

ODESSA I.I. MECHNYKOV NATIONAL UNIVERSITY
FACULTY OF MATHEMATICS, PHYSICS AND INFORMATION TECHNOLOGIES
DEPARTMENT OF MATHEMATICAL SUPPORT OF COMPUTER SYSTEMS

Syllabus of the course "Image processing methods and algorithms and computer vision"

Amount	the total number of: credits – 4; hours – 120; content modules - 2
Semester	spring
Days, Time, Place	according to the class schedule
Teacher(s)	Tetyana Petrushyna, PhD (Physics and Mathematics), Associate Professor of the Department of Mathematical Support of Computer Systems Valery Penko, PhD (Tech.), Associate Professor of the Department of Mathematical Support of Computer Systems
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Workplace	department of mathematical support of computer systems
Consultations	face-to-face consultations: according to the class schedule online consultations: ZOOM (link is generated at the beginning of classes)

COMMUNICATION

Communication with students will be carried out by e-mail, in the classroom or via ZOOM.

COURSE ABSTRACT

Subject of the study of the course is the main types of tasks that arise in the context of processing natural language texts, theoretical methods and software tools for solving them.

Course Prerequisites

The course material is based on previously acquired knowledge, practical skills and skills of topics and areas related to algorithms, data structures, discrete mathematics and probability theory. The corresponding courses are taught within the educational program of the first (bachelor) level of higher education in specialty 126 "Information systems and technologies".

Course Post-requisites

According to the used theoretical approaches and models, this course complements the discipline "Methods of natural language text processing" in the field of data analysis and processing and is the basis for mastering the following disciplines of the educational and professional master's training program in the specialty 126 "Information systems and technologies": "Professional and research practice", "Execution of master's qualification work".

Purpose of the course is an introduction to the broad context of the field of machine vision, a theoretical study of the basic tasks of machine vision and modern approaches to their practical solution.

Course content

Considered:

- Introduction, basic concepts, fields of application and promising tasks.
- Formation of images. Image presentation formats.
- Basic operations at the image preprocessing stage.
- Extraction of three-dimensional information. Processing of binocular stereo data and texture.
- Analysis of the movement of objects.
- Recognition of objects on the scene. Image understanding.
- Modeling the neurobiology of vision.
- Compression of visual data.

EXPECTED RESULTS

As a result of studying the course, the student must

know: the main assortment of tasks in the context of machine vision, to have the theoretical apparatus used in the process of implementing machine vision tasks, to know the structure of the sequence of image processing stages and to understand the logic of their interaction, to know the main methods used at different stages of video information processing.

be able: develop software modules to implement some stages of video information processing and organize their interaction.

Competencies that the student receives as a result of studying the course:

- ability to abstract thinking, analysis and synthesis.
- the ability to develop mathematical, information and computer models of objects and informatization processes.
- the ability to solve physical and mathematical problems related to the modeling of natural phenomena or technological processes, using modern computer methods.
- the ability to mathematically model digital data and use effective algorithms for the analysis and transformation of multimedia data in modern information systems.
- the ability to model the architecture, behavior and functioning processes of specialized, autonomous and distributed intelligent systems of automated information search and analysis.

Learning outcomes: upon completion of the course, the student will have skills

- search for necessary information in scientific and technical literature, databases, other sources, analyze and evaluate this information.
- justify the choice of technical and software solutions, taking into account their interaction and potential impact on solving organizational problems, organize their implementation and use.
- develop models of information processes and systems of various classes, use methods of modeling, formalization, algorithmization and implementation of models using modern computer tools.
- determine types of signals, dynamic and spectral forms of their mathematical models, methods of mathematical modeling of signals, methods of transforming information signals during processing, transmission and storage of information in computer systems.
- develop mathematical models and software and information systems for solving current problems of analysis and processing of multimedia information.
- create optimized pipelines for preparing data for further storage and processing.

FORMS AND METHODS OF TEACHING

The course will be taught in the form of lectures (16 hours) and laboratory classes (18 hours), organization of students' independent work (86 hours).

The basic training of students is carried out in lectures and laboratory classes.

During the teaching of the course, the following teaching methods are used: verbal (lecture, explanation); face-to-face (Power Point presentation); practical (laboratory works); work with literary sources (independent work of students).