Computer Vision (MOD-E06)

Code Number	Workload	Credits	Semester	Frequency	Duration
10406	180 h	6		annually	1 Semester

1	Course Title	Contact hours	Self-Study	Planned Group Size
	Computer Vision	4 SWS / 60 h	120 h	25 students

2 Course Description

Computer Vision is both a basic technology and an application domain for mechatronic and embedded systems. It is used in automotive systems, robotics and biomedical systems. This module focus on the use in mobile robots (e.g. autonomous driving, unmanned air vehicles) industrial robots and biomedical applications (e.g. surgical robotics), since Dortmund University of Applied Sciences and Arts has established many research activities in these domains. Research topics from research centres (biomedical technology, pimes) and other key areas of the university are defining the content of this module. The module introduces the basic algorithms and components for computer vision and robotic vision systems. In addition, students will learn about the application of that knowledge in the specific domain. The course will involve topics from a recent research project.

3 Course Structure

1. Introduction
2. Position and Orientation
3. Light and Color
4. Image Creation
5. Image Processing
6. Feature Extraction
7. Multiple Images
8. Advanced Topics and Applications

4 Parameters

- Course characteristics: elective
- Course frequency: every year - summer semester
- Capacity: 25 students
- Course admittance prerequisites: higher mathematics, basics of embedded systems
- Skills trained in this course: theoretical, practical and methodological skills
- Assessment of the course: Oral Exam (30 min) at the end of the course (50%) and group work as homework (50%): modeling and target mapping of an example with Matlab/Simulink, demonstration and presentation
- Teaching staff: Prof. Dr. Jörg Thiem, (Dr. Roland Brockers)

5 Learning outcomes

5.1 Knowledge

- Knows standards and platforms for computer vision
- Knows cameras, components, target systems
- Has acquired overview of algorithms and methods

5.2 Skills

- Can model signal processing path for computer vision
- Can apply methodology and state of the art tools for computer vision
- Can adapt and modify/parameterize relevant algorithms

	5.3 Competence - attitude • Can structure a real computer vision project • Can integrate cameras and vision modules into mechatronic systems • Can analyze mechatronic systems and derive requirements for computer vision
6	**Teaching and training methods** • Lectures, Labs (with MATLAB/Simulink), homework • Access to tools and tool tutorials • Access to recent research papers
7	**Course mapping** Requires: • MOD1-01 – Mathematics for Controls & Signals • MOD1-03 - Embedded Software Engineering • MOD2-04 – Signals & Control Systems 1 Connects to: • MOD-E01 – Applied Embedded Systems • MOD-E04 – Signals and Systems for Automated Driving • MOD-E10 – Automotive Systems
8	**References** P. Corke: Robotics, Vision and Control, Springer, 2013 R. Szeliski: Computer Vision: Algorithms and Applications, Springer, 2011 E. Gopi: Digital Signal Processing for Medical Imaging Using Matlab, Springer, 2013