



## Introduction to Computer Vision

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### Overview course

#### Objectives

- Introduction to computer vision
- Image acquisition
- Operators
- Applications

#### Workshop

- Theory with hands-on exercises
- Case study

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### Overview subjects, Informatica I2 (\*)

- Introduction with example application
- Development environment
- Image acquisition
- Image math,
- Contrast manipulation
- Segmentation
- Color image processing
- Labeling and blob measurement
- Geometric operators
- Blob matching
- Binary morphology
  
- Short introduction to other subjects

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### Overview subjects

- Introduction with example application
- Development environment
- Image acquisition
- Image math, geometric operators and synthetic images
- Contrast manipulation
- Segmentation
- Labeling and blob measurement
- Blob matching
- Color image processing
- Linear filters (Convolution)
- Edge detection
- Binary morphology
- Non linear filters
- Distance and Hough Transforms
- 2D Camera calibration
- Fourier transform
- Classification with neural networks

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### Overview subjects

- Barcode identification (\* optional part)
- Infra red cameras and thermal imaging (\* optional part)
- Vision and robotics (\* optional part)
- Genetic algorithms (\* optional part)
- Optical filters (\* optional part)

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### Course on Computer Vision



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### Some related subjects

- **Computer graphics**  
information generates images
- **Image processing**  
image with information generates new image
- **Computer vision**  
information is extracted from images
- **Machine vision**  
information is extracted from images in real-time

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### Examples of computer vision applications

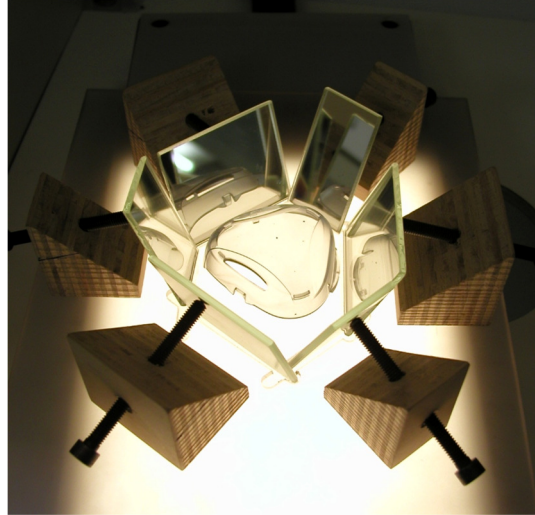
- **Quality control of products**
- **Surveillance**
- **Pick and placement**
- **Recognition of objects**
- **Mobile applications**

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**Quality control**



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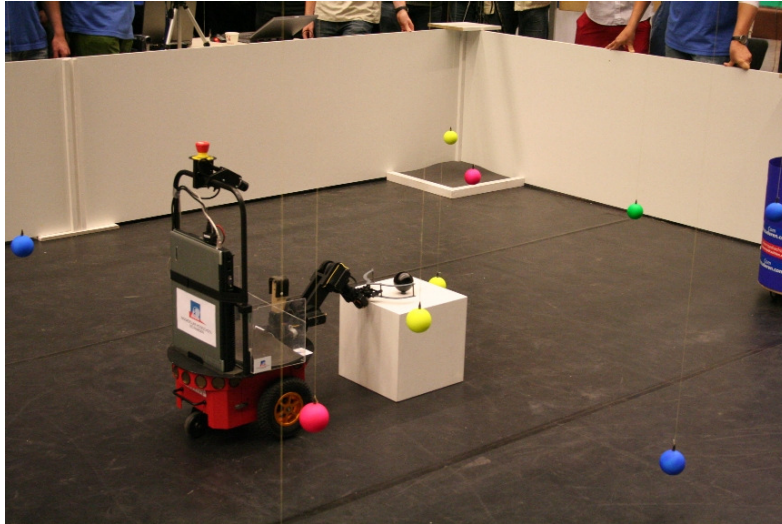
**Quality control**



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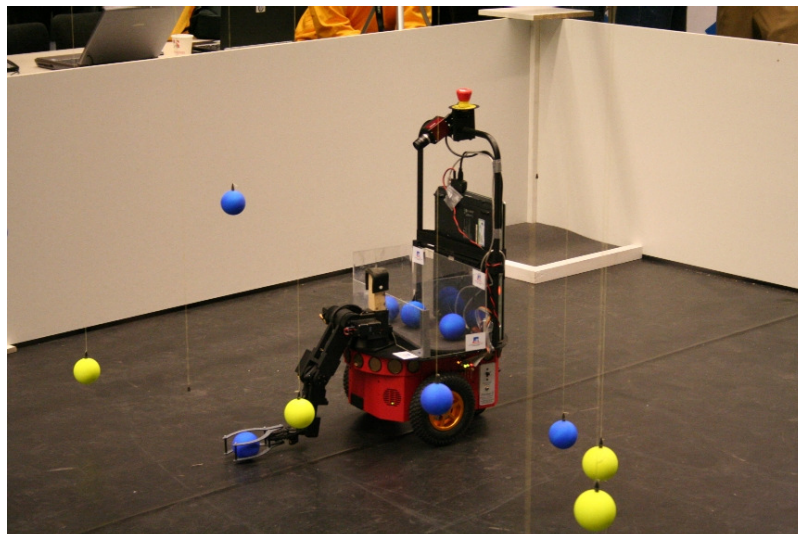
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**Pick and placement**

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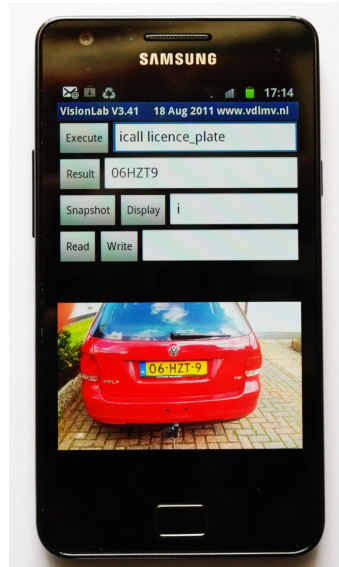
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**Pick and placement**

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**Mobile applications, example on Android**

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**Increase of use of computer vision**

- **Increased importance of QC and QA**
- **Decrease of cost**
- **Low budget computer vision systems are now possible**

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### Outline image application

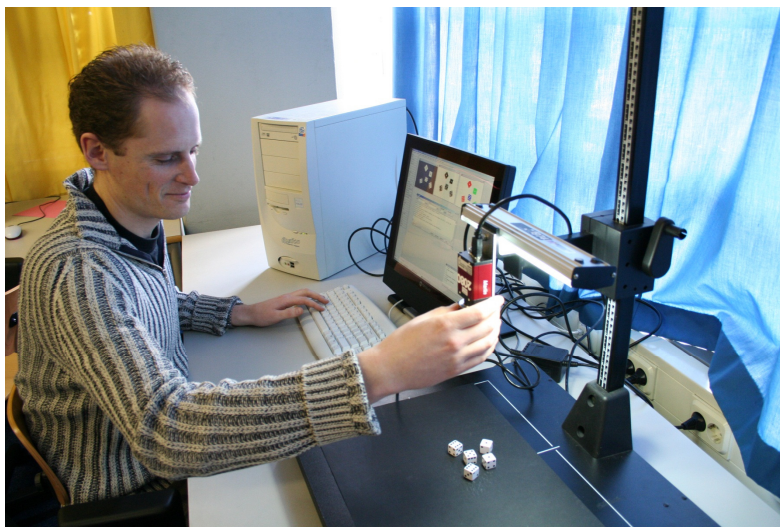
- Acquisition
- Enhancement
- Segmentation
- Feature extraction
- Classification

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### Dice recognition



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### Example dice recognition

- Analyse image
- Find candidates for dice:
  - Threshold for die
  - Label candidates
- Check dimensions for die:
  - Blob analyse
- For each die:
  - Find dots and check dimensions:
    - Threshold for dots
    - Label dots
    - Blob analyse

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### Example dice recognition

- Open file dice.jl
- (Enlarge2 if necessary for projection)
- Explain pixel value with use of Edit [0..255]
- Show distribution of brightness with Edit:
  - background = [50..80], die (the six) white > 200,
  - die dots (the six) = [70..140]
- Demonstrate the same with Analyse pixels
- Threshold 80 255 gives to much background
- Threshold 170 255 isolates the dice from the background
- Label blobs gives every die a unique number, show with Edit
- Blob Analyse with Area, Height, NOfHoles, TopLeft and Width gives positions of dice, check on size/nrholes is possible
- Measure size of dots:
  - With ROI cut out from dice.jl the six with a border of some pixel wide
  - Analyse pixel, Threshold 0 140 for isolating the dots
  - Label Blobs followed by Analyse Blobs gives number of dots, check on size of dots is possible
- Problems if dice touch each other

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### VisionLab functions used

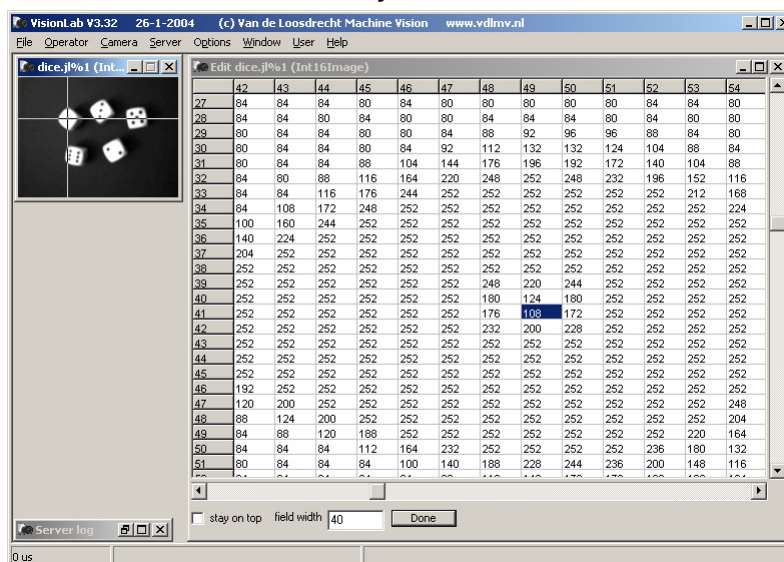
- **Start application:**  
Go to the directory VisionLab and double click on the file VisionLab.exe
- **Runtime help:**  
F1
- **Open image:**  
Menu: File | Open
- **Edit or examine pixel values:**  
Menu: Operator | Analyse | Edit
- **Analyse Pixels, examine profile lines:**  
Menu: Operator | Analyse | Pixels
- **Threshold, to segment image (from gray values to binary):**  
Menu: Operator | Segmentation | Threshold
- **LabelBlobs, label a binary image:**  
Menu: Operator | Label | LabelBlobs
- **BlobAnalyse, make measurements in labeled image:**  
Menu: Operator | Label | BlobAnalyse

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### Analyse Edit



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