



UNIVERSITAS GADJAH MADA

# Vision-Based Intelligent System and Its Applications



**Wahyono, Ph.D.**

Department of Computer Science and Electronics  
Faculty of Mathematics and Natural Sciences  
Universitas Gadjah Mada, Yogyakarta, Indonesia  
Email: wahyo@ugm.ac.id



# Wahyono, Ph.D.



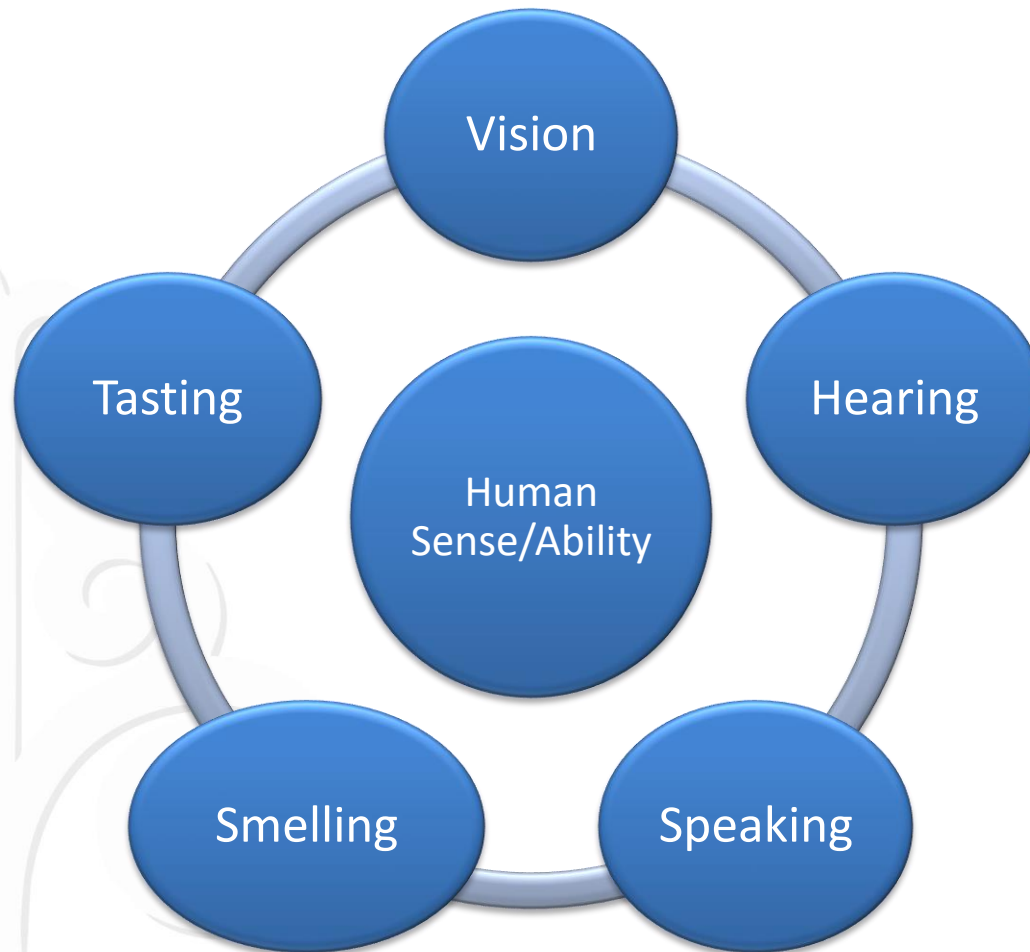
## ADDRESS

L.4 Gedung C,  
FMIPA UGM  
Bulaksumur,  
Yogyakarta, 55281

- Current Position
  - Assistant Professor and Researcher, Computer Science Department, Universitas Gadjah Mada
  - Head of Algorithm and Computation Research Laboratory, UGM
- Education
  - PhD, University of Ulsan, Korea, 2012-2017
  - B.Sc, Universitas Gadjah Mada, Indonesia, 2006-2010
- Awards and Projects
  - World Class Research, DIKTI Kemdikbud, 2020
  - Vision-based Welding Inspection System, Toyota & UGM, 2020
  - Intelligent Surveillance System, Busan Metropolitan City, Korea, 2016-2017
  - Best Paper Award, Ministry of Science, Republic of Korea, 2016
  - Autonomous Vehicle, Hyundai Motor, Korea, 2016
  - Korean Copyright, Intelligent Surveillance System
- Interests
  - Computer Vision, Image Processing, Video Processing
  - Intelligent Surveillance System
- Publications
  - <https://scholar.google.co.id/citations?user=agr1gDAAAAAJ>



# Why Vision?



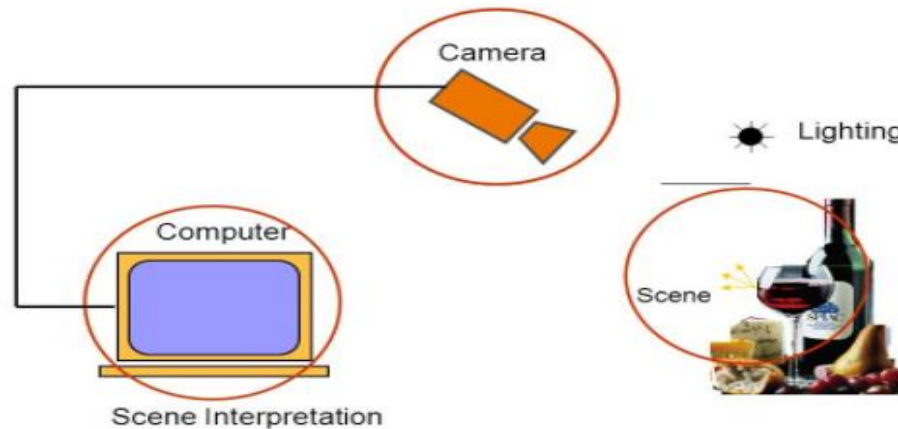


# What did you see?





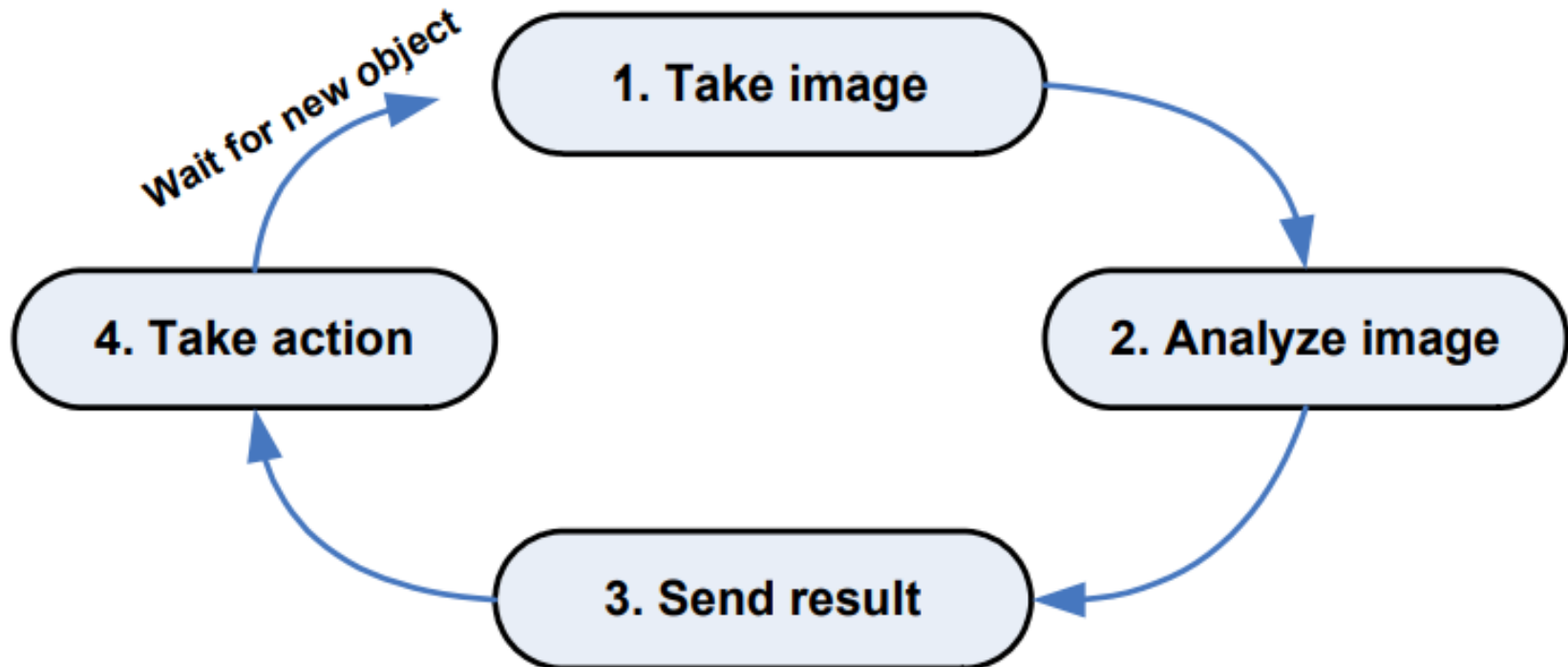
# Vision System



- These systems understand, interpret, and comprehend visual input on the computer.
- The structures of vision system consists of
  - Camera sensor
  - Processing unit
  - Lighting



# Typical Processes





# Steps of Analysis

## AESFERM

Acquisition

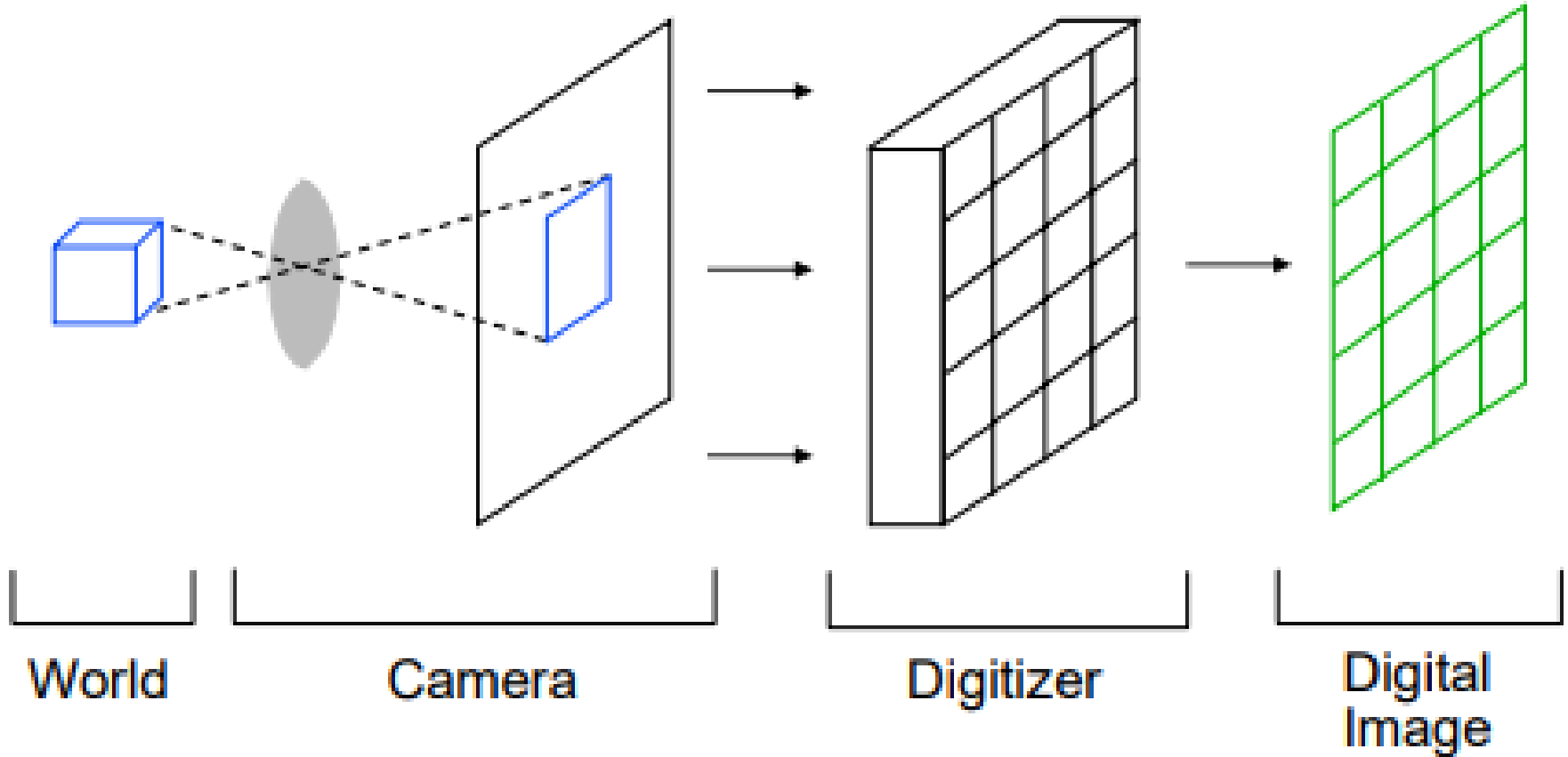
Enhancement

Segmentation

Feature  
Extraction,  
Representation,  
and Matching



# Acquisition







# Image

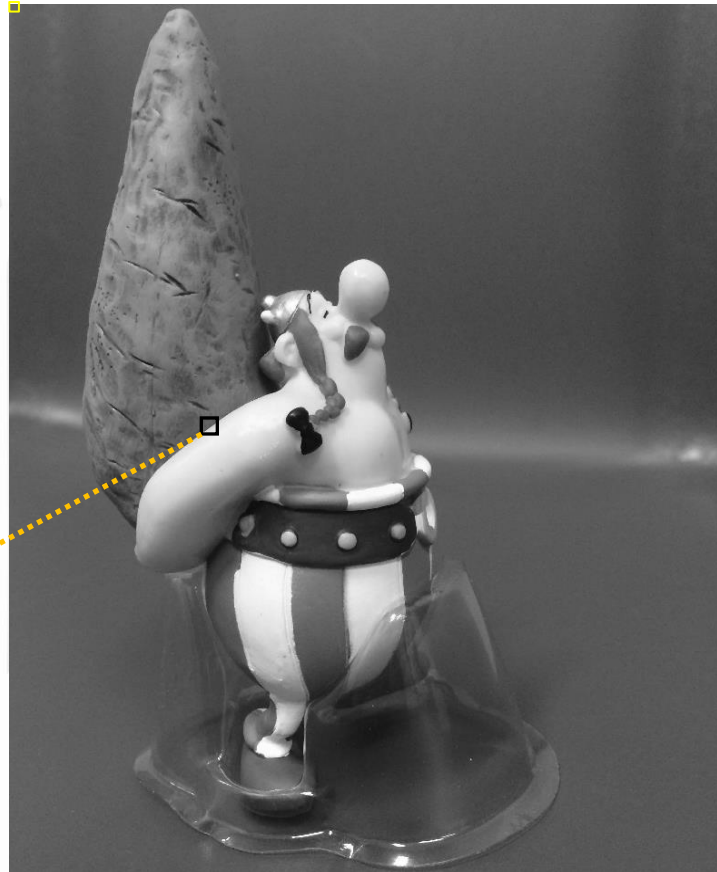
Consider the following image (2724x2336 pixels) to be 2D function or a **matrix** with **rows** and **columns**

In **8-bit** representation Pixel intensity values change between **0 (Black)** and **255 (White)**

Pixel intensity value

$$f(1,1) = 103$$

Pixel location



rows columns

$$f(645:650,1323:1328) =$$

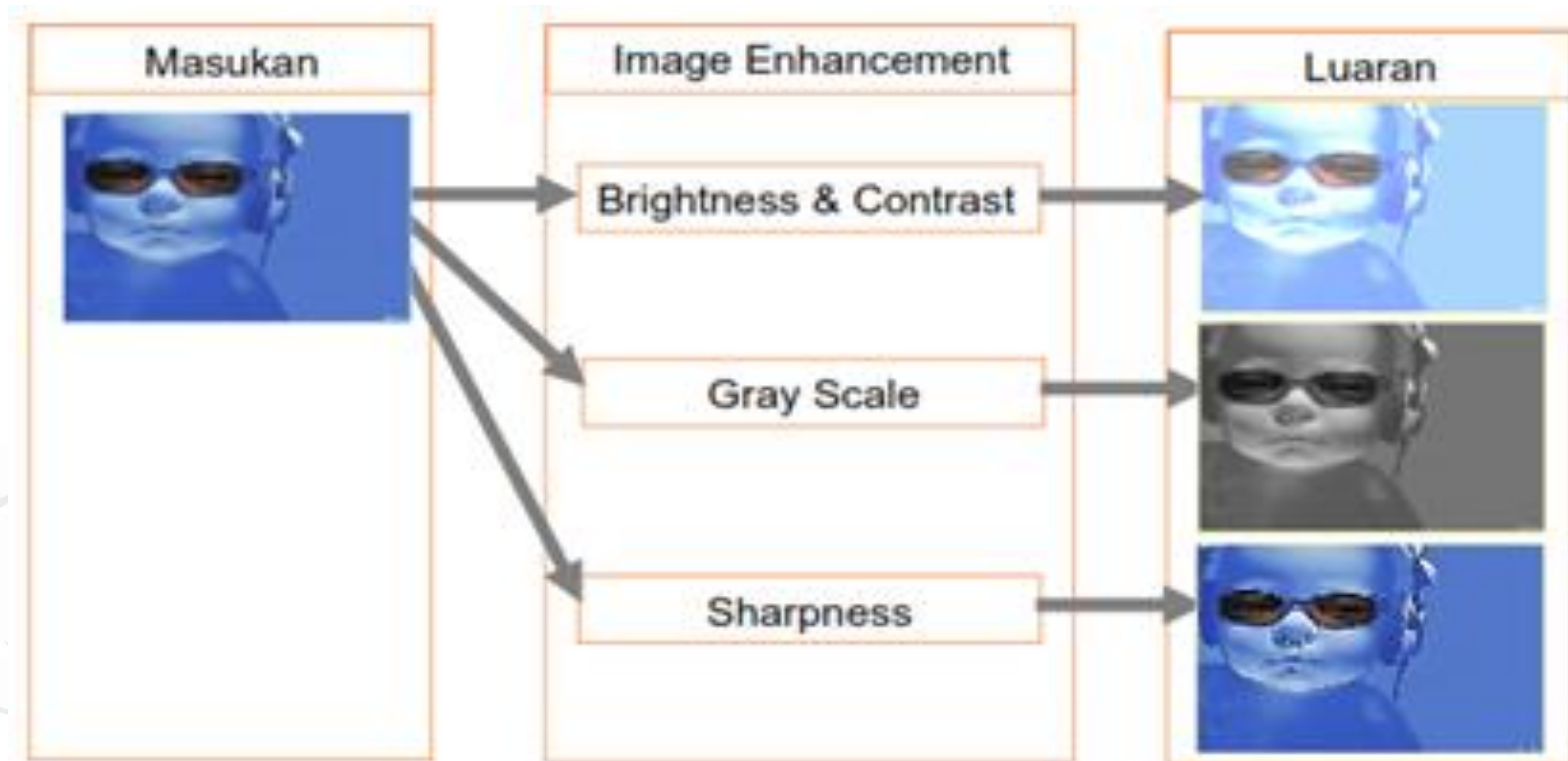
83	82	82	82	82	82
82	82	82	81	81	81
82	82	81	81	80	80
82	82	81	80	80	79
80	79	78	77	77	77
80	79	78	78	77	77

$$f(2724,2336) = 88$$



# Enhancement

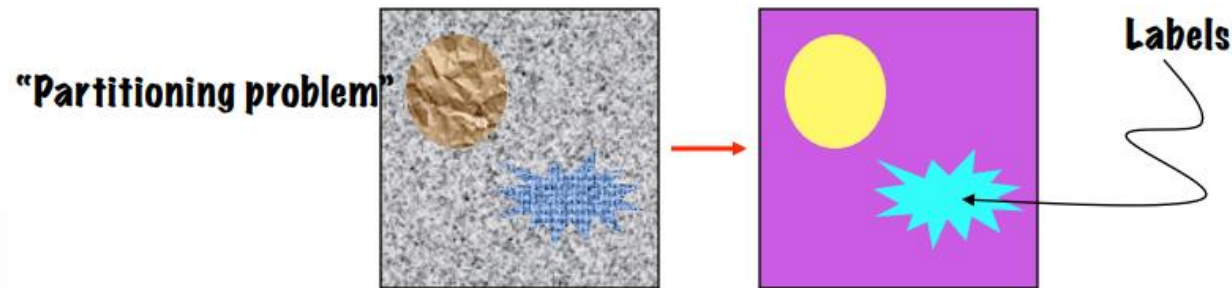
- The process to improve image quality, both contrast and brightness.



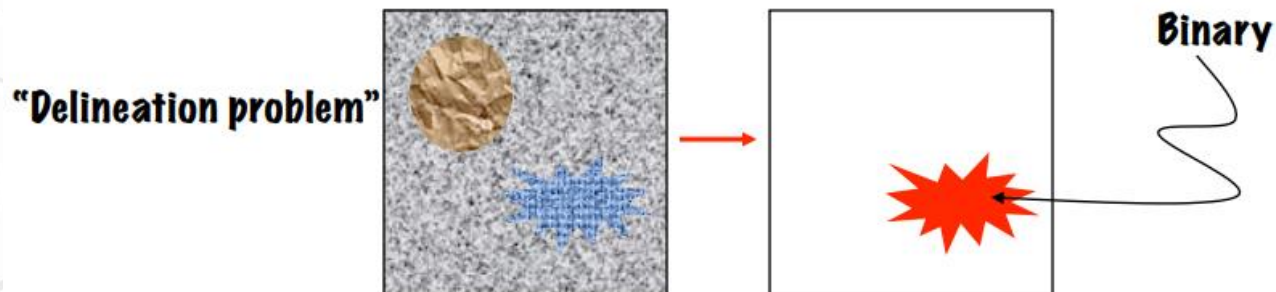


# Segmentation

- Partitioning image into meaningful pieces

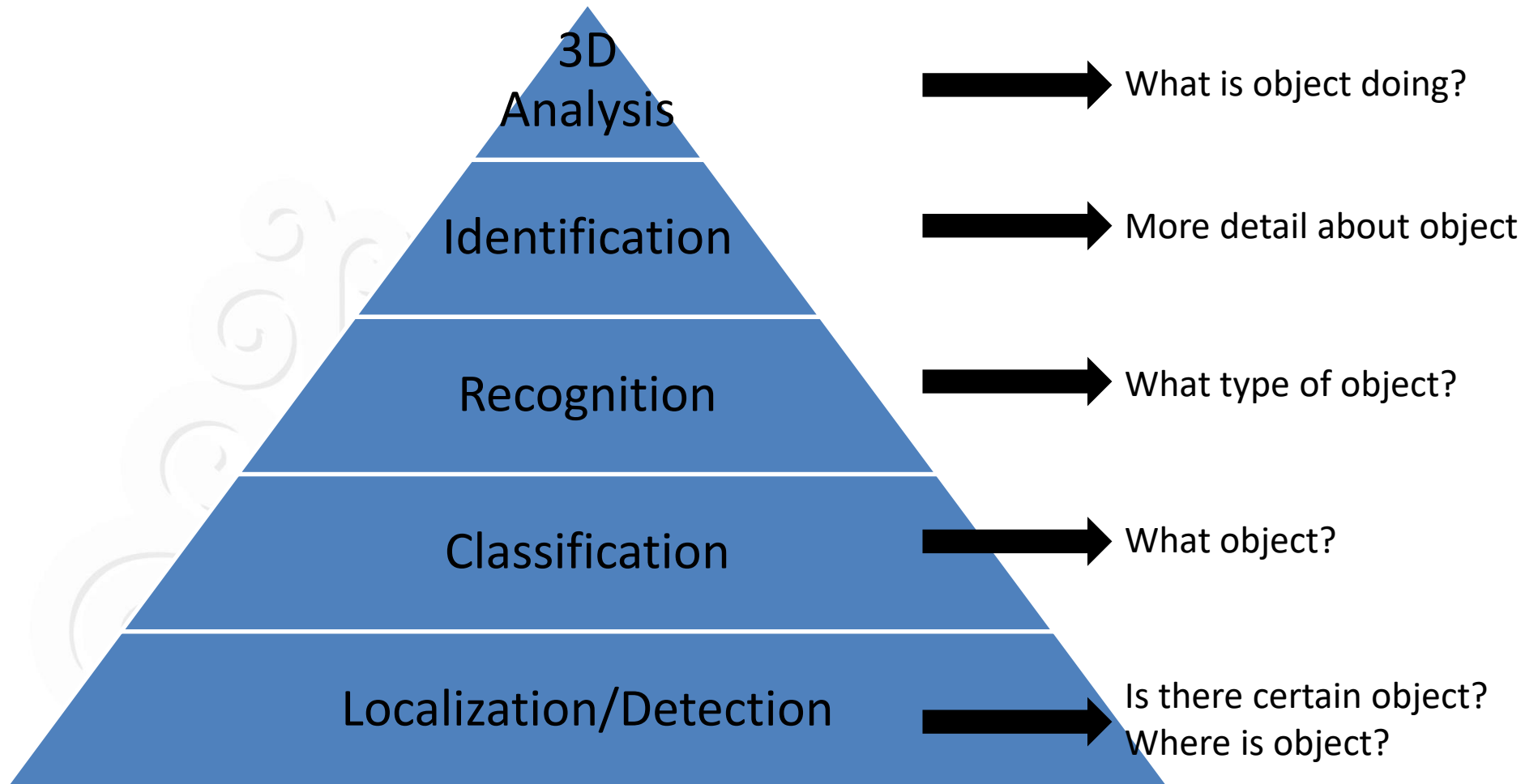


- Isolating a specific region of interest





# Level of Analysis





# Surveillance System



 **85%**  
Safety & Security

 **61%**  
Reduce Loss/ Theft

 **58%**  
Vandalism Prevention



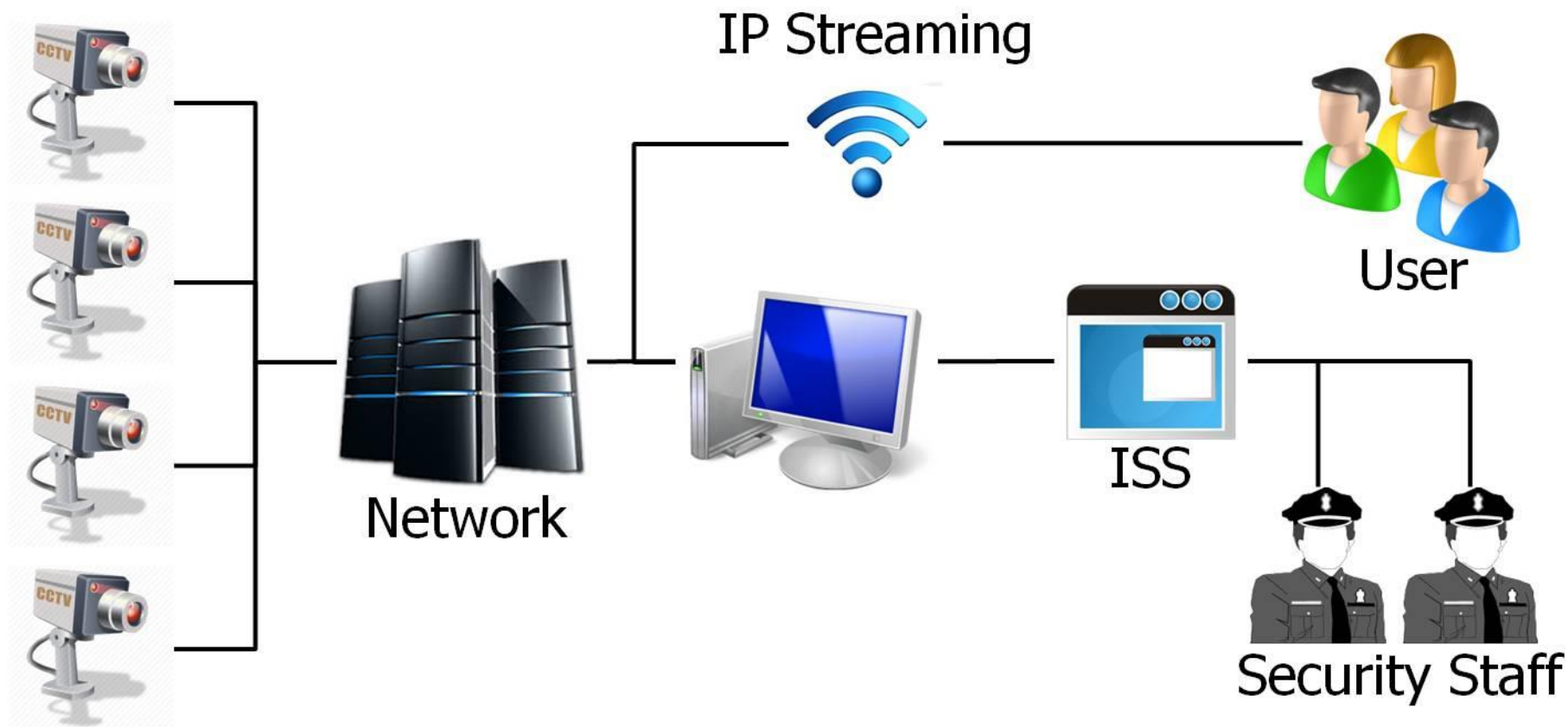
# Surveillance System



Illustration of manual inspection of surveillance system



# Automatic Surveillance System





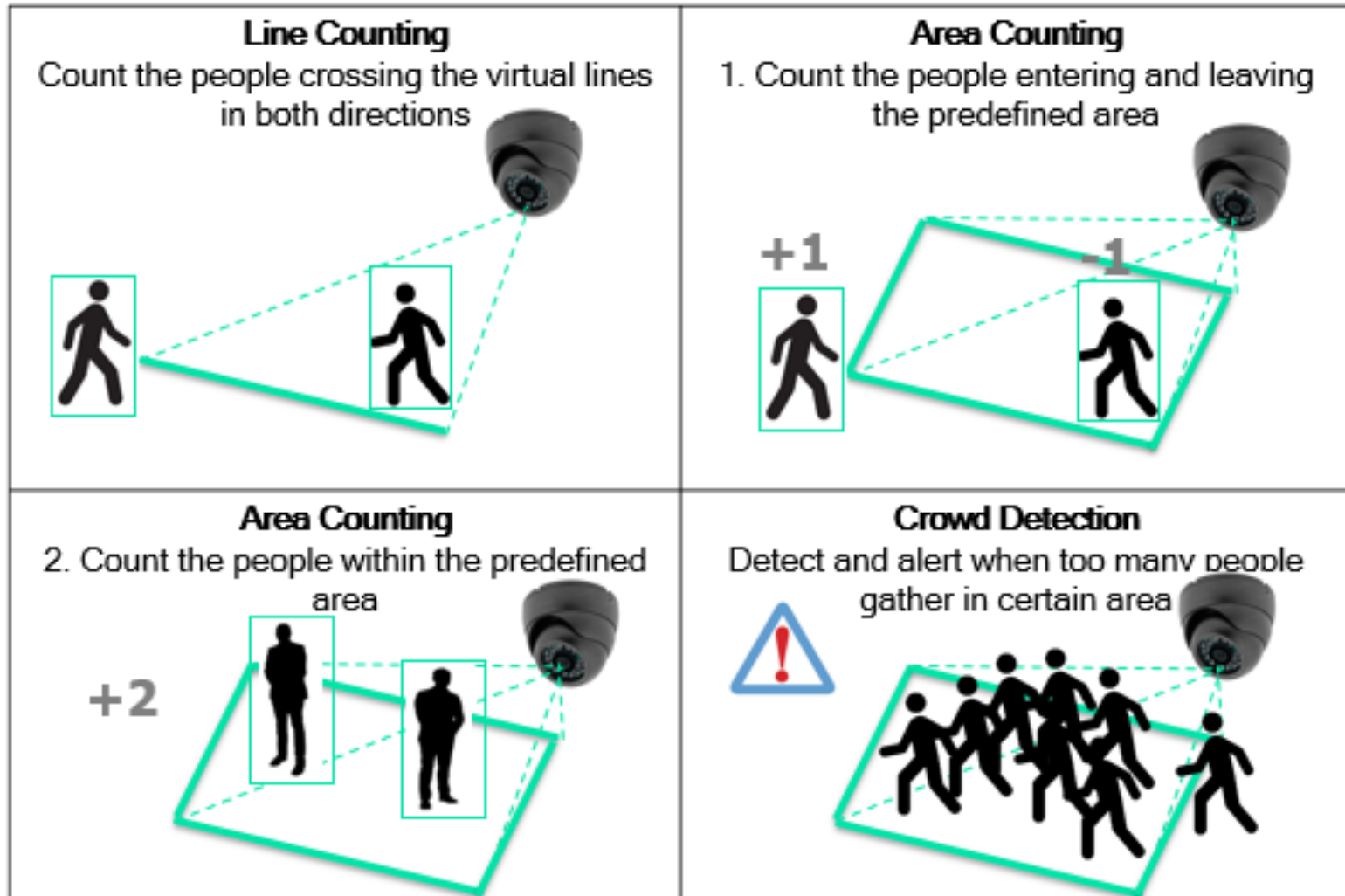
# Scenario in Surveillance System

- People Counting
- Illegally Parked Vehicle Detection
- Facial Recognition System
- Loitering Detection
- Human Action Recognition
- Multicamera Tracking





# People Counting





# People Counting - Example





# Facial Recognition System

- To enhance the task of intruder detection
  - Integrating the face recognition system to current state of Intelligent Surveillance System





# Face without Mask Detection





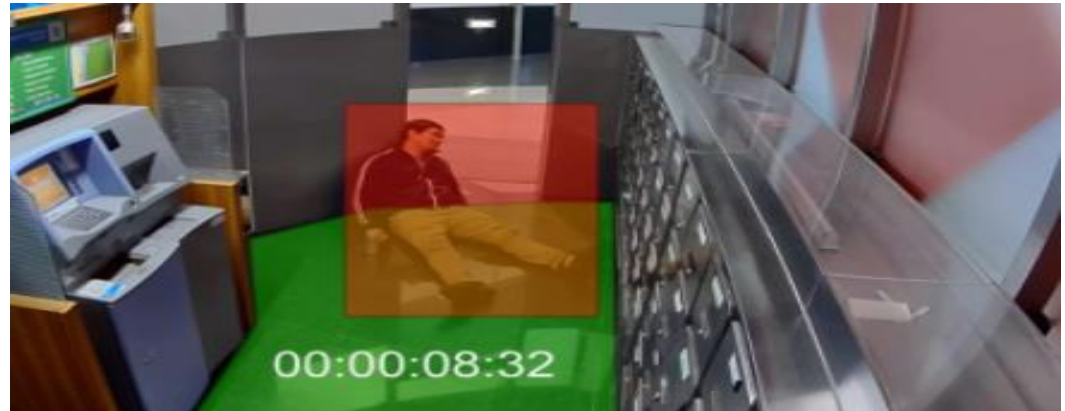
# Face without Mask Detection





# Loitering Detection

- Detect loitering people in certain area
- Applications
  - ATM Machine
  - Main Gate
  - Front Door



Copyright to <https://www.acti.com>

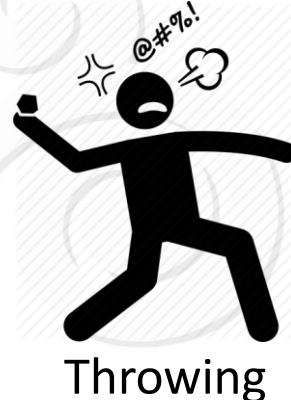
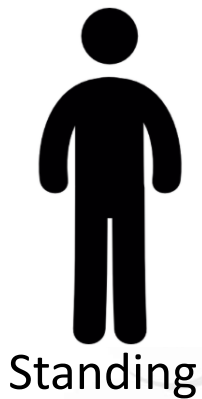


Bosch Security



# Human Action Recognition

- Recognize human action for identifying illegal behaviour in monitoring area.





# Intelligent Transportation System

- System to assist traffic management system and its relationship.
- Samples
  - Traffic Monitoring
  - Traffic sign recognition
  - Traffic Density Estimation

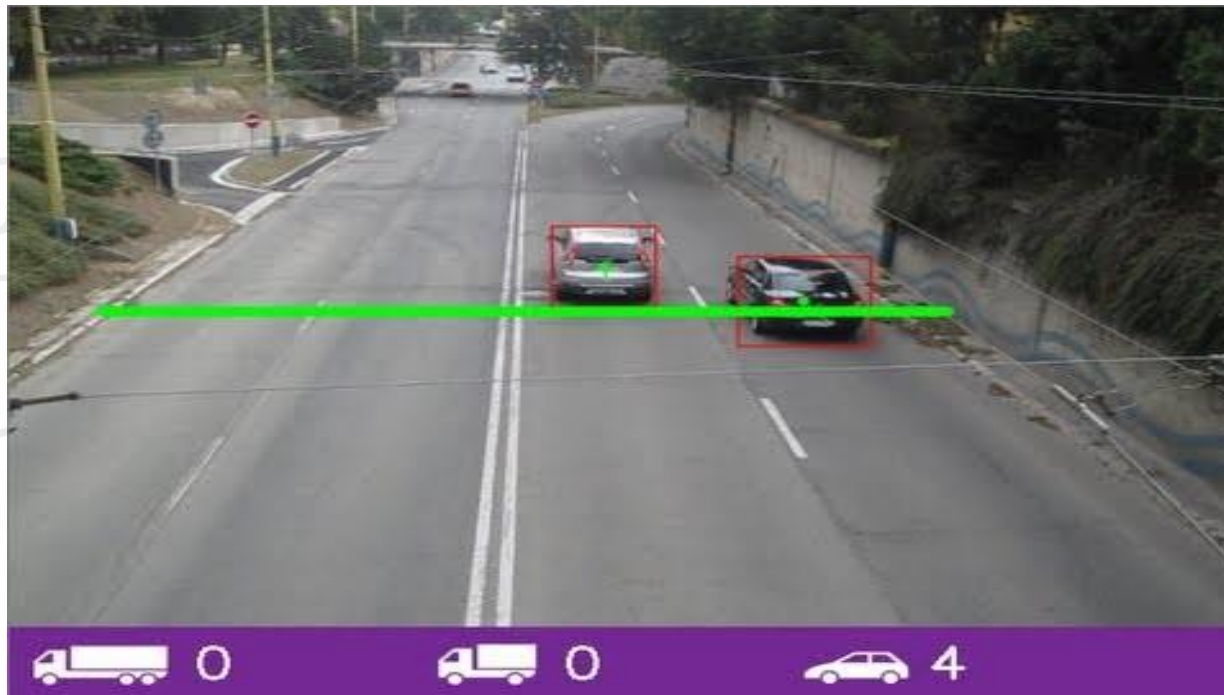






# Traffic Monitoring

- One of the application in traffic monitoring is vehicle classification in counting



[https://www.youtube.com/watch?v=z1Cvn3\\_4yGo](https://www.youtube.com/watch?v=z1Cvn3_4yGo)



# Traffic Sign Recognition

- Classify the type of traffic sign





# Utilization of VIS

## Public Facilities/School

- Human Action and Emotion Analysis
- Gate Access Monitoring
- Facial Recognition

## City Surveillance

- People Counting
- Crowded Detection
- Human Behaviour Analysis

## Law Enforcement

- Facial Recognition
- Multicamera Tracking and Person Re-Identification
- Human Localization

## Retail/Shopping Mall

- Visitor Counting
- Gate Access Monitoring
- Facial Recognition

## Banking/Finance

- Loitering Detection in ATM
- Facial Recognition



# Hot Issue in Indonesia



- Parkir Sembarang
- Melewati Marka Jalan
- Batas Kecepatan
- Penggunaan Helm
- Melawan Arus
- Menerobos Lampur Merah
- Melanggar Aturan Ganjil Genap
- Tanpa Sabuk Pengaman
- Bertelepon Saat Berkendara



# Challenges and Opportunity?





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**THANK YOU**

