

# Course Manual DBT

Digital Imaging

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## – General information

<b>Long name</b>	Digital Imaging
<b>Approving CModule</b>	<u>DBT MaMT</u>
<b>Responsible</b>	Prof. Dr. Gregor Fischer Professor Fakultät IME
<b>Valid from</b>	winter semester 2020/21
<b>Level</b>	Master
<b>Semester in the year</b>	winter semester
<b>Duration</b>	Semester
<b>Hours in self-study</b>	78
<b>ECTS</b>	5
<b>Professors</b>	Prof. Dr. Gregor Fischer Professor Fakultät IME
<b>Requirements</b>	none
<b>Language</b>	German
<b>Separate final exam</b>	Yes

## Literature

R.W.G. Hunt, The Reproduction of Color

M. Fairchild, Color Appearance Models, Wiley, 2nd ed.

G. C. Holst, T. S. Lomheim, CMOS/CCD Sensors and Camera Systems, SPIE

J. Nakamura, Image Sensors and Signal Processing for Digital Still Cameras, Taylor & Francis

Reinhard/Ward/Pattanaik/Debevec, High Dynamic Range Imaging, Elsevier 2010

R. Gonzales/R. Woods/Eddins, Digital Image Processing Using Matlab, Prentice Hall, 2004

W. Pratt, Digital Image Processing, Wiley, 4th ed., 2007

A. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1988

## Final exam

**Details** Short project with final oral exam

**Minimum standard** Working Matlab program Oral presentation of the project objectives and the project results

**Exam Type**

EN mündliche Prüfung,  
strukturierte Befragung

## – Lecture / Exercises

### Learning goals

Goal type	Description
Knowledge	Color Imaging Color capturing with electronic sensors Color detectors Demosaicking Optical antialiasing filters Color management for DSCs ICC profiles computing with least squares fit Testing color accuracy Color appearance models Multispectral Imaging Spectral sensitivities estimation by means of a general method to stabilize an instable set of linear equations Statistics of natural spectra (Principal Components Analysis) Spectral stimulus estimation
Knowledge	HDR Imaging HDR capturing technology Contrast management photo receptor model unsharp masking retinex algorithm Automatic control
Knowledge	Imaging Methods Automatic white balancing Grey world approach Color-by-Correlation Dichromatic reflection model MTF management MTF measurement filter design for MTF optimization and sharpening Adaptive sharpening Denoising Modelling of sensor noise Locally adaptive smoothing filter Wiener filtering Bilateral filtering Non-Local-Means filtering Defect pixel / cluster correction
Skills	Describe the function and effects of different imaging methods
Skills	derive correction models for the image processing from the optical and electronic mechanisms

### Special requirements

Basics of the multivariate statistics, Principal Components Analysis (basic course mathematics)  
 Linear optimization methods (basic course mathematics)

<b>Accompanying material</b>	electronic slides as presented during lectures, electronic collection of exercises
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<b>Separate exam</b>	No
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Skills

explain the application of basic mathematical tools for modelling and optimization of imaging methods

### Expenditure classroom teaching

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

## – Practical training

### Learning goals

Goal type	Description
Skills	analyse optical and electronic imaging characteristics
Skills	recognize and assess imaging defects
Skills	realize imaging methods by software programmin according to a given specification or scientific paper
Skills	measure optical and electronic imaging characteristics or defects
Skills	implement new imaging methods according to a given specification or scientific paper
Skills	optimize imaging methods by basic mathematical optimization methods
Skills	compare image quality of different imaging methods
Skills	document results

### Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	2
Tutorial (voluntary)	0

### Special requirements

none

### Accompanying material

electronic description of lab-exercices, electronic developping tools for:  
access to raw image data (Matlab)  
image processing (Matlab)  
digital camera simulation (Stanford's Imageval in Matlab)

### Separate exam

Yes

### Separate exam

#### Exam Type

EN praxisnahes Szenario bearbeiten (z.B. im Praktikum)

#### Details

Protocol reports about lab exercises

#### Minimum standard

Reports for all lab exercices must be delivered in correct form with correct results