EUROPEAN COMMISSION
Community Research

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SCOVIS

COGNITIVE SYSTEMS ROBOTICS

SEVENTH FRAMEWORK PROGRAMME

Self-Configurable Cognitive Video Supervision

Grant agreement No: *216465*

Project summary

SCOVIS will significantly improve the versatility and the performance of the current monitoring systems for security purposes and workflow control in critical infrastructures. The resulting technology will enable the easy installation of intelligent supervision systems. SCOVIS supports the automatic detection of a) behaviours, b) workflow violation and c) localization of salient moving or static objects in scenes, monitoring by multiple cameras (static or active). The project investigates weakly supervised learning algorithms and self-adaptation strategies for analysis of visually observable workflows and behaviours. Camera network coordination is also supported so that complex behaviours can be identified as combination of spatio-temporal object relations in multiple scenes. SCOVIS supports *self-configuration* (system is able to automatically calculate the camera spatial relations) and *adaptation* (the models are automatically enriched through time via online data acquisition and unsupervised learning strategies). User's interaction is also foreseen for improving the behaviour detection through relevance feedback mechanisms.

S&T Objectives

- A methodology for largely unsupervised learning of salient objects, implemented as an open architecture
- A methodology and an open architecture for large-scale camera networks
- A toolkit for weakly supervised learning and object detection
- A toolkit for behaviour analysis
- A toolkit for adaptation mechanisms
- A toolkit for camera network coordination
- An integration testbed for demonstrating all above toolkits and the benefits of the proposed synergies

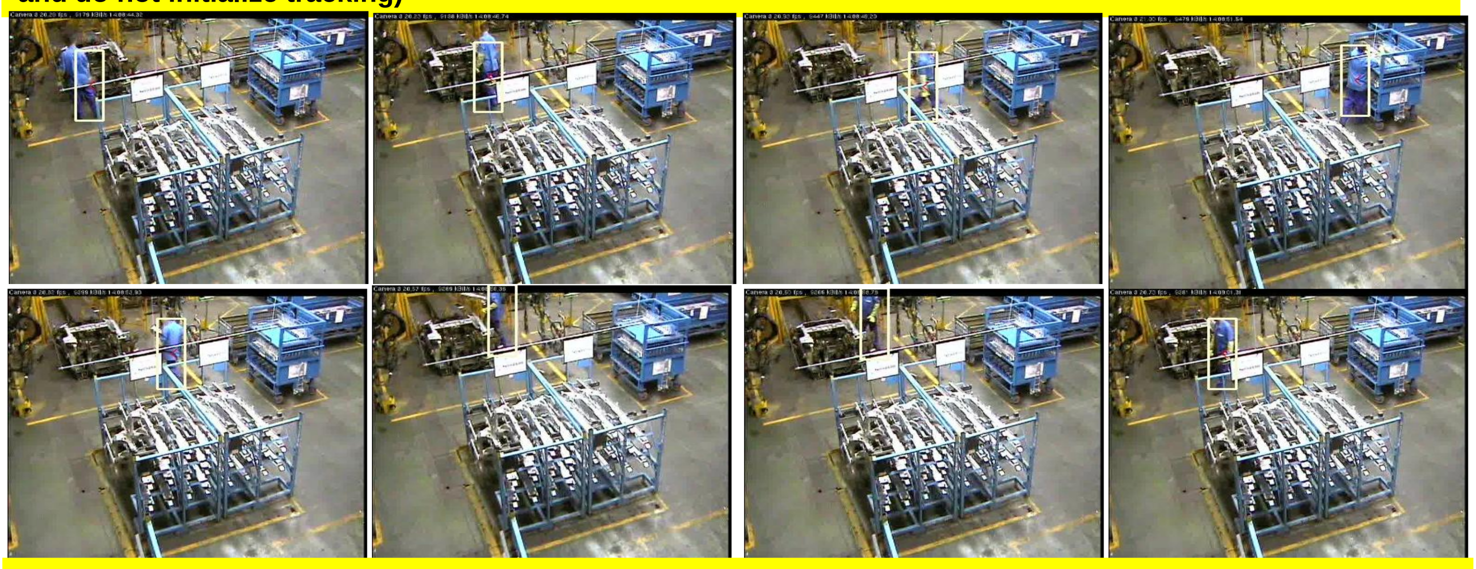
WP1 Weakly supervised learning and object detection

Task 1.1 Definition of Generic Descriptors
Task 1.2 Learning and detection of static object categories
Task 1.3 Learning, Detection and Tracking of Moving Objects
Task 1.4 Attention models

✓Improved detection and tracking with automatic scene adaptation
✓Occlusion handling in crowded scenes

Person detection results (shown in orange) initialize and reinforce tracking (shown in red).

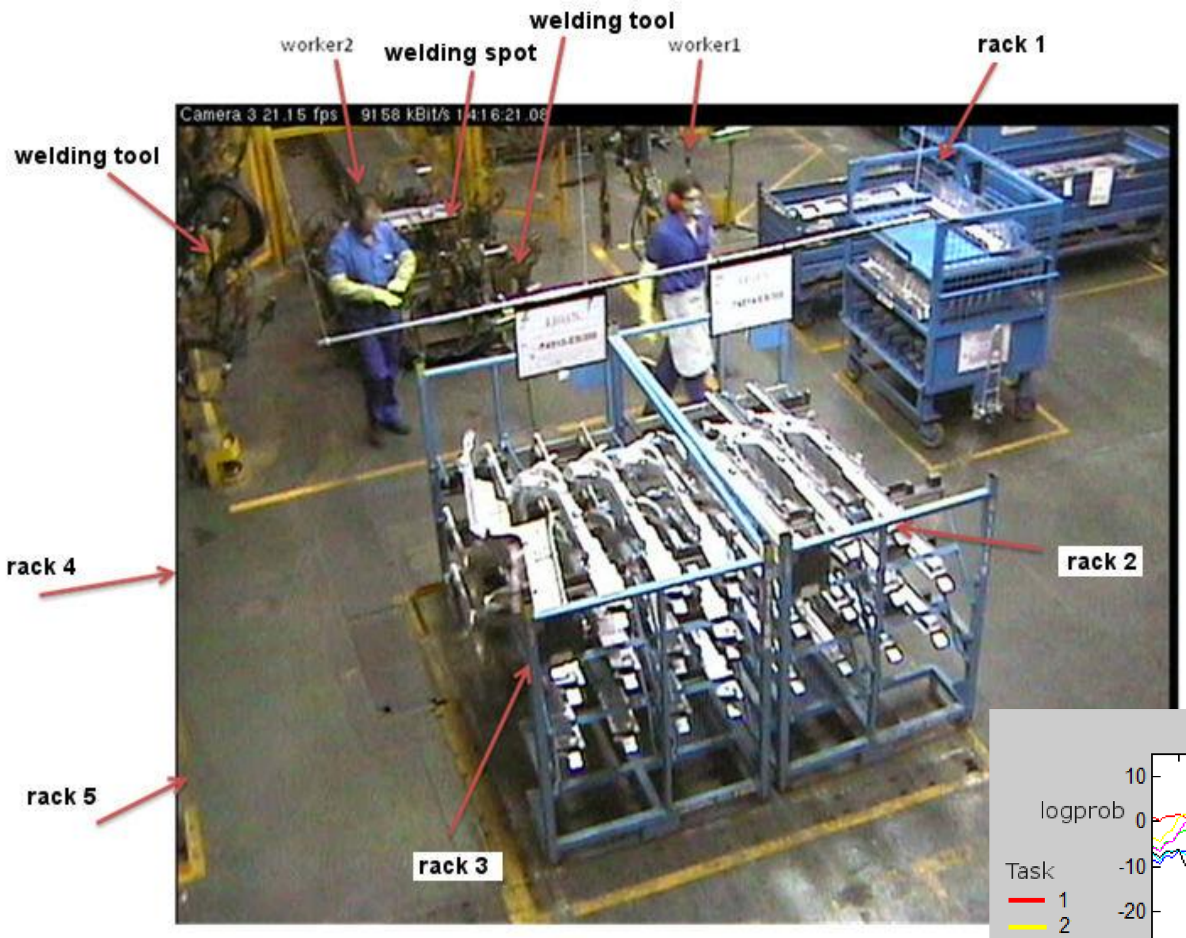
Typical tracking results which feed the local classifier grids (Detections at wrong scales are ignored and do not initialize tracking)



Performance of the Tracker Grid algorithm on SCOVIS data

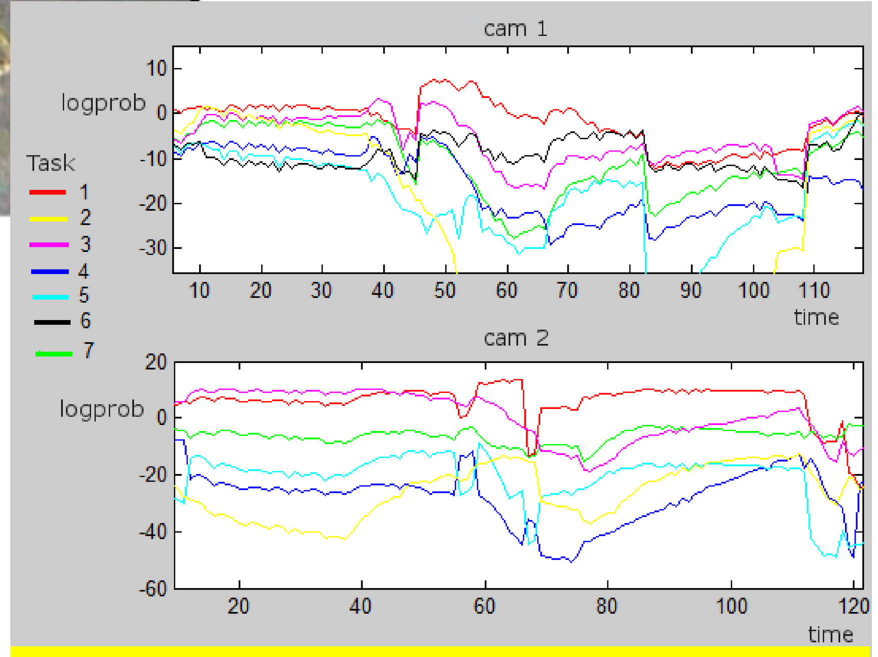
WP3 Behaviour analysis

Task 3.1 Workflow learning and recognition for a single agent
Task 3.2 Workflow learning and recognition for multiple agents
Task 3.3 Workflow disambiguation



WORKFLOWS' TASKS

1. One worker picks part #1 from rack #1 and places it on the welding cell.
2. Two workers pick part #2a from rack #2 and place it on the welding cell.
3. Two workers pick part #2b from rack #3 and place it on the welding cell.
4. A worker picks up parts #3a and #3b from rack #4 and places them on the welding cell.
5. A worker picks up part #4 from rack #1 and places it on the welding cell.
6. Two workers pick up part #5 from rack #5 and place it on the welding cell.
7. Welding: two workers grab the welding tools and weld the parts together.

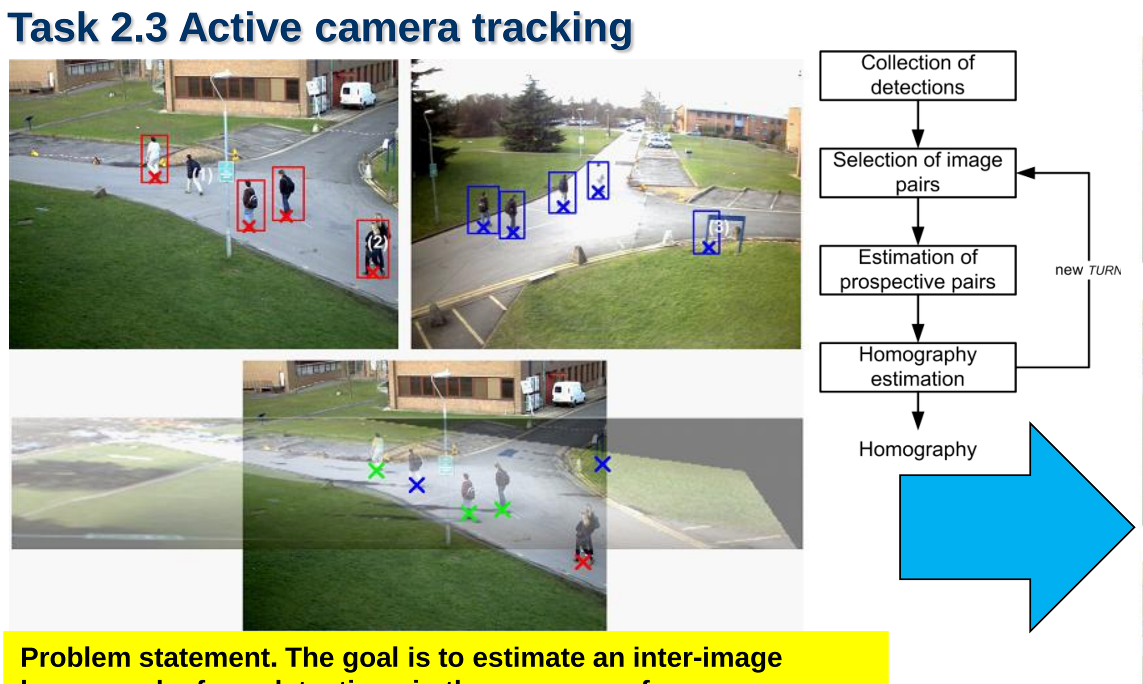


Workflow tasks recognition

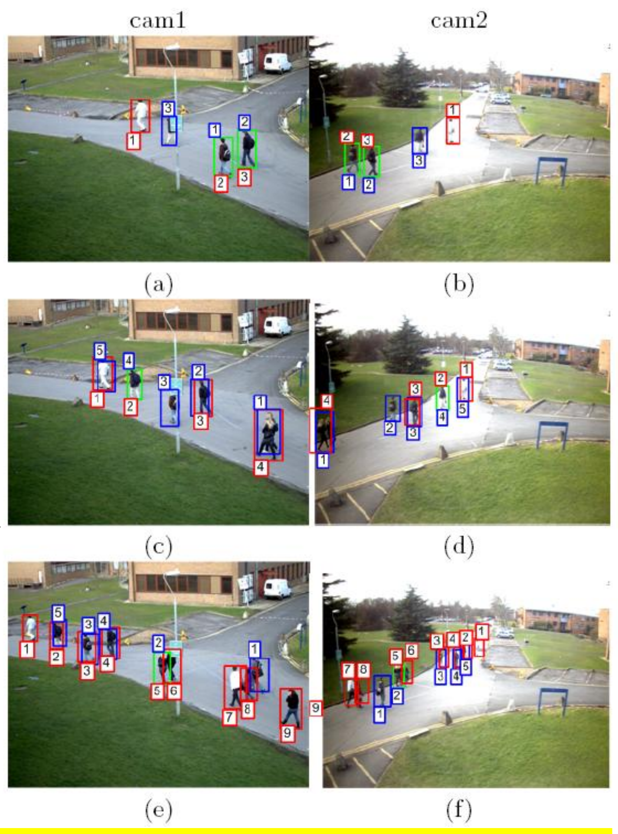
✓ Real time task recognition
✓ Hidden Markov Models tolerant to noise
✓ Fusion from multiple cameras

WP2 Intelligent algorithms for camera network coordination

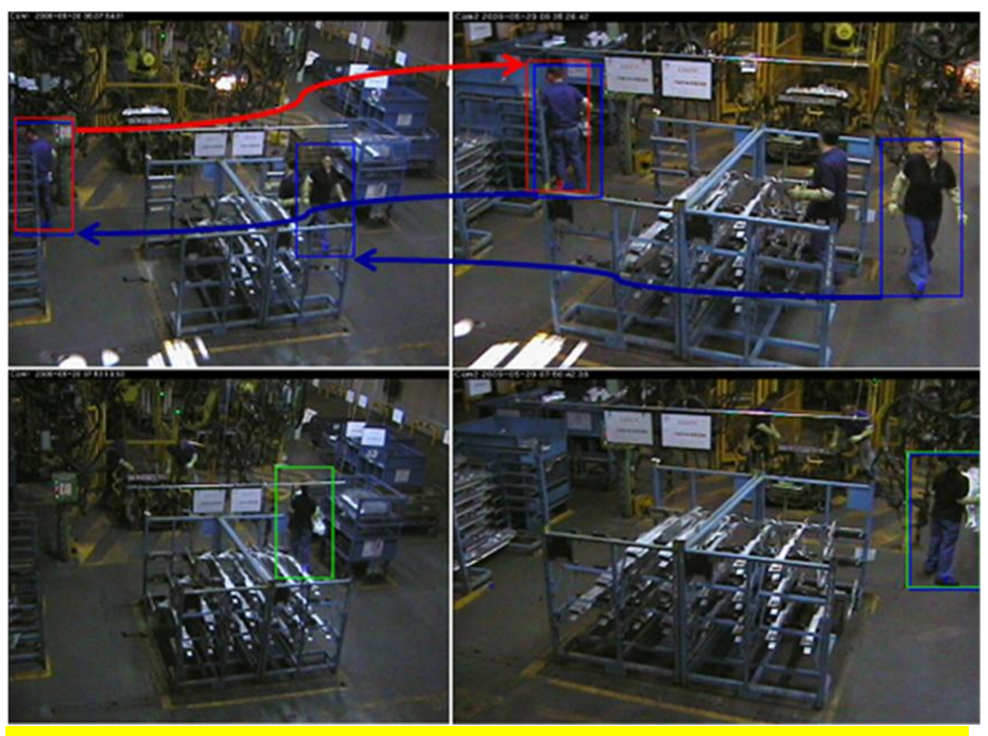
Task 2.1 Consistent monitoring across cameras with overlapping views
Task 2.2 Consistent monitoring across cameras with disjoint views
Task 2.3 Active camera tracking



Problem statement. The goal is to estimate an inter-image homography from detections in the presence of error sources: missed detections (1), field of view (2), and false detections (3).



Three different synchronized image pairs from PETS 2009 after collection of detections and selection of image pairs. Detections in cam1 are indicated by a red box and label at the bottom. Detections in cam2 are shown in blue. The boxes in green denote the 4 estimated prospective correspondences from which a homography is calculated. Based on this homography the detections are projected to the opposite view, identified by bounding boxes with opposite color and with labels on top



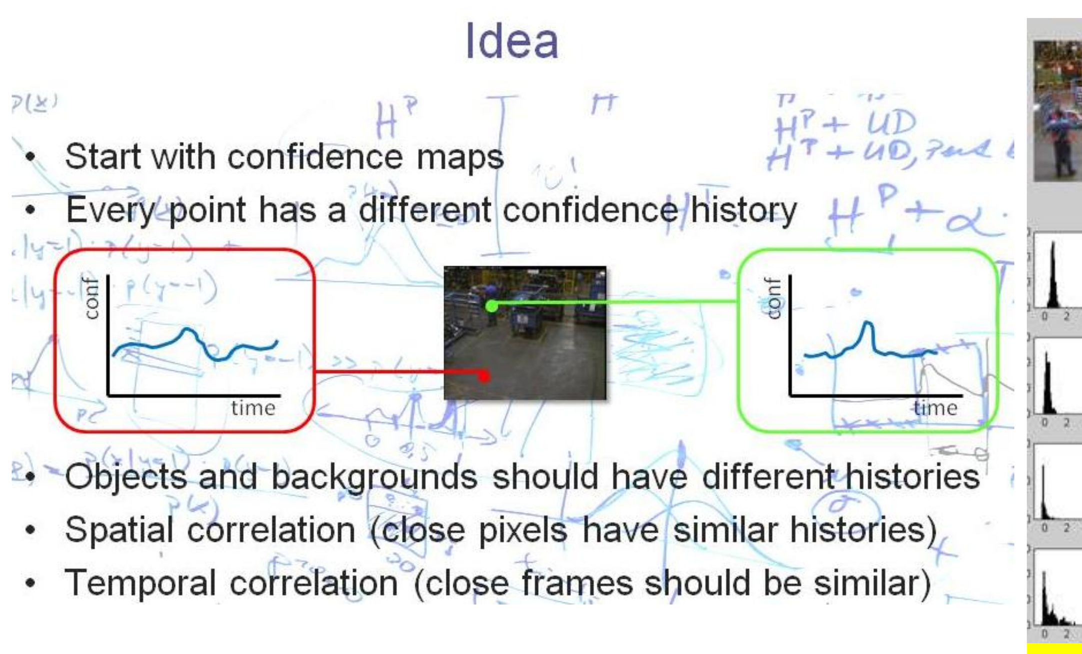
Solved correspondence problem on NISSAN data

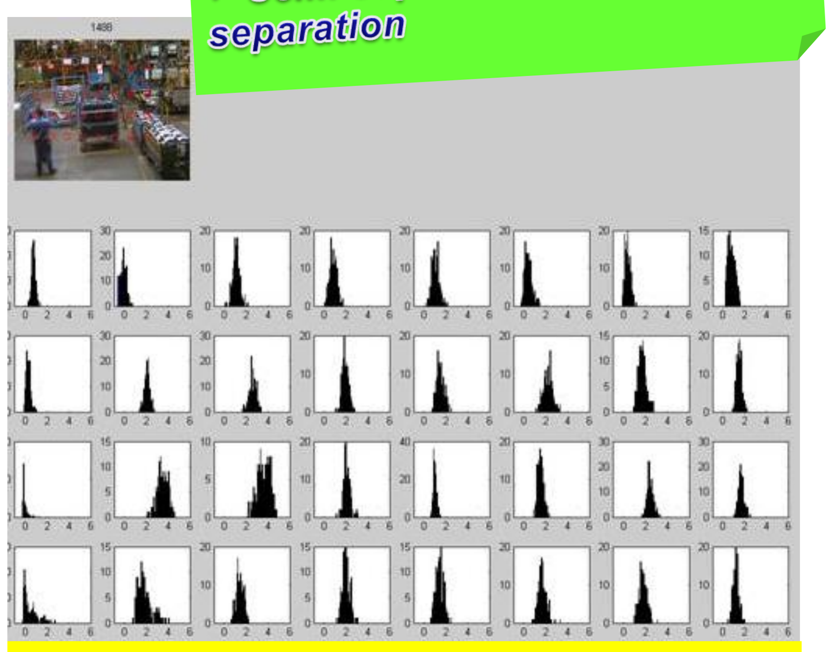
✓Correspondence across overlapping views
✓Gait Analysis in disjoint views
✓Active camera tracking

WP4 System Adaptation

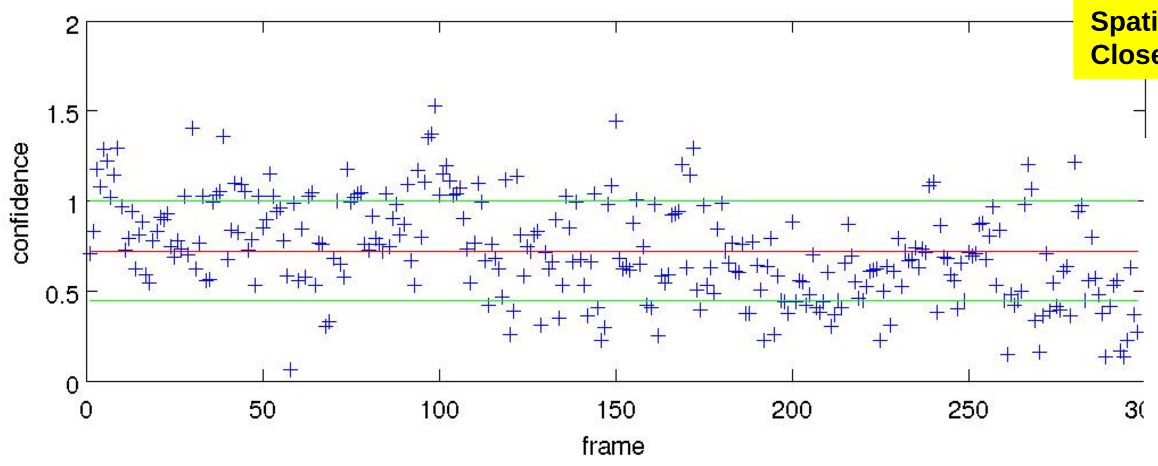
Task 4.1 Semi-Supervised Learning for On-line Adaptation
Task 4.2 Relevance Feedback for Scene Modelling

✓Online task separation
✓ Semi supervised scene separation

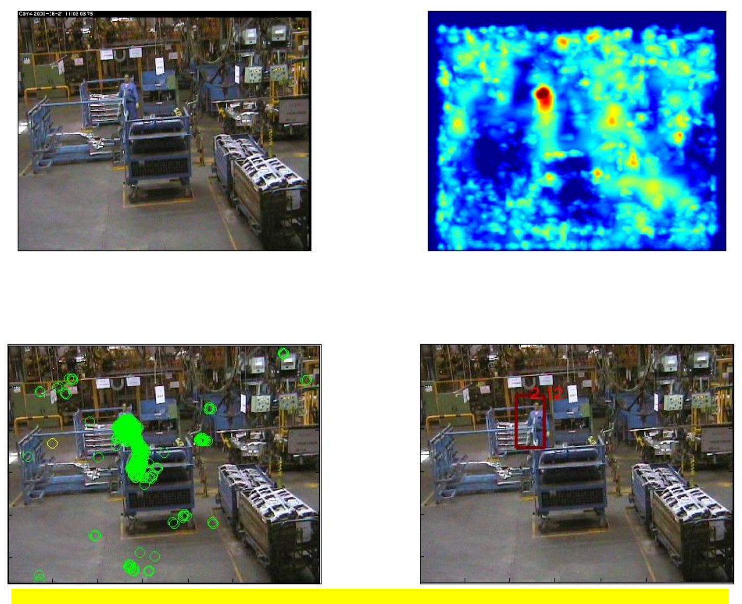




Spatial Correlation, points highlighted in red, histograms Close pixels have similar distribution



Variation of confidence for a stationary individual

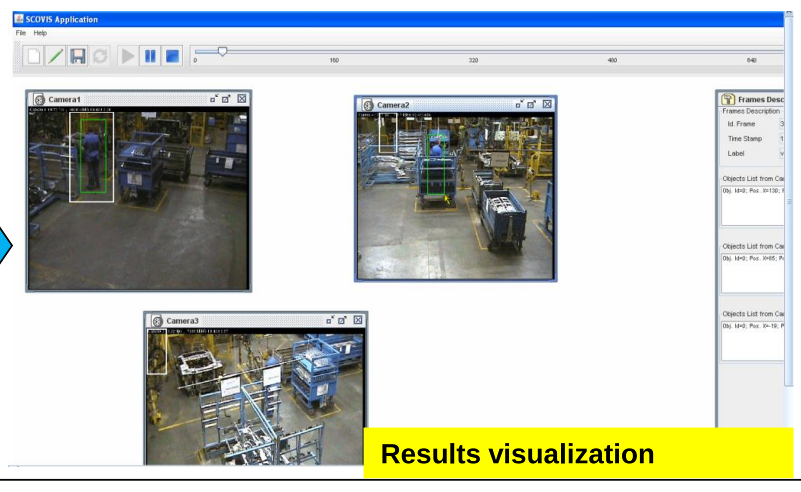


(top left) Original image
(top right) Confidence map
(bottom left) Classification
(bottom right) Resulting bounding box

WP5 Evaluation testbed

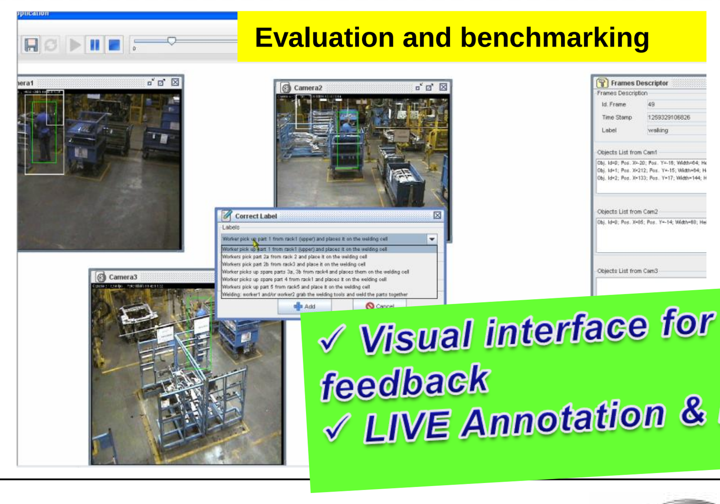
Task 5.1 Content collection
Task 5.2 Application Scenario Definition
Task 5.3 Evaluation Architecture
Task 5.4 Scenario Implementation and Evaluation
Task 5.5 Project Benchmarking

Industrial scenario



Results visualization

Evaluation and benchmarking



✓ Visual interface for User feedback
✓ LIVE Annotation & Evaluation

Institute of Communication and Computer Systems/National Technical University of Athens (ICCS/NTUA)
University of Southampton
Joanneum Research Forschungsgesellschaft mbH
ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich
Eidgenoessische Technische Hochschule Zuerich
Atos Origin
ATOS Origin Sociedad Anonima Espanola Unipersonal
KATHOLIEKE UNIVERSITEIT LEUVEN
Katholieke Universiteit Leuven
NISSAN
Nissan Motor Iberica S.A.