COURSE DESCRIPTION CARD - SYLLABUS

Course name
Introduction to computer vision [S1AiR2>PO8-WdPO]

Course

Field of study
Automatic Control and Robotics

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Marek Kraft
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Lecturers

Prerequisites

Knowledge: The student should have general, undergradate-level knowledge on mathematics - algebra, mathematical analysis, logic and probabilistics. Skills: The student should be able to use the personal computer efficiently and be capable of implementing simple algorithms and progrmming assignments. The skill of acquiring knowledge from indicated sources is also required.

Course objective

The aim of the course is for students with basic issues in the functioning of vision and image processing systems and their application in automation and robotics applications.

Course-related learning outcomes

Knowledge:
Has advanced structured knowledge of selected algorithms and data structures as well as procedural and object-oriented programming methodologies and techniques [K1_W8 (P6S_WG)].
Has a structured knowledge of computer architectures, computer systems and networks and operating systems including real-time operating systems [K1_W9 (P6S_WG)].
Knows and understands typical engineering technologies, principles and techniques of construction of

simple automation and robotics systems; knows and understands the principles of selection of executive systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Is familiar with the current status and latest development trends of the field of automation and robotics [K1_W21 (P6S_WG)].
Knows and understands the fundamental dilemmas of modern civilisation related to the development of automation and robotics [K1_W28 (P6S_WK)].

Skills:
Can design and practically use simple diagnostic and decision-making systems dedicated to automation and robotics systems [K1_U21 (P6S_UW)].
Is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system [K1_U22 (P6S_UW)].
Be able to identify and formulate specifications for simple engineering tasks in the field of automation and robotics [K1_U23 (P6S_UW)].
Is able to develop a solution to a simple engineering task and implement, test and run it in a selected programming environment on a PC for selected operating systems [K1_U26 (P6S_UW)].

Social competences:
Is aware of the importance and understands the non-technical aspects and consequences of engineering activities, including their impact on the environment and the related responsibility for decisions; is ready to care for the achievements and traditions of the profession [K1_K2 (P6S_KR)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - final credit test carried out on Moodle plaftorm.
Laboratories - project and final practical programming test.

Programme content

Image acquisition, image encoding methods, basic video encoding.
Using the OpenCV library for image processing.
Processing based on colors and histograms.
Pre-processing of the image - local methods (gamma correction, histogram-based processing, thresholding, etc.).
Contextual methods - convolution, linear and non-linear filtering; morphological operations.
Detection of image features (lines, points, circles).
Image feature descriptors.
Segmentation and analysis of shapes.
The role of lighting in vision systems.
Industrial vision systems.
Introductory information on the application of deep learning for image processing.

Course topics

The topics covered in this course include basic information to enable practical use of vision systems to solve engineering problems. The course begins with a discussion of the basic components of machine vision systems and their key parameters for selection for a specific application. This is followed by a discussion of the algorithms used in machine vision systems. The lecture concludes with introductory information about machine vision systems using machine learning methods.

Teaching methods

Lectures with multimedia presentations, additionally placed in the streaming service to be played later.

Laboratory classes covering the implementation and testing of selected algorithms of image and video

processing using Python language and solving selected practical problems.

Bibliography

Basic:
1. R. Szeliski, Computer Vision: Algorithms and Applications, Springer, 2010
2. Supplementary material published on Moodle

Additional:
Selected scientific articles related to the subject matter.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50