新世代影像辨識功能大突破

AI ~ MACHINE LEARNING CAMERA

技術部經理 呂學儒

BOSCH

Agenda

- 什麼是AI Technology & Deeply machine learning
- 認識前端影像智慧分析(Edge computing IVA)
- Camera Trainer
- 應用案例場景
- 人機介面操作

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什麼是
AI TECHNOLOGY & DEEPLY MACHINE LEARNING

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未來五年技術趨勢

- Cybersecurity
- AI & Machine Learning
- User and data privacy
- Edge computing

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認識機器學習
人工智能與機器學習

AI的三個關鍵字

機器學習 Machine Learning
- 自主學習的演算法
- 預測的對應數學模型

專家系統 Expert System
- 建立大量的解決方式
- 自身學習能力有限

人工神經網路 (ANN)
- 使用機器打造如同人類腦神經元
- 網路方式之建構數學模型

AI的三個應用

自然語言處理 (NLP)
- 互動機器人
- 聽得懂你說什麼

影像辨識
- 感知處理，高精度地圖，駕駛決策
- 像人一樣之駕駛決策

語音辨識
- 跨語言的辨認與翻譯
- 降低人工成本

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認識機器學習
人工智能與機器學習

Artificial intelligence (AI):
模仿大腦運作的機器學習方式

人工智能-AI

目前的影像分析：

- 通過背景演算法進行物體檢測
- 物件追蹤

機器學習-Machine learning

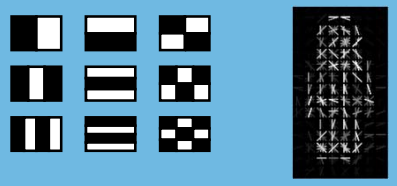
神經網絡:

深度學習:

非常大的數據庫

其他:

特徵點分析模式



- **Camera Trainer ✓**
- Face detector

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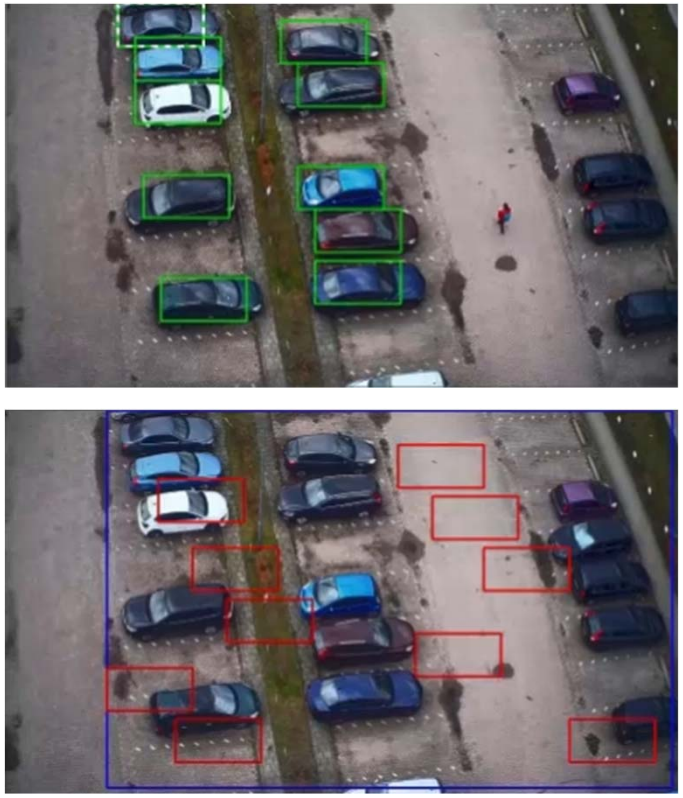
什麼是machine learning?
建立特徵點和背景影像的分離

▶ 在畫面中找到特徵點樣本並加以區分



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認識機器學習
為什麼採用深度學習模式?

目前的硬體架構無法作深度學習

深度學習

- Has typically ~20 million parameters
- Takes days / weeks to train
- Needs high-performance chip sets
- Performance gain typically ~30%

Bosch (特徵點分析模式)

- Typically ~10.000 parameters for single pose
- Optimized for low processing power

目前的攝影機硬體架構

- Can run 2 neural networks with ~10.000 parameters each in real time

目前的攝影機硬體架構

- Can run several of them in real time

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Camera Trainer enabled by machine learning technology

Camera Trainer: Train your own detector

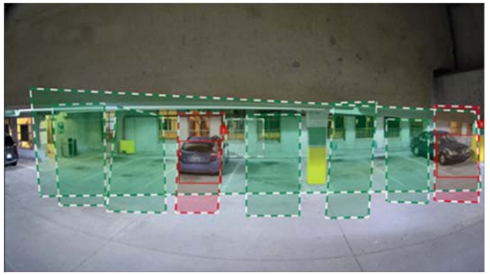
完全訓練有素的探測器

- Needs to know the “whole world”

- Training done by manufacturer
- Training samples needed:
  - 20.000 - 100.000
  - Billons
- Used in face or car detector applications

BOSCH Camera Trainer

- Only knows a single camera view
- Train your own customized detector
- Training samples needed:
  - 100 - 300



= positive sample

= negative sample

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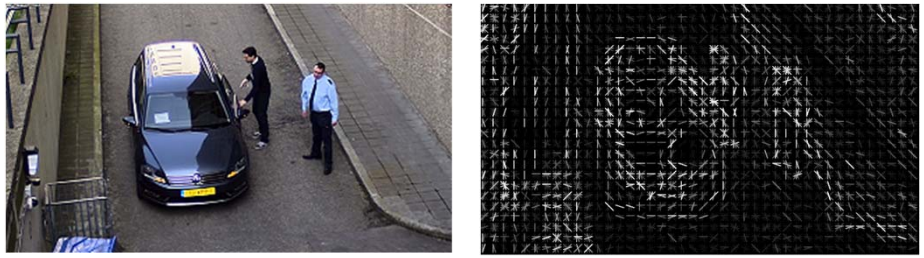
What is machine learning?
How does it work?

Edge descriptors

- For the separation edge descriptors are used like in the example below:

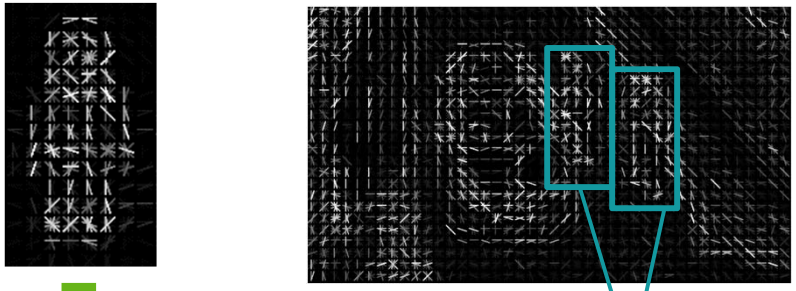


- Known as HOG models

方向梯度直方圖
（Histogram of oriented gradient，簡稱HOG）

Threshold features: Edge descriptors

- Each part of the image is compared to the target object model.



Target object model

Similarity above threshold

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認識前端影像智慧分析
(EDGE COMPUTING IVA)

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如果攝影機具備了影像分析(IVA):
可以改善並提高安全性

>14

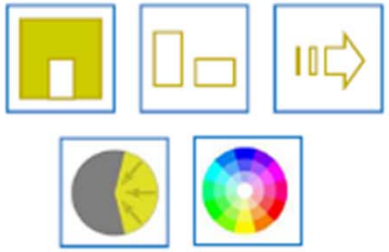
影像分析任務規則

8

同時執行8個分析任務

5

目標過濾



應用場景管

2D/3D 跟踪

博物館模式

船址跟踪

人臉捕捉

目標分類

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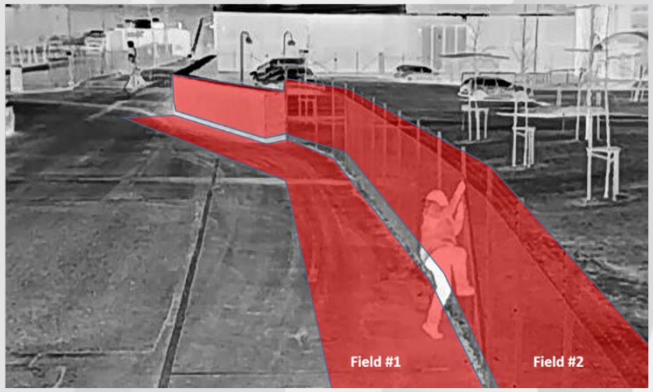
如果攝影機具備了影像分析(IVA):
可以改善並提高安全性

發生預設事件時
攝影機會主動告警

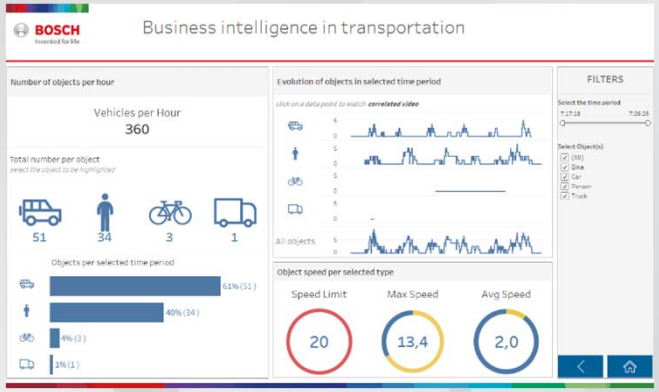


提高安全性

前端影像智慧分析
(Edge IVA)

011001
000101
010110

Metadata-元數據



提高安全
提供商業數據分析

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如果攝影機具備了影像分析(IVA):
可以改善並提高安全性

„越線“
- 單線 或多線 甚至是邏輯複合

“閒逛目標”
- 銀行， ATM, 學校，停車場

„條件改變“
- 在可選時間內目標改變縱橫比，大小，速度

„軌跡“
- 目標沿一定線路移動 – 主要應用于智慧搜索

„圖像防破壞“
- 針對攝影機噴塗或信號丟失等告警

“遺失物偵測”
- 高價值目標被移動

„物件計數功能“
- 可定義進入或離開區域的次數“遺失物偵測”

„檢測流量恆定的運動對象的“
- 高速公路事故車偵測”

“滯留物偵測”
- 目標遺棄在場景中
- 車輛停靠
- 目標停止移動

„進入或離開監視區“
- 進入綠化帶，廣場，軍事禁區
- 離開工位，位置

“相似性搜索”
- 常用於取證搜索

“人群檢測”
- 車站，機場，重要出入口人群密度

“從空中鳥瞰計數人員（BEV人計數器）”
- 計算多少人進入房間，並在指定數值時發出警報

„檢測單一物體運動方向“
- 登機口或車輛逆向檢測”

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CAMERA TRAINER

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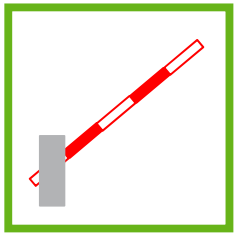
The next step in Video Analytics
Cameras with built-in machine learning capabilities

With the **Camera Trainer** you can teach your camera to:

Detect user-defined objects



Recognize user-defined situations

Find stationary objects

Separate objects clustered together

Enable cameras to detect objects or situations that matter most to you.

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Cameras with built-in machine learning capabilities
Camera Trainer

1: Train the camera

- Provide examples to teach camera. (Car / no car)

2: Start application specific detection

- Camera detects parked cars.

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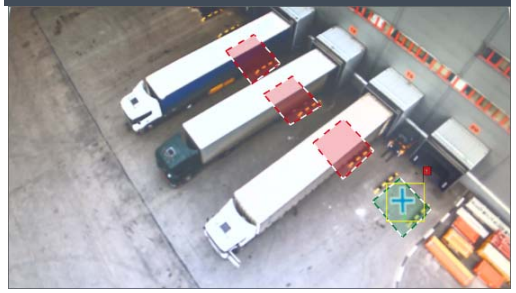
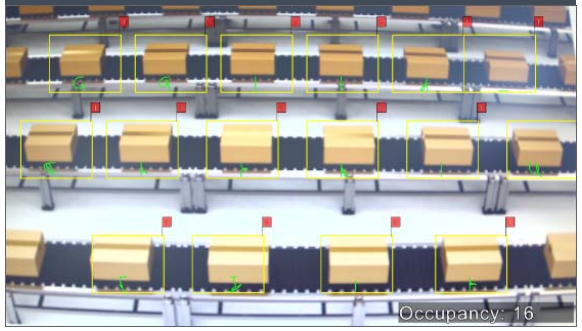
Bosch VS Solution
Video data mining – Camera Trainer

Available parking slot

Available platform



Production line integrity monitoring



Counting on ruler

Counting on needle

Panel monitoring

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Cameras with built-in machine learning capabilities

Camera Trainer: Video Analytics with customized precision

Teach cameras to detect objects or situations that you previously couldn't detect.

- Improve accuracy and make Video Analytics more relevant to customer needs.

- Improve operational safety and efficiency.

- Open up new business opportunities.

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應用案例場景

Camera Trainer use cases
Icicle detection

- Challenge:
  - The forming of icicles hanging on the roof of a building can cause a lot of damage and it can be very dangerous for people walking beneath them.
- Solution:
  - Teach the camera to detect the forming of icicles and get alarmed in an early phase.
- Benefit:
  - Public services can remove icicles before they get heavy and fall down. This saves a lot of damage and it can even save lives!

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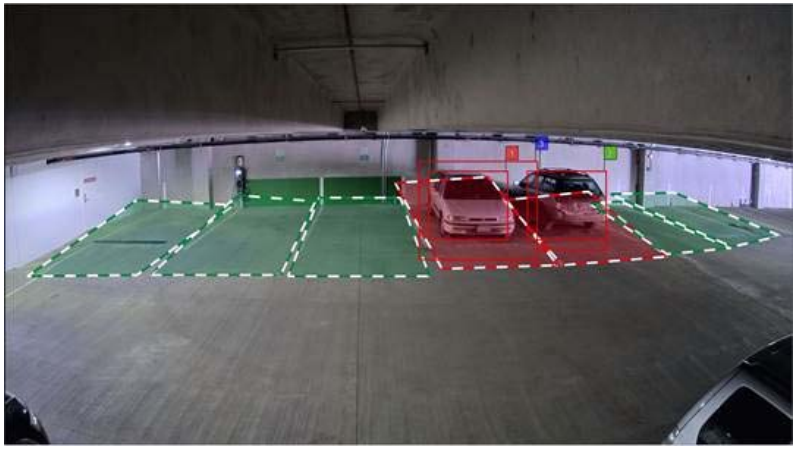
Camera Trainer use cases
Free / occupied parking spot detection

- Challenge:
  - I want to know how many parking spaces are occupied. I need reliable information to optimize traffic flow.
- Solution:
  - With Camera Trainer you can teach your system to very reliably recognize occupied and free parking spots.
- Benefit:
  - Be alerted when all spots are occupied and take measures.
  - Save costs by not having the need to put sensors in the ground.
  - By gathering statistics you have business intelligence which gives you a lot of insights.



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Camera Trainer use cases
Parking time violation

- Challenge:
  - At some parking spots you can only park for a certain time period. I want to be able to send a operator if a car exceeds the limit.
- Solution:
  - Teach your camera to detect a car which is parked on a time-limited spot and delay the alarm for any period that is needed.
- Benefit:
  - Get warnings as soon a the time exceeds and inform parking operators on the ground to check the situation.

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Camera Trainer use cases
Presence of trucks at loading docks

- Challenge:
  - I want to know if certain loading docks are free or occupied. With this business intelligence I can optimize my business processes.
- Solution:
  - Detect free loading docks with Video Analytics by training the camera to recognize a physical mark on the ground.
- Benefit:
  - Increase efficiencies and save costs by receiving up-to-date information about the occupancy of loading docks.

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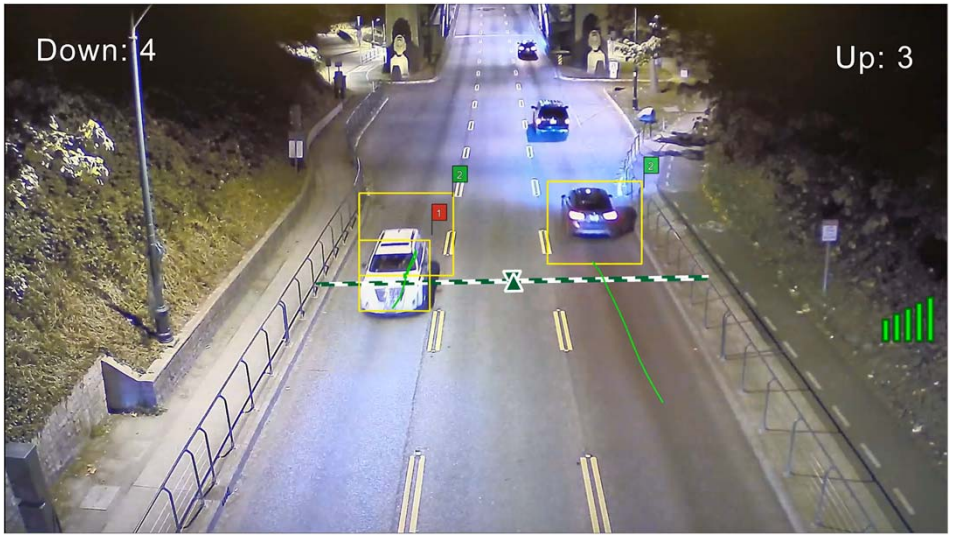
Camera Trainer use cases
Vehicle counting

- Challenge:
  - I need reliable data about objects going in a certain direction. These insights can help in preventing traffic jams.

- Solution:
  - Teach your camera to detect cars, trucks, busses or bikes going into a certain direction. Using camera trainer will result in a high reliable counter.

- Benefit:
  - Get reliable data about in- and out-going traffic and optimize traffic flows.



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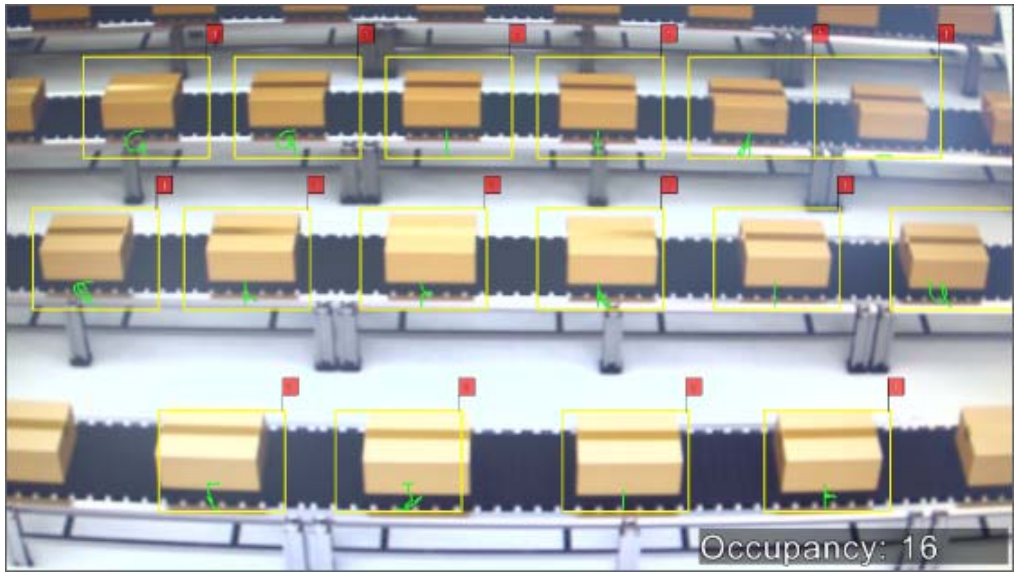
Camera Trainer use cases
Box pile up in production lines

- Challenge:
  - I want to get an alarm when boxes are piling up on a conveyer belt. This can distort the production. (or logistics)

- Solution:
  - With Camera Trainer you can teach the camera to give an occupancy alarm if there are too many boxes.

- Benefit:
  - Generate business intelligence with the help of video data and optimize logistics in your warehouse or production in a plant.



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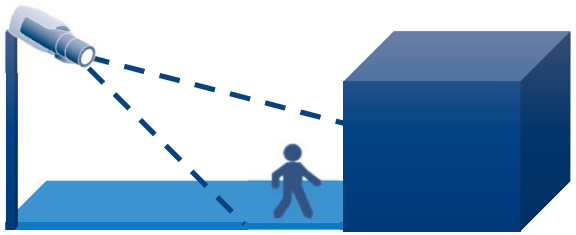
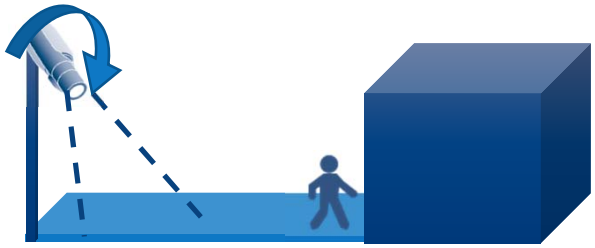
Camera Trainer use cases
Camera tamper detection via markers

- Challenge:
  - Intruders change the field of view purposefully to hide their intrusion.
  - Cleaning staff changes the field of view by accident.



- Solution:
  - Train detectors on prominent landmarks in the field of view. Alarm whenever these landmarks move from their target area or vanish completely if the camera is blinded.
  - With Camera Trainer you can have several references. Normal tamper detection has only one. This is better suited to outdoor environments.



- Benefit:
  - Camera is always monitoring what it should be.

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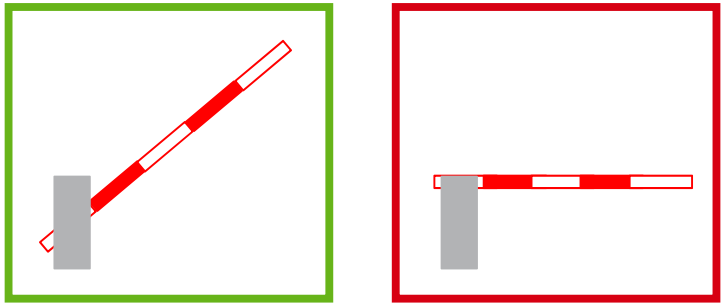
Camera Trainer use cases
Object states: Open / closed / in position

- Challenge:
  - I continuously want to monitor the state of a barrier without the need of having to check a video feed.



- Solution:
  - Teach the camera any state by giving negative and positive samples of an object. There are multiple solutions to feed-in data in a system.

- Benefit:
  - Improve security and create new value by optimizing business processes with video data.
  - There is no need to rewire sensors or contacts.

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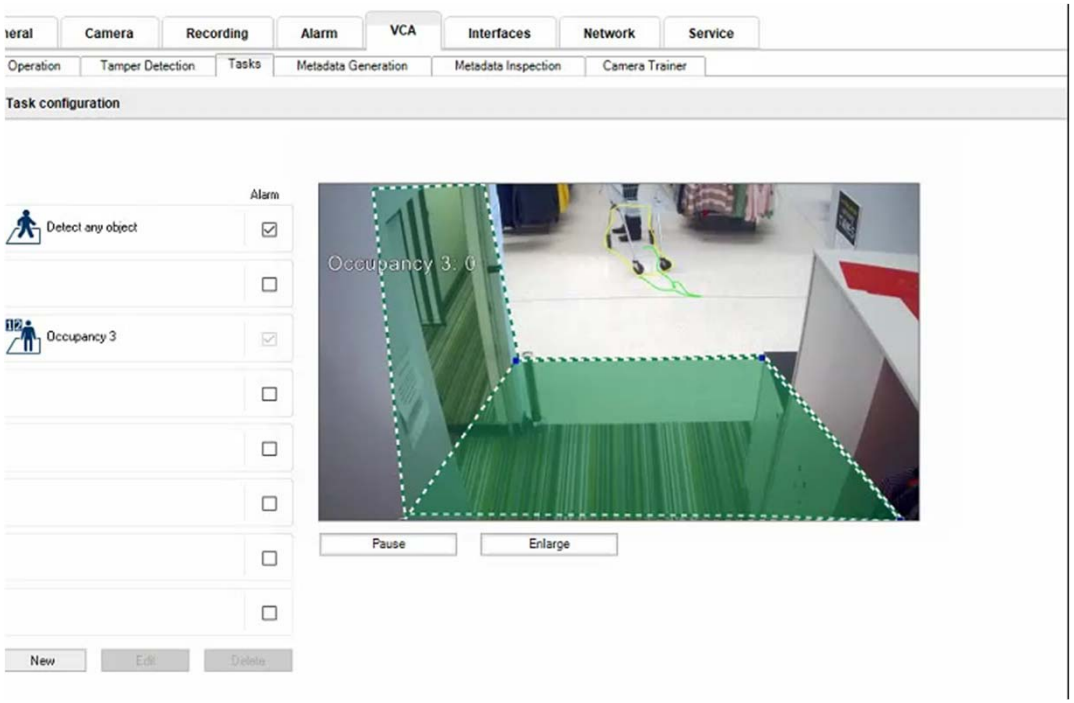
Camera Trainer use cases
Detect shopping carts / shopping baskets

- Challenge:
  - I want to be alerted when someone with a shopping cart or shopping basket is entering an unsecured area.
- Solution:
  - Teach your camera to detect the wheels of a trolley or the shape of a shopping basket and detect when someone enters a fitting room or other unsecured area.
- Benefit:
  - Detect unusual behavior and Increase loss prevention.



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人機介面操作

Camera Trainer – How to get it
Supported cameras and software

- Camera Trainer is available on all **Intelligent Video Analytics** cameras*
  - CPP 6, 7 and 7.3, firmware version 7.10
  - Configuration Manager 6.20
- No-charge activation with license
- Thermal cameras are not supported
  - Optical imager on MIC IP fusion 9000i is supported
- Camera Trainer is available on moving cameras in a tour
  - Up to 16 Video Analytics profiles can be configured and assigned to prepositions
- BVMS and 3rd party support: no additional integration effort needed (also full ONVIF support)

*A list of supported devices is available here

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Camera Trainer
Supported alarm rules and filters

Available tasks:

- Inside field
- Enter field
- Exit field
- Line crossing
- Loitering
- Route
- Counter
- Occupancy
- Condition change
- Similarity search

Tasks not supported:

- Idle object
- Removed object
- Crowd detection
- Tampering
- Flow
- Counter Flow

Available object filters:

- Class
- Direction
- Size
- Aspect ratio

Object filters not supported:

- Velocity (no 3D ground tracking)
- Color (due to processing power limitations)

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THANK YOU

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