Technology
Arts Sciences
TH Köln

Course
IBV - Industrial Image Processing

Version: 2 | Last Change: 23.09.2019 09:14 | Draft: 0 | Status: vom verantwortlichen Dozent freigegeben

General information

Long name	Industrial Image Processing
Approving CModule	IBV_BaET, IBV_BaTIN
Responsible	Prof. Dr. Lothar Thieling Professor Fakultät IME
Level	Bachelor
Semester in the year	summer semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Lothar Thieling Professor Fakultät IME
Requirements	basic skills in signal processing basic skills in Java and/or C basic skills in analysis and linear algebra
Language	German
Separate final exam	Yes

Final exam

Details

The students should demonstrate the following competences in an oral exam: 1.) Safe handling of basic concepts and mechanisms. 2.) Analyze problems in the field of industrial image processing and solve them with suitable methods. 3.) Analyze existing solutions and explain the used algorithmic and theory.

Minimum standard

At least 50% of the total number of points

Exam Type

The students should demonstrate the following competences in an oral exam: 1.) Safe handling of basic concepts and mechanisms. 2.) Analyze problems in the field of industrial image processing and solve them with suitable methods. 3.) Analyze existing solutions and explain the used algorithmic and theory.

Lecture / Exercises

Learning goals

Knowledge

image construction, global image properties, and access to image data
graylevel and color images
global image properties,
mean value, variance, entropy
histogram, cumulative histogram
development environment
software design tools
compiler
linker
debugger
softwaretools for image processing and image analysis
softare-based access to image data and parameters
overview of the available ip-modules (moduls dor image processing and image analysis)
design and implementation of own ip-moduls
design of algorithmic chains based on ip-modules using visual programming

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gray level transformation
linear gray level transformation, histogram spreading
non-linear gray level transformation
histogram equalization
local histogram equalization
look-up-table

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analysis and processing of color images
technical and human color perception
additive and subtractive color mixing
RGB color space
HSI color space
transformation RGB to HSI and vise versa

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rank-order operators (non-linear filtering)
max, min, median
morphologische Operatoren
erosion, dilation
opening, closing
locating structures

analysis and processing in frequency domain
fourier analysis and synthesis of one-dimensional digital signals
real spectrum, imaginary spectrum
amplitude spectrum, phase spectrum
filtering in frequency domain
fourier analysis and synthesisf of images
real spectrum, imaginary spectrum
amplitude spectrum, phase spectrum
filtering in spatial domain
non directional filter
directional filter
inverse filtering

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linear filtering in spatial domain
convolution, convolution, transfer function
typical convolution maks (mean, gauß, differencial-operator, sobel-operator, laplace-operator)
gradient and its calculation using differential-operator and sobel-operator
analysis and evaluation of the operator in the frequency domain

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Tracking
normalized cross-correlation
without prediction
with prediction (kalman filter)

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measuring of subpixel edges
one-dimensional
two-dimensional using gradient

Skills

the presented methods for image enhancement can be
named
described
delineated in terms of application areas
evaluated in terms of advantages and disadvanteges
problemspecific parameterized

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the presented color spaces and corresponding algorithms can be
named
described
delineated in terms of application areas
evaluated in terms of advantages and disadvanteges
problemspecific parameterized

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the presented methods for non liniar filtering can be
named
described
delineated in terms of application areas
evaluated in terms of advantages and disadvanteges
problemspecific parameterized

Spectra of images and / or convolution masks can be
analyzed
designed
discussed

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the presented methods for linear filtering can be (space and frequency domain)
named
described
delineated in terms of application areas
evaluated in terms of advantages and disadvanteges
problemspecific parameterized

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	0
Exercises (shared course)	0
Tutorial (voluntary)	0

Separate exam

none

Practical training

Learning goals

Skills

purposeful handling of the tool chain for image processing

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deal with complex tasks in a small team

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derive complex solutions that can be implemented using image processing and image analysis

Expenditure classroom teaching

Type	Attendance (h/Wk.)

Practical training	2
Tutorial (voluntary)	0

Separate exam

none