**Nazwa przedmiotu:**

Computer vision

**Koordynator przedmiotu:**

Włodzimierz Kasprzak, Ph.D., D.Sc. Professor

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia II stopnia

**Program:**

Robotics

**Grupa przedmiotów:**

Przedmioty obowiązkowe

**Kod przedmiotu:**

EM04

**Semestr nominalny:**

1 / rok ak. 2020/2021

**Liczba punktów ECTS:**

5

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

1) Number of hours that require the presence of a teacher – 50, including
a) presence of the lectures - 30;
b) presence in the exercises - 15
c) presence on consultation - 5
2) The number of hours of independent work of student - 85

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

3 ECTS credits – number of hours that require the presence of a teacher – 50, including
a) presence of the lectures - 30;
b) presence in the exercises - 15
c) presence on consultation - 5

**Język prowadzenia zajęć:**

angielski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

3 ECTS credits – which are obtained during classes of a practical nature;

number of hours during classes of a practical nature - 80, including
b) presence in the exercises - 15
c) presence on consultation – 5
d) independent work of student on solving practical exercise tasks and a homework task – 60

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład:  | 30h |
| Ćwiczenia:  | 15h |
| Laboratorium:  | 0h |
| Projekt:  | 0h |
| Lekcje komputerowe:  | 0h |

**Wymagania wstępne:**

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**Limit liczby studentów:**

100

**Cel przedmiotu:**

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**Treści kształcenia:**

Contents:
Image formation and auto-calibration. Low-level image processing: image normalization, colour spaces, image compression and image filtering. Image segmentation: edge detection, chain and line segment detection, Hough transforms, homogeneous region-, shape- and texture description. Object classification: the potential functions-, Bayes-, k-NN, SVM- and MLP- classifiers. Object recognition: dynamic programming, hypothesis generation-and-test, model-to-image matching and graph search. Image motion estimation: gradient- and block-based optical flow, discrete feature motion and active contour tracking. Two-view geometry - stereo-vision. Multi-view and motion-based 3-D object reconstruction. Dynamic vision: object tracking – recursive state estimation, autonomous navigation, discrete self-localization.
Practical Work: Exercises on image processing for recognition purposes

**Metody oceny:**

Assessment will be marked out of a hundred points, where 70% comes from continuous assessment, and 30% comes from end-semester examination. In particular, points can be earned from:
• tutorial, including a practical homework task, 0-40 pts.;
• midterm test, 0-30 pts.;
• final exam, 0-30 pts.
The attendance requirements: an obligatory attendance of tutorial and an optional attendance of lecture.

**Egzamin:**

tak

**Literatura:**

Recommended texts:
- W. Kasprzak, Computer Vision, lecture e-notes, WUT, 2008-2014.
- Y. Ma, S. Soatto, J. Kosecka, S. Sastry, An Invitation to 3D Vision. From Images to Geometric Models, Springer-Verlag, New York 2004. on-line: vision.ucla.edu/MASKS/
- I. Pitas, Digital Image Processing Algorithms, Prentice Hall, New York, 1993.
- O. Faugeras, Three-dimensional computer vision. A geometric viewpoint, The MIT Press. Cambridge, Mass. 1993, 2001
Further readings:
• B. Siciliano, O. Khatib (eds.): Handbook of Robotics. Springer, Berlin Heidelberg, 2008
• OpenCV documentation: http://opencv.org/documentation.html
• PCL (point clouds library) documentation: http://pointclouds.org/documentation/

**Witryna www przedmiotu:**

http://studia.elka.pw.edu.pl/pub/14Z/ECOVI.A/

**Uwagi:**

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## Charakterystyki przedmiotowe

### Profil ogólnoakademicki - wiedza

**Charakterystyka EM04\_W1:**

Knowledge of different image processing methods

Weryfikacja:

Continuous assessment at tutorials regarding the acquired knowledge needed to solve computational and algorithmic exercise tasks, related to the content of this course.
Written assessment of the course outcomes by a written mid-time test.
Written assessment of the course outcomes by a final exam

**Powiązane charakterystyki kierunkowe:** AiR2\_W01, AiR2\_W04, AiR2\_W11, AiR2\_W12

**Powiązane charakterystyki obszarowe:** I.P7S\_WG, P7U\_W, III.P7S\_WG.o, I.P7S\_WK, III.P7S\_WK.o, III.P7S\_WG

### Profil ogólnoakademicki - umiejętności

**Charakterystyka EM04\_U1:**

Ability to select proper image processing method for a specific purpose.

Weryfikacja:

Continuous assessment at tutorials regarding the acquired knowledge needed to solve computational and algorithmic exercise tasks, related to the content of this course.

**Powiązane charakterystyki kierunkowe:** AiR2\_U01, AiR2\_U06, AiR2\_U16

**Powiązane charakterystyki obszarowe:** P7U\_U, I.P7S\_UW.o, III.P7S\_UW.o, I.P7S\_UW, III.P7S\_UW.2.o, III.P7S\_UW.4.o, III.P7S\_UW.1.o, III.P7S\_UW.3.o

**Charakterystyka EM04\_U2:**

Able to process the images for the purpose of getting the required information

Weryfikacja:

Continuous assessment at tutorials regarding the acquired knowledge needed to solve computational and algorithmic exercise tasks, related to the content of this course.

**Powiązane charakterystyki kierunkowe:** AiR2\_U12, AiR2\_U16, AiR2\_U06

**Powiązane charakterystyki obszarowe:** III.P7S\_UW.4.o, I.P7S\_UW, III.P7S\_UW.1.o, III.P7S\_UW.3.o, III.P7S\_UW.2.o

**Charakterystyka EM04\_U3:**

Able to use the vision for objects recognition and robot motion guidance

Weryfikacja:

Continuous assessment at tutorials regarding the acquired knowledge needed to solve computational and algorithmic exercise tasks, related to the content of this course.

**Powiązane charakterystyki kierunkowe:** AiR2\_U14, AiR2\_U17

**Powiązane charakterystyki obszarowe:** I.P7S\_UW, III.P7S\_UW.2.o, III.P7S\_UW.4.o, III.P7S\_UW.3.o