



Introduction to Computer Vision

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Noordelijke Hogeschool Leeuwarden and Van de Loosdrecht Machine Vision
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j.van.de.loosdrecht@tech.nhl.nl, jaap@vdlmv.nl

Overview course

Objectives

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

Workshop

- Theory with handson excercises
- Case study

Overview subjects

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

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3

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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4

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5

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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6

Examples of computer vision applications

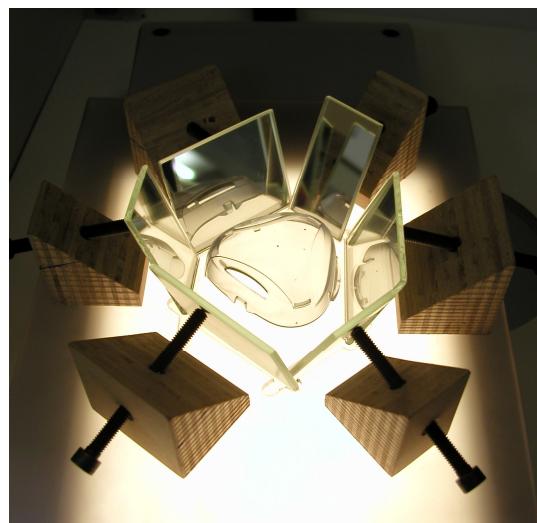
- Quality control of products
- Surveillance
- Pick and placement
- Recognition of objects

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7

Quality control



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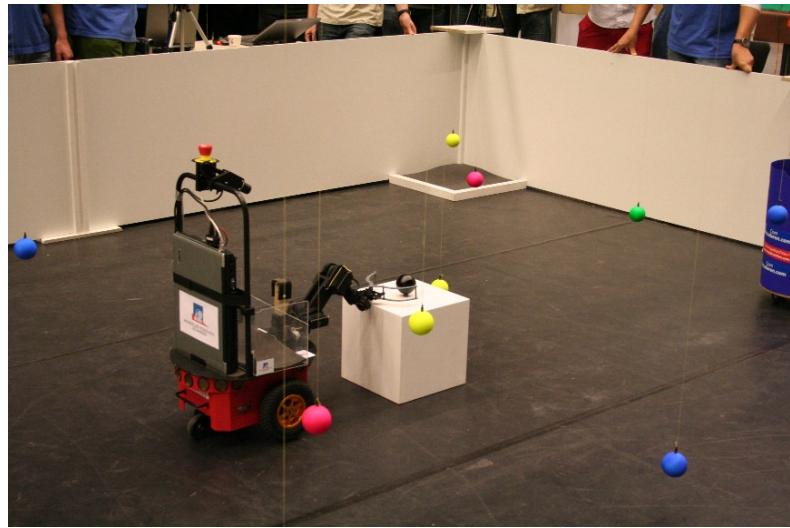
8

Quality control

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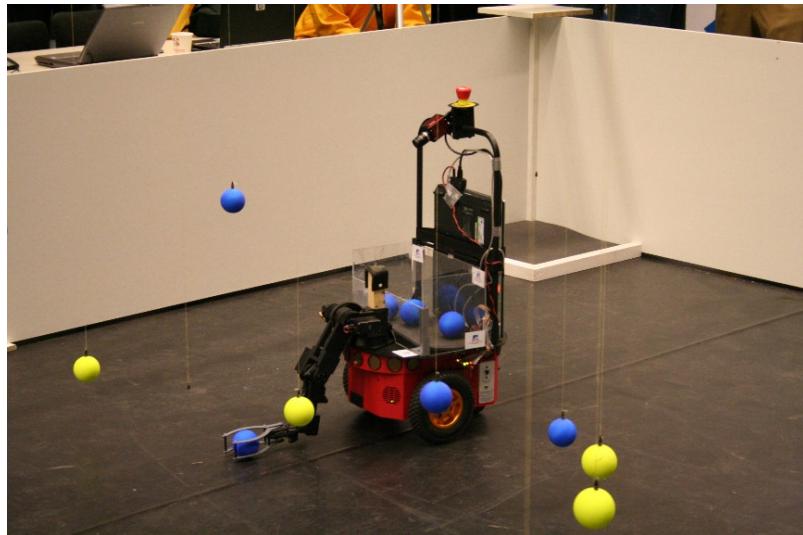
9

Pick and placement

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10

Pick and placement

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11

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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12

Outline image application

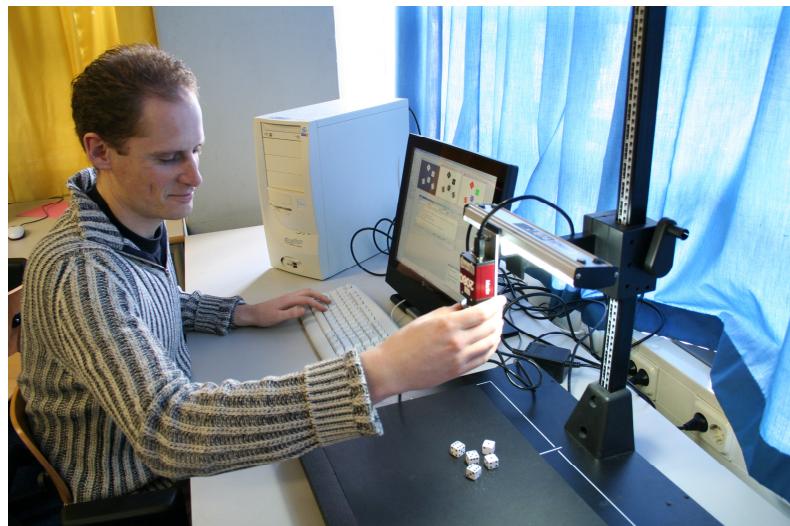
- **Acquisition**
- **Enhancement**
- **Segmentation**
- **Feature extraction**
- **Classification**

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13

Dice recognition



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14

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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15

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, NrOfHoles, 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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16

VisionLab functions used

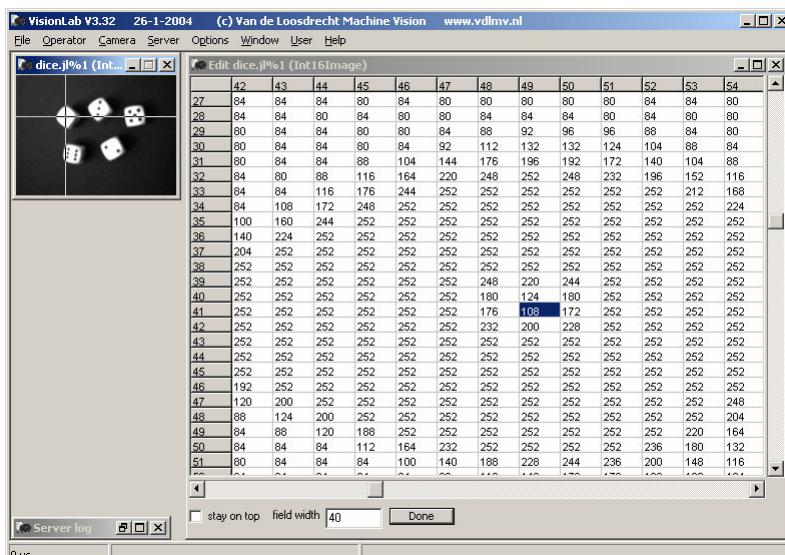
- **Start application:**
Go to the directory VisionLab and double click on the file VisionLab.exe
- **Runtime help:**
F1
- **Open image:**
Menu: File | Open
- **Edit or examine pixel values:**
Menu: Operator | Analyse | Edit
- **Analyse Pixels, examine profile lines:**
Menu: Operator | Analyse | Pixels
- **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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17

Analyse Edit



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18

