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# ANALYTICS: DISCOVERING A WORLD OF POSSIBILITIES

# Discussion Points

Where are Analytics today?

Where do Analytics make sense?

How do I optimize the environment for Analytics?

How do Analytics really work?

Fact vs. Myth: How do I set expectations with client?

What does AI have to do with Analytics?

# Traditional Analytics

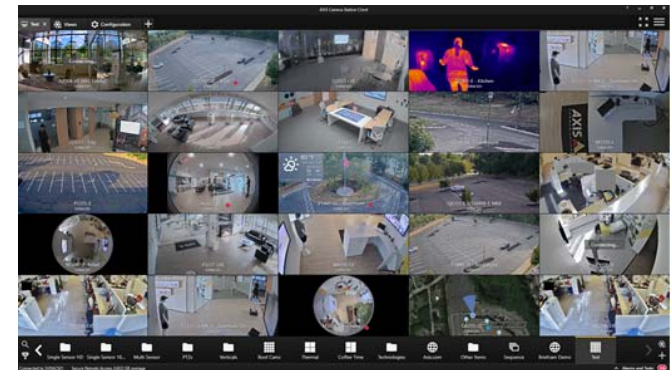
- Analytics are straightforward
  - **Video:** Analyze live and recorded video, provide alerts, forensic search, automated responses and actionable details
    - More cameras with greater quality means more information to review
      - How do we automate response
      - How do we eliminate noise?
    - Cameras are moving from forensic video review to proactive responses
  - **Audio:** Technology for detection of gunshots, aggression, glass break, stressed voice, cough detection, etc.
    - Targeted analytics provide quicker response to actionable threats
    - Higher accuracy to responses when audio is utilized
    - Privacy is maintained since audio is not recorded (when using certain analytics)



# Proactive Analytics

Proactive = “Ahead of the threat”

- Abnormal behavior detection
- Used together with VMS
- Alert tagged as alarm event



# Reactive Analytics

Forensic review technology assists in investigations (video summarization, voice analysis)

- Reduces review time by 50%
- Links to full content on VMS
- Metadata tagging and search



# Wide Range of Analytics

## Security enhancements

- Improve surveillance efficiencies
- Expedite investigation
- Trigger automated response
- De-escalation



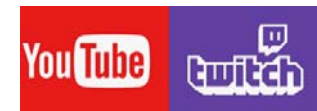
## Business management add-ons

- Use video data to improve business efficiencies
  - Understand traffic patterns by day / hour / demographic
  - Anticipate product restocking needs
  - Review heat maps to understand customer interest
  - Detect lines at checkout
  - Detect VIP / known person of interest



## Product feature add-ons

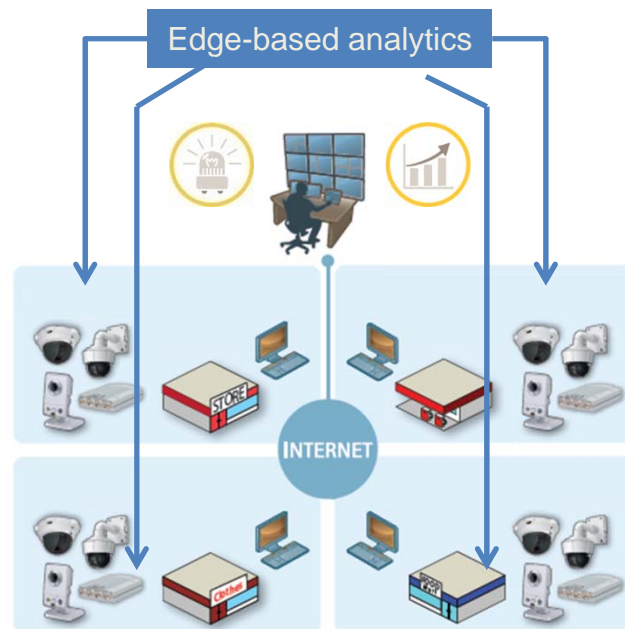
- Add features beyond product core functionality



# Benefits of Using Applications at the Edge

## Good:

- Reduce bandwidth and storage consumption
- Reduce system cost and complexity
- Design truly scalable deployments
- Simplify deployment



## Not-so Good:

- Limited processing capacity
- Each edge device must be maintained



# Benefits of Using Server-Based Applications

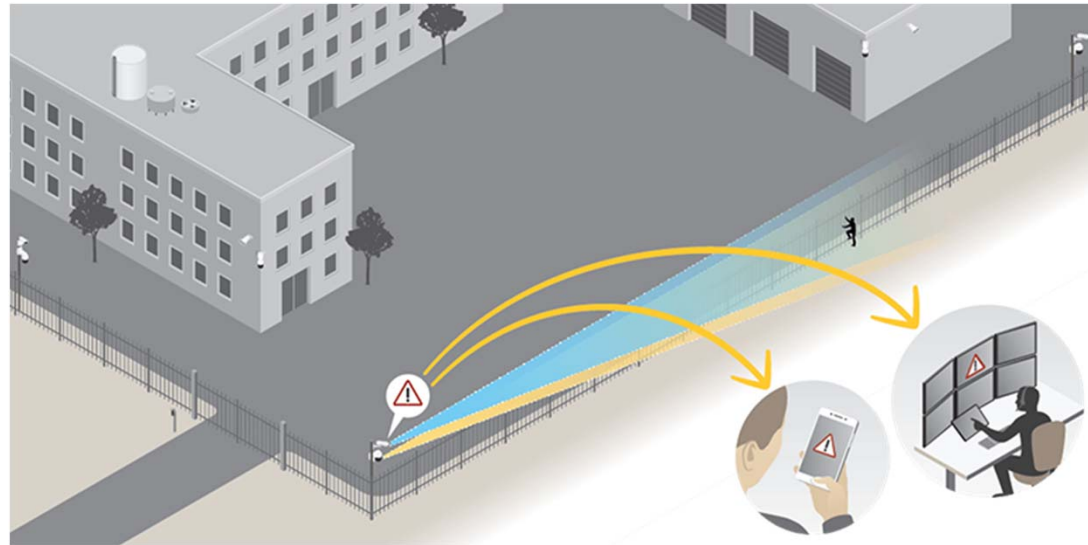
## Good:

- More processing power available
- Scalable
- Easy maintenance
- Readily available data access

## Not-so Good:

- All data and video must be continuously transmitted from remote sites
- Strain on bandwidth and network traffic
- Viability and integrity of video data can be reduced





Quick review of what is available today.

# ANALYTIC APPLICATIONS – SECURITY

# Security – Perimeter Protection

Automatically detects and responds to people and vehicles intruding on your property.



Provides visual confirmation of detected objects.



# Fence Line / Perimeter Monitoring

Establish “virtual fences”  
in a camera's field of view  
to protect an area  
from intrusion.



# Loiter Monitoring

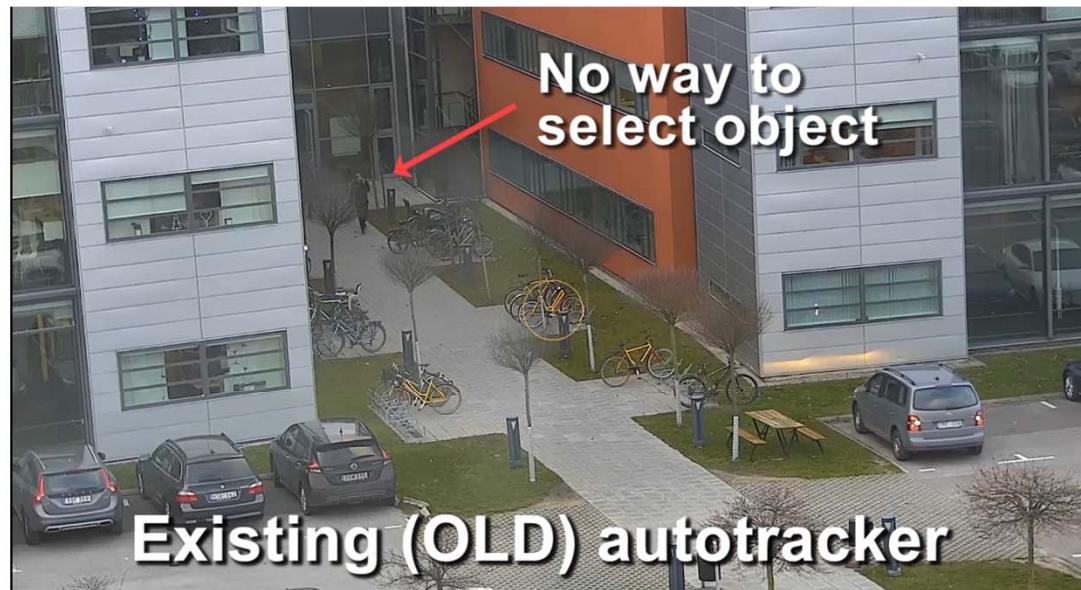
Ideal for low-traffic areas and after business hours on semi-public properties such as office parking lots and schoolyards, as well as near fences.

Analytic tracks moving objects such as people and vehicles and triggers an alarm if they have been in a predefined area for too long.



# Autotracking

Autotracking helps you get the details on intruders by enabling a PTZ camera to automatically zoom-in on and follow alarm objects.

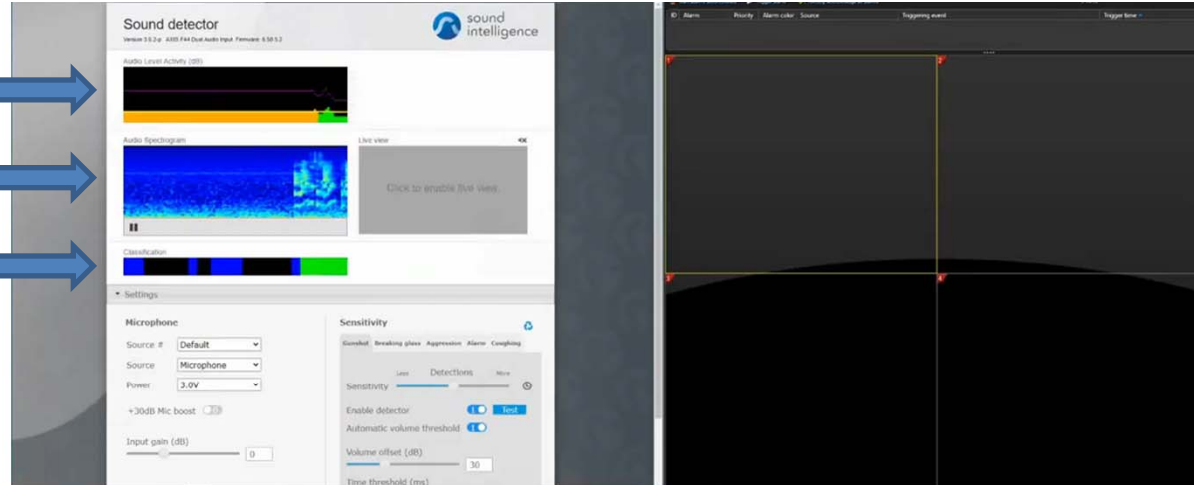


# Audio Intelligence

Audio / threshold level

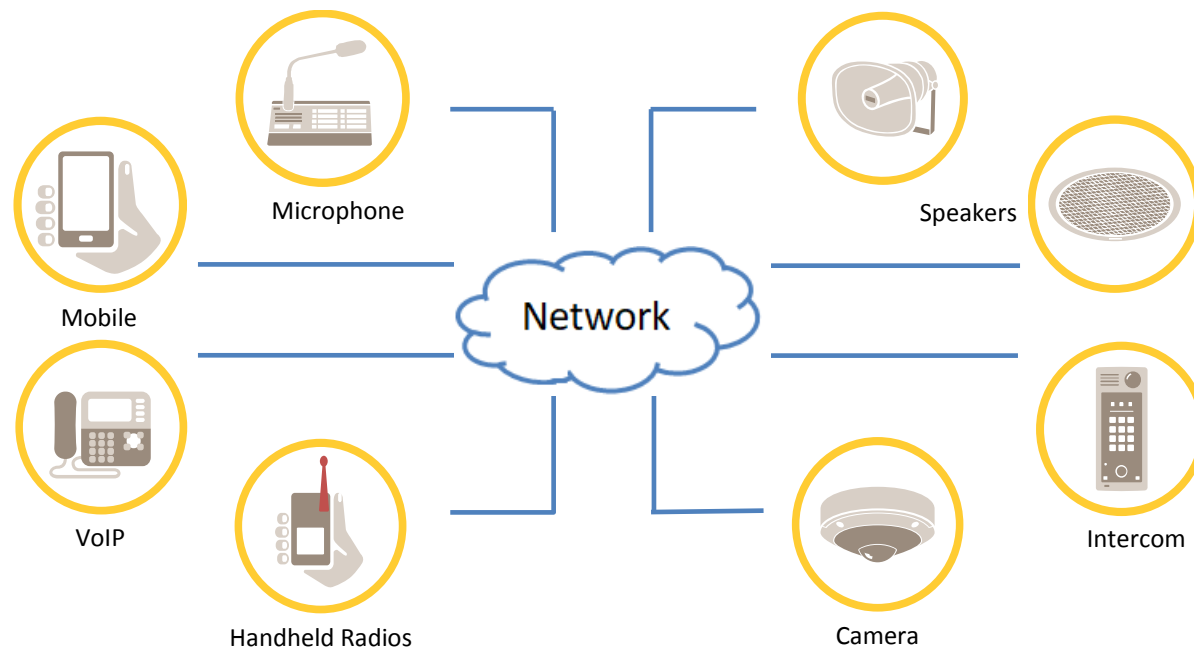
Audio spectrogram

Sound classification





# How Can We Improve Response?



# Integrated audio intelligence in action!

**Network Camera**  
Detects individuals



**Network Speaker**  
Triggers announcement



“Attention! This facility is now closed, and you are trespassing...”

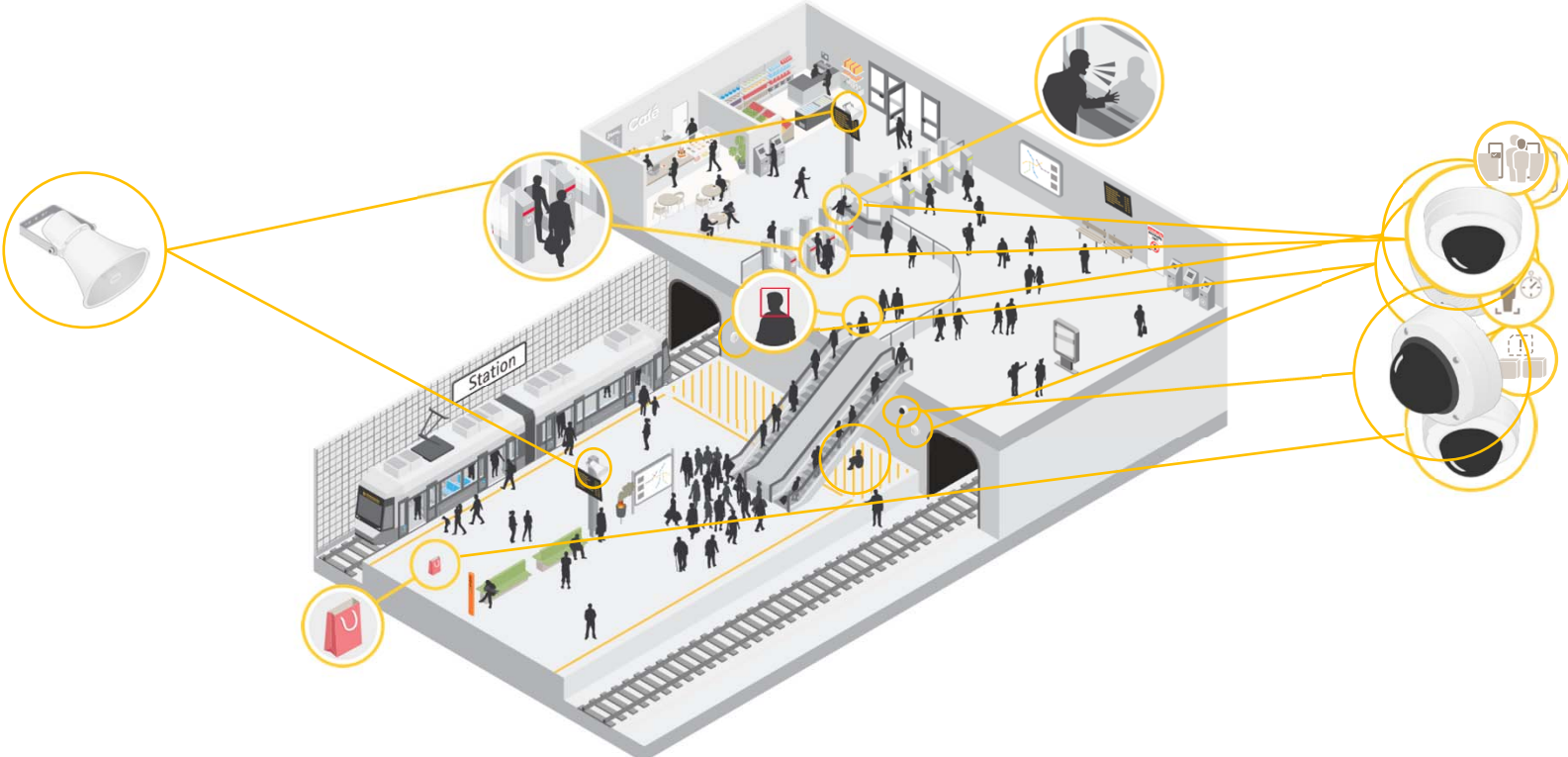




Quick review of what is available today.

## **ANALYTICS APPLICATIONS - SEGMENTS**

# Metro Station Security and Emergency Response (eggs and shell) Messaging



# Traffic Monitoring

Thousands of **parking violations** occur every

# Education

## 1 Incident Occurs

Aggression is detected by embedded sound analytic on network camera

## 2 Alert received

Personnel receive alert and incident is verified by video

## 3 Incident response

Appropriate personnel quickly respond and deescalate the incident





# Analytic Applications - Segments

- **Critical Infrastructure**
  - Power, chemical & nuclear plants, dams and telecommunications stations seeking higher security at their sites (detection / evidence of perimeter intrusion, post-incident analysis, etc.)
- **City Surveillance**
  - Law enforcement agencies managing security in metropolitan areas (unauthorized entry, loitering, illegal parking, crowding, forensic search, etc.)
- **Government & Military Facilities**
  - Government / military buildings seeking higher security at their sites (detection / evidence of perimeter intrusion, tailgating, post-incident analysis, etc.)
- **Highway Surveillance**
  - Highways and expressways seeking to prevent accidents and optimize traffic flow (traffic obstacles, vehicle counting, stopped vehicles, etc.)
- **Business**
  - Impact of COVID, physical distancing and mandatory masks requires limiting patrons (people counting / crowd control) and adherence to state regulations (mask detection)



Quick review of what is available today.

# **ANALYTIC APPLICATIONS - BUSINESS**

# Analytics in Retail

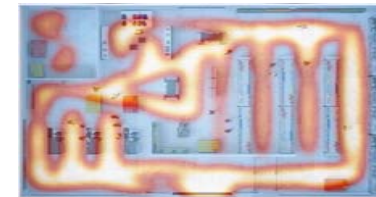


# Business Intelligence (Operational Efficiency)

Leverage video surveillance content to uncover qualifiable data and trends to better understand your consumer behavior and increase profits.

Map customer paths, object interaction and dwell time.

Real-time actions and statistics for measuring number of persons queueing and waiting time



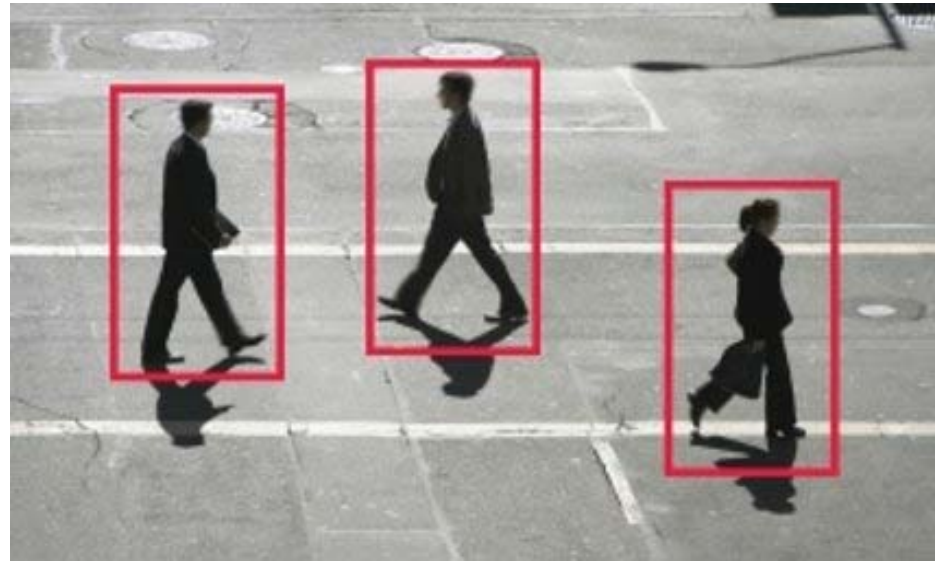




# Protecting Privacy



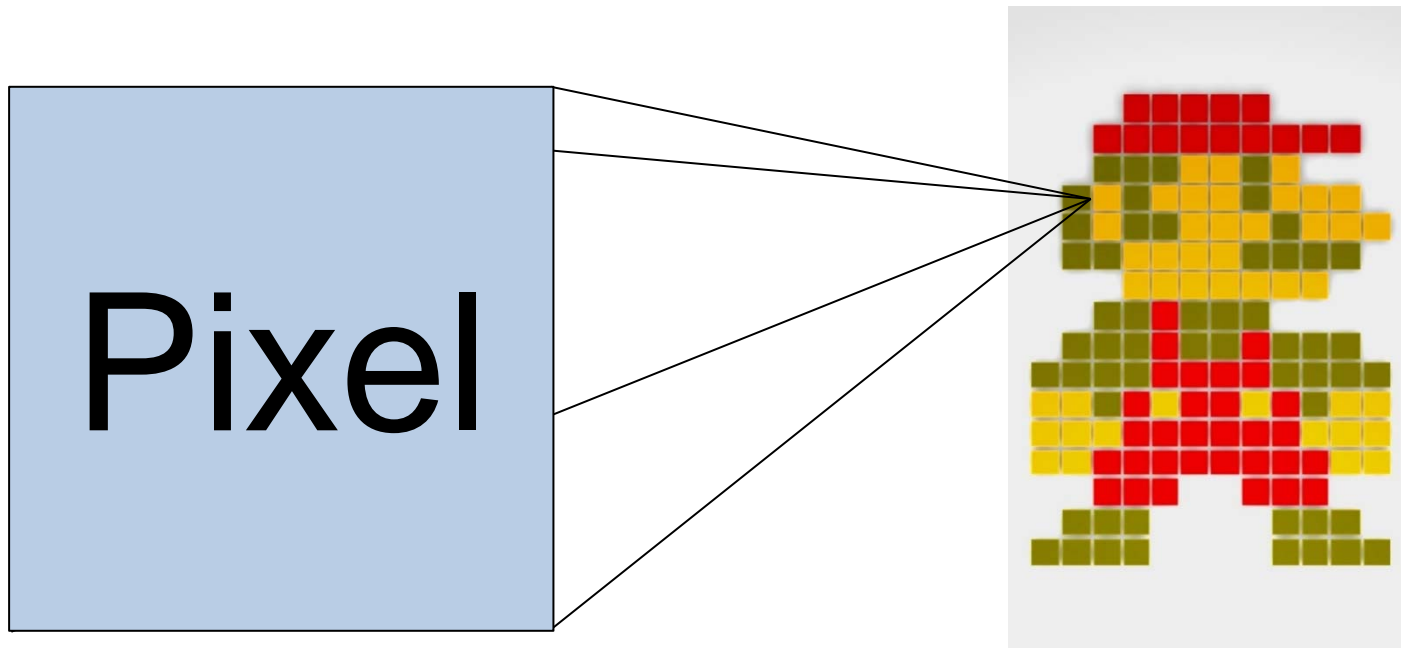




Design Considerations

# HOW DO I OPTIMIZE THE ENVIRONMENT FOR ANALYTICS?

# What is a Pixel?



# Common Aspect Ratios

**4:3 Ratio**

3Mpxl, 5Mpxl

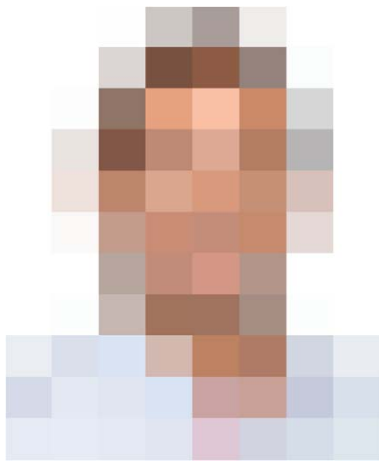


**16:9 Ratio**

720p, 1080p, 4K (HDTV)



# What is Your Goal?



**Detection:**  
4pxl/face - 8 pxl/ft.



**Recognition:**  
20pxl/face - **40 pxl/ft.**



**Identification (Good)**  
40pxl/face - **80 pxl/ft.**



**Identification (Challenge)**  
80pxl/face - 150 pxl/ft.

More information on the different operation requirements: European Standard EN 50132-7:2012 by CENELEC [www.cenelec.eu](http://www.cenelec.eu)

# Design Challenges in the Surveillance Industry

- 24/7/365 Operational Use
- Weather
- Insects
- Changing seasons
- Varying light conditions
- Camera types and settings
- Every installation is unique





# How to Optimize Performance of a Camera Analytic?

## Different requirements?

- Edge-based / Server-based / Cloud-based

## Clean, artifact-free image

- Analytics do not like:
  - Light changes
  - WDR issues
  - Noise
  - Unstable image (shake)

## For best accuracy, avoid:

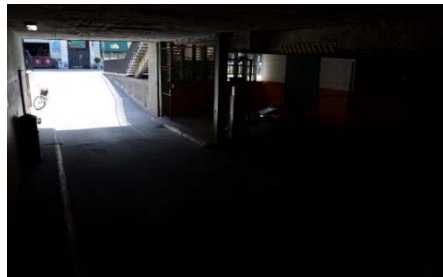
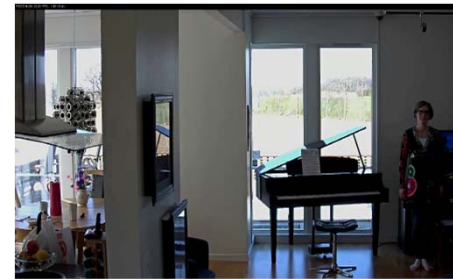
- Camera placement or lens selection that distorts facial features
- Difficult lighting that create shaded areas or whiteout effects
- Compression settings that cause image blur or pixilation
- Motion blur caused by slow shutter speeds or low frame rates
- Excessive noise in low-light situations
- Overlay text appearing in a critical part of the scene





# Environmental Checklist

Even an indoor camera can have challenges such as WDR and Lighting.

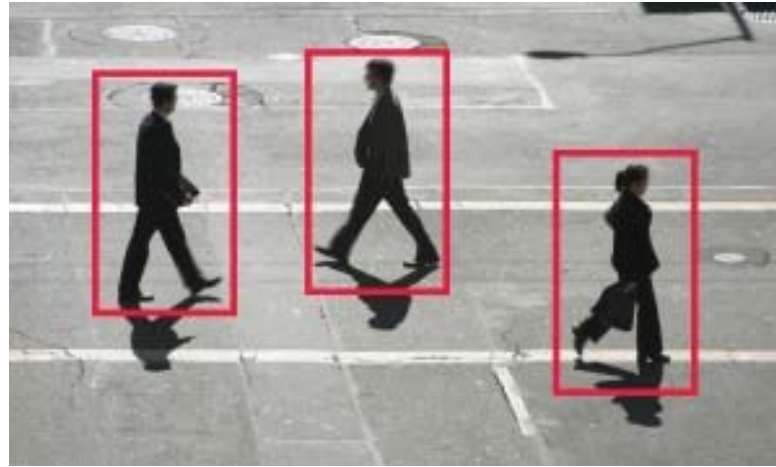


# Image Checklist

Image related issues  
can't be fixed later

**Remember,  
analytics are not  
image enhancers!**





Let's talk nerd!

# ANALYTICS

# How to Describe Success and Failure of Any Analytic?

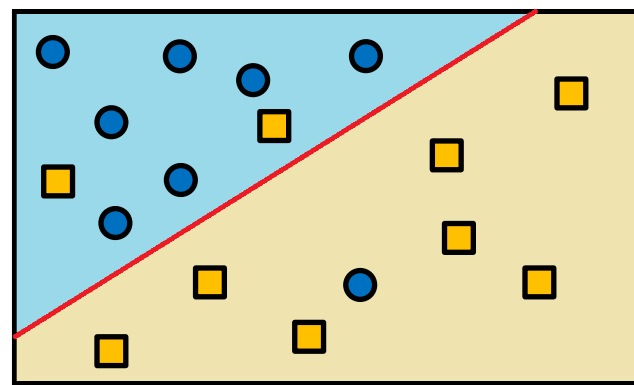
Background defines the ground truth

- Light yellow is the True outcome
- Light blue is the False outcome

Dots are samples from the analytics predicting the outcome.

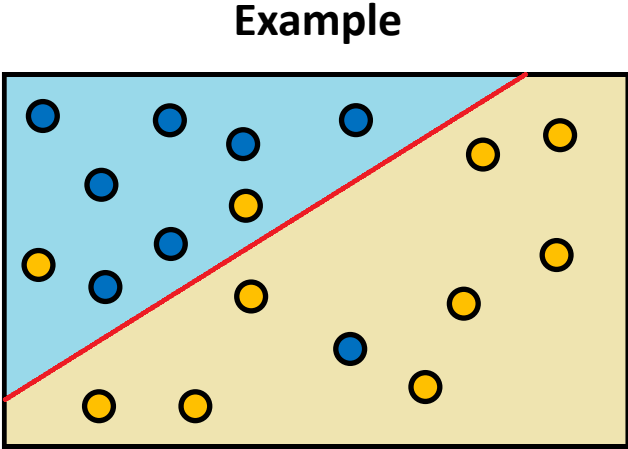
- Dots in the light blue area should have been classified as blue dots
- Dots in the light-yellow area should have been classified as yellow dots

Example



# Confusion Matrix – Describe Success and Failure of Any Analytics

	Prediction	
Ground Truth	True Positive	False Negative
	False Positive	True Negative



# Challenges with Managing Analytics

Analytic objective

Confusion Matrix





# Confusion Matrix Takeaways

## Key takeaway:

Your customers must have a policy to manage false positives.

You should be careful with detection of events that don't happen often, with low probability, especially if the action is costly.

Remember that with independent cameras and analytics only looking at single images, you use the detector multiple times, making false alarms even more likely!



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# Artificial Intelligence

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**Slide 41**

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Geoffrey Bauer, 8/27/2020

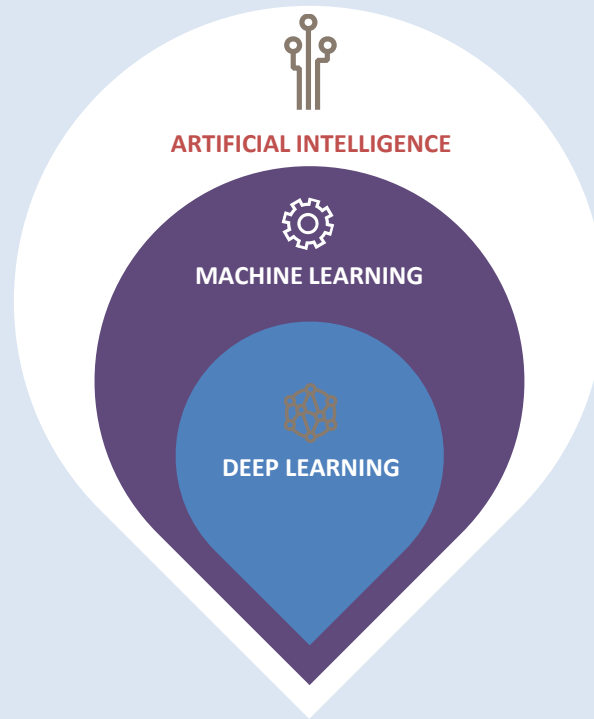


# Definitions

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# What is Artificial Intelligence?





# Different Types of Learning

## Supervised

(task driven - uses labeled examples)

## Unsupervised

(data driven - uses unlabeled examples)

## Reinforcement

(learns from mistakes)

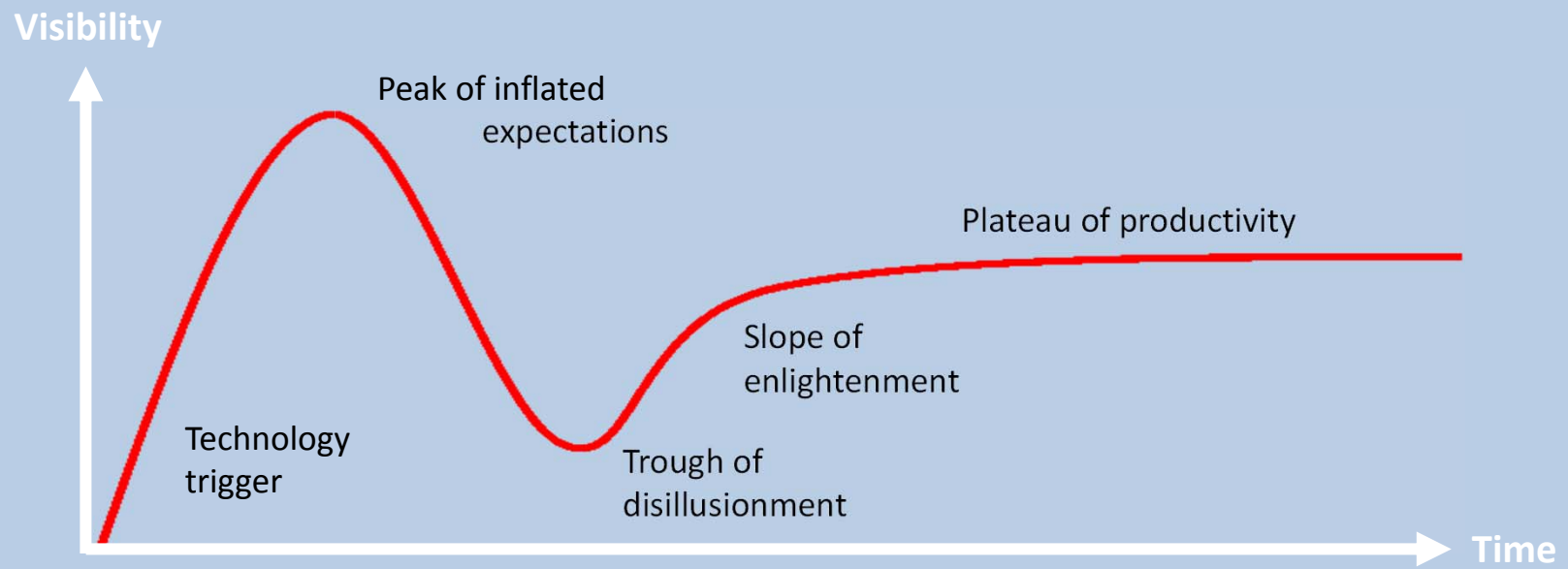


# AI Today

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# Gartner Hype Cycle

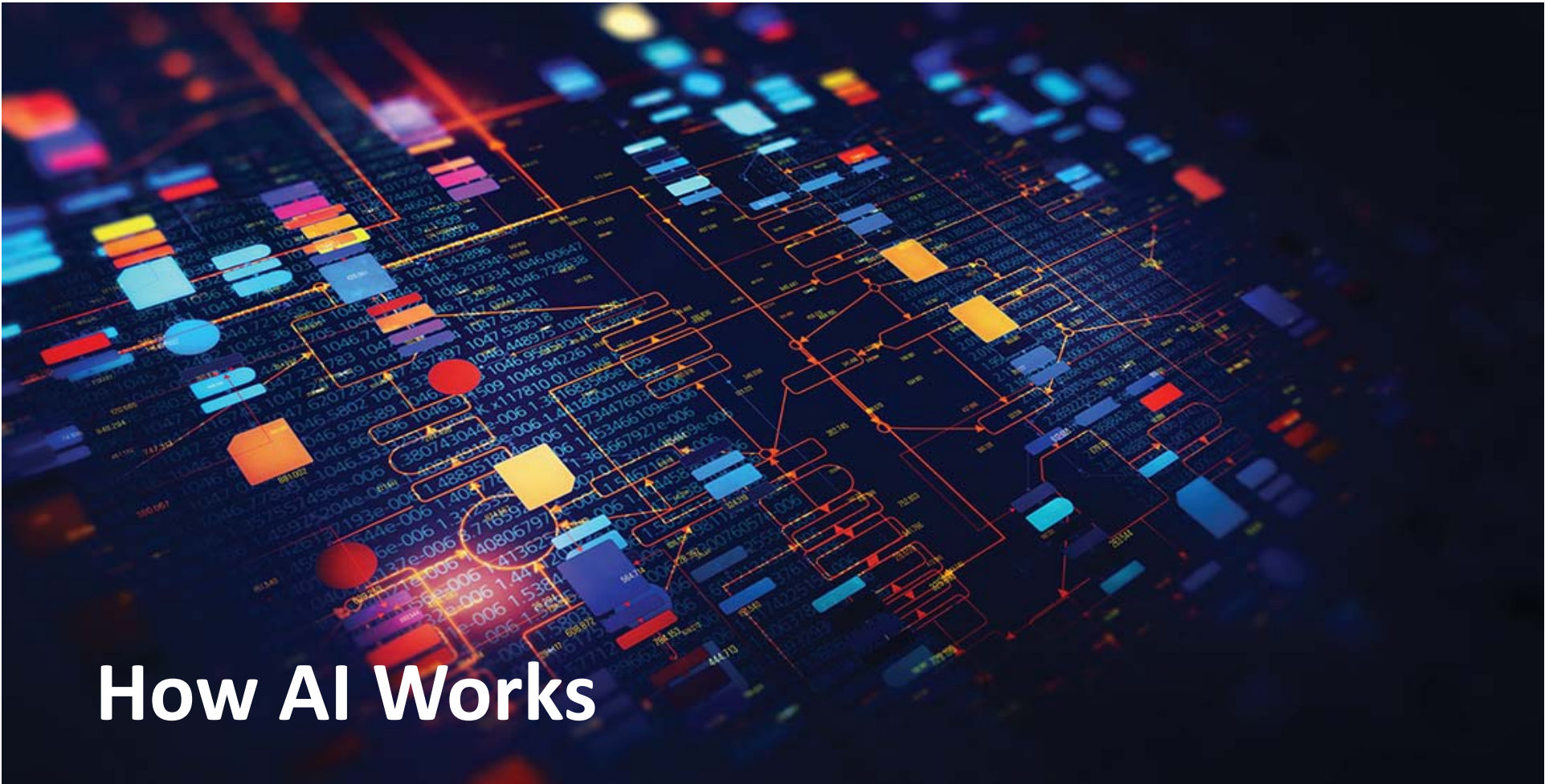


# This is Where We Can Find AI Today

- Image recognition
- Object detection/recognition
- Character recognition
- Speech recognition
- Pattern recognition







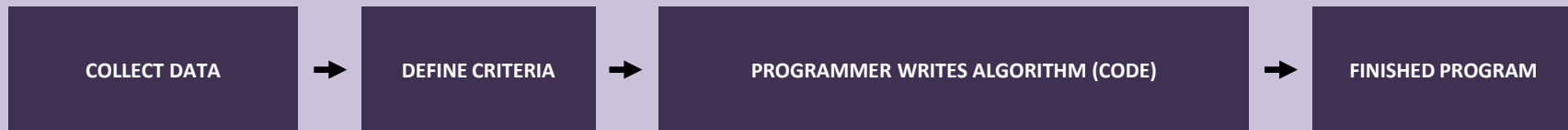
# How AI Works

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# Traditional Programming vs. AI (Supervised Learning)

## Traditional programming

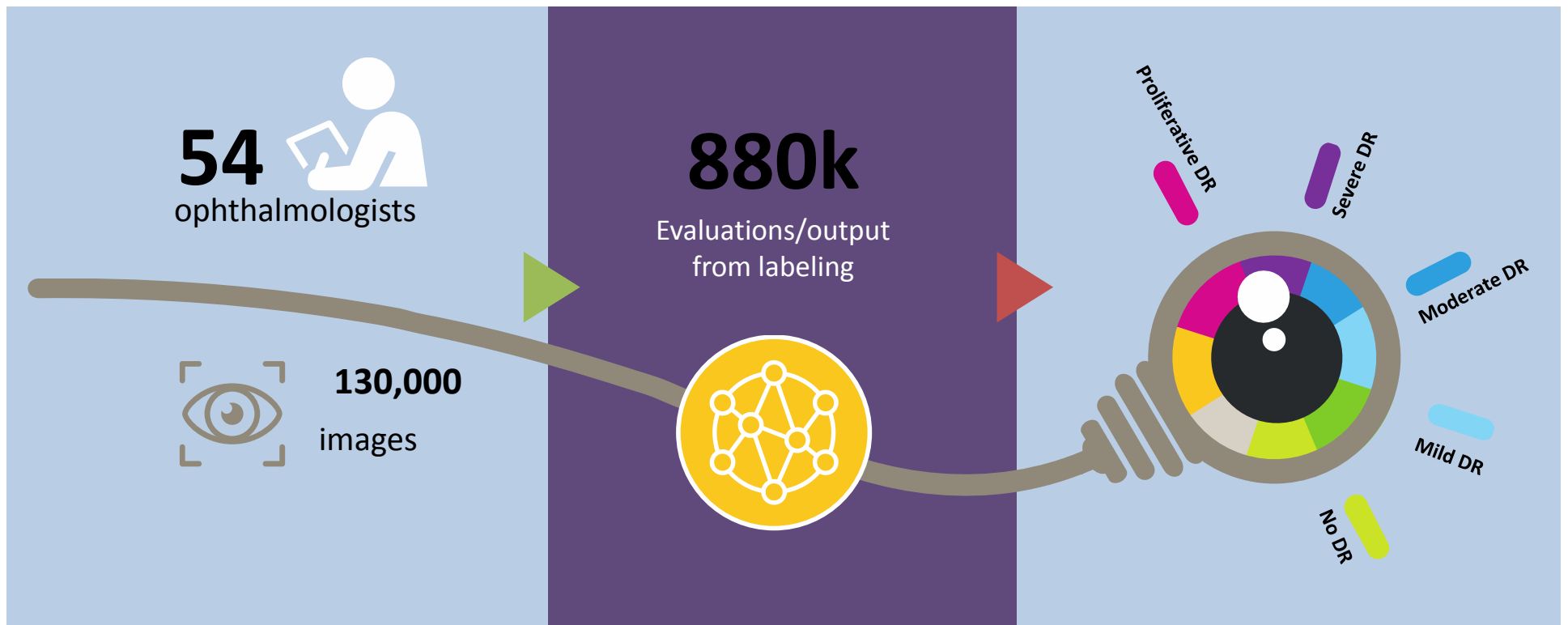


## Artificial intelligence





# Collect and Label – Real-world Example



# Where is AI Successful Today?

A limited scope (a.k.a. narrow AI)

Large amounts of data (very specific)

Clearly and easily defined labeling





# Challenges for AI

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# Analytics are a Tool ... Not a Solution!

## Complicated applications

- Bigger challenges
- Data relevance
- Self-learning
- Higher accuracy
- Compute power demands



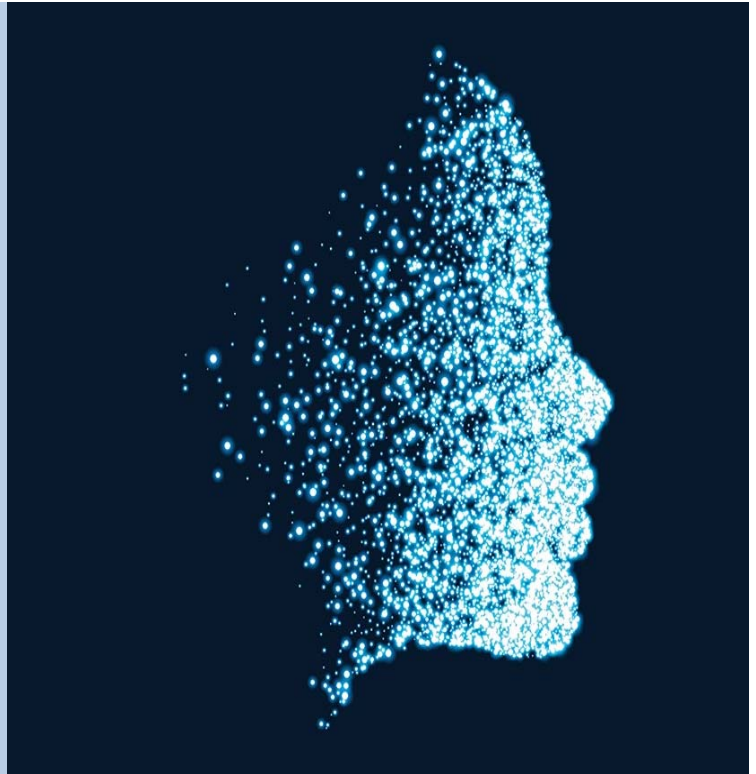
# Data Relevance

- Data scope
- General vs. specific (narrow AI)
- Legal aspects



# Self-learning (Unsupervised Learning)

- No control over the learning process
- No tracing possibilities
- No means to evaluate the quality
- The data depends on the quality of the data collected, i.e., the cameras and where they are placed





# Higher Accuracy



# Compute Power Demands



# Is This a Cat?







# Summary

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# Summary

1

Analytics / AI still has a future within surveillance, in specific use cases.

2

Analytics / AI is assuming a larger footprint in Business Intelligence.

3

Certain design requirements must be considered to get the best performance from an analytic.

4

Need operational procedures to react to notifications (alarms).

5

Analytics are a tool, not a solution.

6

AI works well when the aim is very specific.



# THANK YOU

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