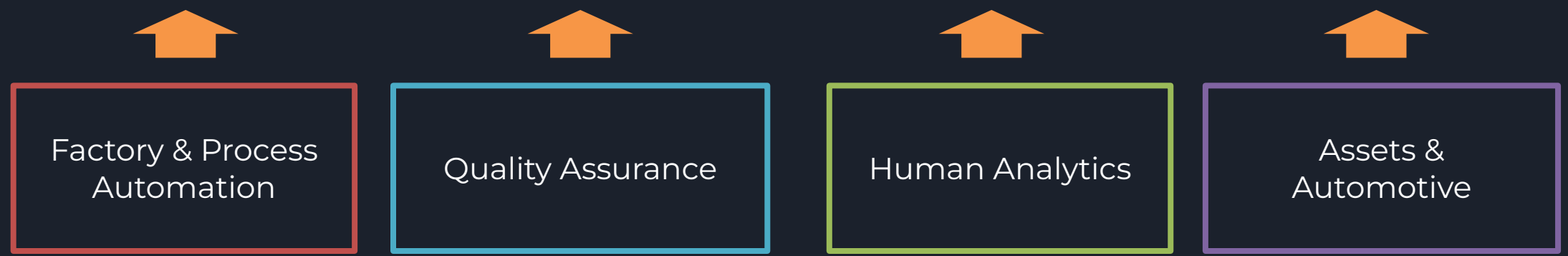
# R&D outcomes: Computer Vision Framework

Customer value through specific use cases



Fast and flexible delivery from problem statements to deployment

Speciality areas



Computer Vision Application Framework

Core competencies

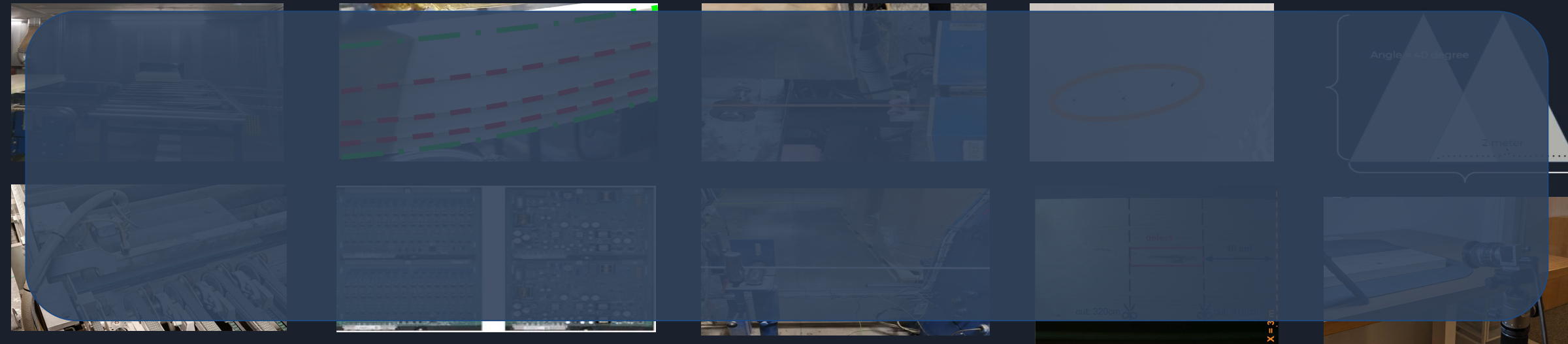


Continually enhancing our capabilities by delivering customer value

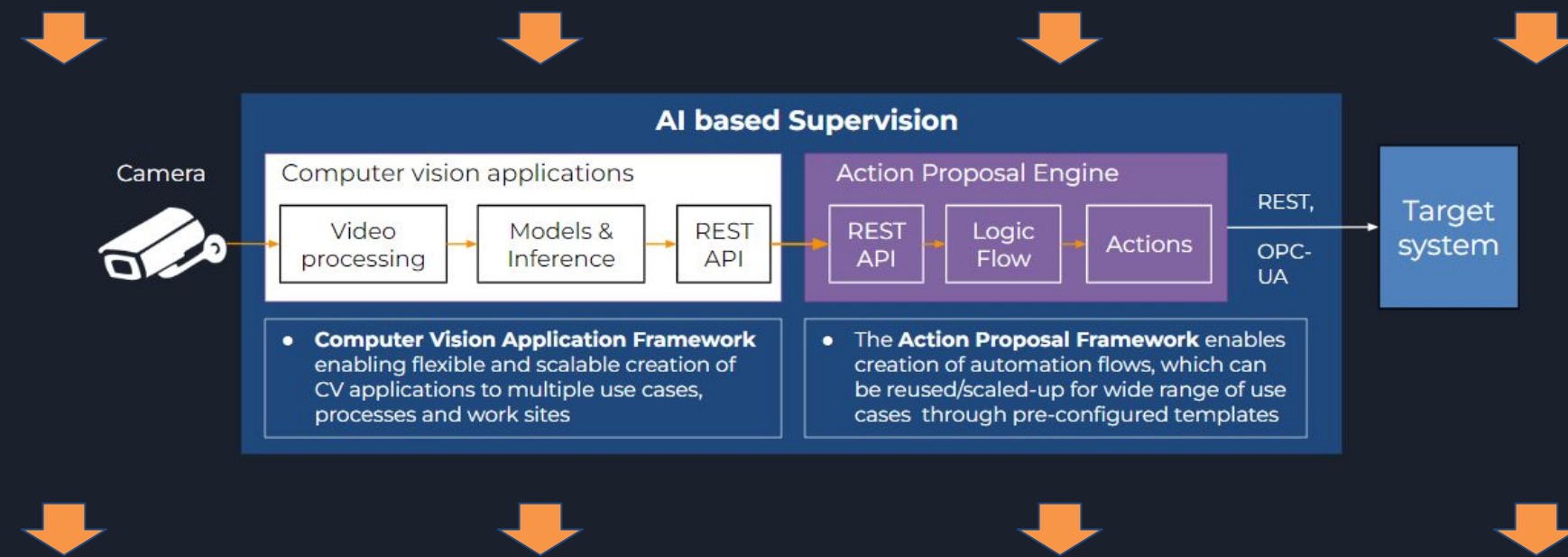


# Extending the automation support: Industrial Quality Assurance

Industrial quality assurance use cases



AI based automation technology frameworks



Value drivers & customer benefits

-  Significant cost and time savings through quality inspection automation
-  Improved quality through more standard quality assurance process
-  Reduced risks and liabilities through improved quality
-  Improved compliance and traceability

# Thank you!

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