Description of learning outcomes for module

<table>
<thead>
<tr>
<th>MLO code</th>
<th>Student after module completion has the knowledge/ knows how to/is able to</th>
<th>Method of learning outcomes verification (form of completion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social competence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_K001</td>
<td>Student is able to point out the areas where you can apply algorithms image processing and analysis, and understands how important it can play their application to the economy and the environment.</td>
<td>Examination</td>
</tr>
<tr>
<td>Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_U001</td>
<td>Student can yourself implement algorithms for image processing and analysis in a specialized software environment.</td>
<td>Completion of laboratory classes</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_W001</td>
<td>Student has a basic knowledge of the methods and equipment for acquisition, processing and visualization of images in digital systems.</td>
<td>Examination</td>
</tr>
<tr>
<td>M_W002</td>
<td>Student has a structured knowledge of the algorithms in the field of pre-processing and basic methods of image analysis.</td>
<td>Examination</td>
</tr>
</tbody>
</table>

FLO matrix in relation to forms of classes
Module content

Lectures

Digital Image Processing and Vision Systems
Acquisition of digital images – equipment, sampling, quantization, colour representation. Methods of digital image processing: arithmetic operations, image enhancement, noise removal, edge detection, thresholding and morphological methods. Analysis of digital images: segmentation, background generation, foreground object detection, labeling and shape coefficients. Image processing in the frequency domain, the 2D Fourier Transform. Vision systems: standards, equipment and acceleration methods.

Laboratory classes

Digital Image Processing and Vision Systems
Classes are based on Matlab Image Processing Toolbox. Laboratory exercises topics:
1. Selected color spaces, basic operations on images
2. Point based image transformations, look-up-table conversion,
3. Histogram equalization,
4. Image resolution, image interpolation,
5. Spatial transformations of images,
6. Image pre-processing (discrete two-dimensional convolution)
7. Thresholding, local thresholding,
8. Morphological transformations,
9. Edge detection, Hough transformation
10. Region growing segmentation,
11. Segmentation by splitting and merging,
12. Advanced filtration (bilateral filtering)
13. Connected component labeling, classification based on shape coefficients
14. The Fourier transformation, filtering in the frequency domain,
15. Discrete cosine transform (DCT), JPEG compression

Method of calculating the final grade
The final grade will be calculated using the following formula:
Final Grade = 0.4 x Laboratory Classes Grade + 0.6 x Exam Grade
Written or oral exam will be at the end of the semester. To participate in the exam will be admitted only students who receive credit from the lab.
The laboratory grade will be calculated using a 0 – 100 point scale, where:
- final test – 71 credit points
- activity – 29 credit points.
The grade scale is available in the AGH Study Regulations.
The completion of all laboratories (exercises) as well as passing the final test is required to obtain a positive grade.
All absences should be made up for before the end of the course, at dates set out with the teacher.
5 min before the end of each class students should present their work to the teacher, who evaluates the obtained results and scores them.
Additional exercises (homework) will be proposed for some laboratories. The obtained score will be included in points for activity.
All exercises and homework are individual work of a particular student. All events of cheating and copying (i.e. presenting work of other students or downloaded from the Internet) will result in a negative grade for the whole course.
The written final test will be divided into two parts. The first will be held in half of the semester and the other at the end. Both parts should be passed (minimum score 50% for each). The topics include issues presented in the lecture as well as during laboratories. In the case of not passing the test one correction date will be determined in the end of the semester. The maximal score for the second attempt will be 50% of the points in the first attempt.
The total score of the test will be converted into credit points according to the following formula: 
7.16984848098350 • $\sqrt{x} - 0.698484809835009$. This means that passing the test with 50% of points will result in 50 credit points and 100% test points will result in 71 credit points.

Prerequisites and additional requirements
Basic knowledge of Matlab

Recommended literature and teaching resources

Scientific publications of module course instructors related to the topic of the module
M. Gorgoń, “Parallel Performance of the Fine-Grain Pipeline FPGA Image Processing System”, Opto-
Gorgoń M., Jabłoński M., Binary image labelling, HANDEL-C design implementation flow, AGH University of Science and Technology, Kraków, 2003.

Additional information
None

Student workload (ECTS credits balance)

<table>
<thead>
<tr>
<th>Student activity form</th>
<th>Student workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in lectures</td>
<td>28 h</td>
</tr>
<tr>
<td>Participation in laboratory classes</td>
<td>28 h</td>
</tr>
<tr>
<td>Preparation for classes</td>
<td>42 h</td>
</tr>
<tr>
<td>Realization of independently performed tasks</td>
<td>50 h</td>
</tr>
<tr>
<td>Examination or Final test</td>
<td>2 h</td>
</tr>
<tr>
<td>Summary student workload</td>
<td>150 h</td>
</tr>
<tr>
<td>Module ECTS credits</td>
<td>6 ECTS</td>
</tr>
</tbody>
</table>