SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Master
1.6 Program of study / Qualification	Artificial Intelligence and Vision
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	**Human-computer interface**			Subject code	13.00
2.2 Course responsible / lecturer	Assoc. prof. dr. eng. Tiberiu Mariţa - Tiberiu.Marita@cs.utcluj.ro				
2.3 Teachers in charge of seminars / Laboratory / project	Assoc. prof. dr. eng. Tiberiu Mariţa - Tiberiu.Marita@cs.utcluj.ro				
2.4 Year of study		2.5 Semester		2.6 Type of assessment (E - exam, C - colloquium, V – verification)	E
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary				SD
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)				ED

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminars	-	Laboratory	1	Project	-
3.2 Number of hours per semester	42	of which:	Course	28	Seminars	-	Laboratory	14	Project	-
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										14
(b) Supplementary study in the library, online and in the field										14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										27
(d) Tutoring										
(e) Exams and tests										3
(f) Other activities:										

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	58
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	Image processing, Pattern recognition systems, Human-computer interaction, Design with microprocessors.

5. Requirements (where appropriate)

5.1. For the course	Graphic board / tablet, projector, computer, e-learning platforms
5.2. For the applications	Specific documentations, Computers, sensors (MS Kinect, Intel RealSense, etc.) specific software (Visual Studio, OpenCV, MS Kinect SDK, Intel Real Sense SDK, Google MediaPipe, Python), e-learning platforms

6. Specific competence

6.1 Professional competences	create data sets define technical requirements design process develop creative ideas develop statistical software deliver visual presentation of data use data processing techniques create data models implement ICT security policies utilise machine learning conduct scholarly research develop computer vision system apply statistical analysis techniques
6.2 Cross competences	The graduate: • develop an analytical approach • taking a proactive approach • developing strategies to solve problems • being open minded

7. Expected Learning Outcomes

Knowledge	The student has knowledge of: • algorithms • artificial neural networks • computer programming (Python) • data models • digital data processing • principles of artificial intelligence • machine learning (computer programming) • computer vision • deep learning • image recognition • security engineering
Skills	The student is able to: • create data sets • define technical requirements • design processes • develop creative ideas • develop statistical software • use data processing techniques • design application interfaces • perform dimensionality reduction • utilise machine learning • create data models • use an application-specific interface
Responsibilities and autonomy	The student has the ability to work independently in order to: • develop an analytical approach • take a proactive approach • develop strategies to solve problems • be open-minded

8. Discipline objective (as results from the *key competences gained*)

8.1 General objective	The main objective of this discipline is to provide specific information and prepare students for the design and implementation of non-standard interfaces for human-machine interaction using vision, proximity, biometric, inertial, etc. sensors. and methods and technologies specific to artificial vision and digital signal processing. Thus, the aim is to confer the ability to analyse, design and / or implement interfaces that offer human-machine interaction capabilities in real time and with high accuracy.
8.2 Specific objectives	To achieve these general objectives, students will: • Learn to understand and interpret specialized scientific literature • Study of existing applications and technologies in which the methods of interaction through non-standard interfaces have allowed the significant improvement of the performance of computer system interfaces (security, ergonomics, productivity) • Learn to understand and apply advanced algorithms used in image segmentation, feature detection, dynamic analysis of image sequences, detection and recognition of faces and facial components, detection and tracking of body components, interpretation of gestures (facial/body), recognition/sound interpretation and vocal commands etc. • • Learn to use advanced technologies used in human-computer interfaces based on specific sensors and tools: Microsoft Kinect, Intel Real Sense, Open Computer Vision Library, Google MediaPipe etc. • Aims to understand and solve complex advanced design problems, such as those related to real-time operating constraints, error analysis and evaluation.

9. Contents

9.1 Lectures	Hours	Teaching methods	Notes
Introduction to human-computer perceptual interfaces	2	Oral with multimedia or e-learning means, interactive teaching style, consultations.	N/A
Biometric interfaces. Fingerprint recognition, signature recognition, Iris recognition	2		
Handwriting recognition, case study: virtual whiteboard	2		
Hand detection. Interfaces based on hand gesture recognition from 2D images	2		
Detection of the face and facial components.	2		
Interfaces based on eye gaze direction and eye-blinking pattern	2		
Recognition and modeling of faces. Case studies: "Eigenfaces" method and methods based on deep neural networks	2		
Interfaces based on depth sensors.	2		
Interfaces based on the modeling and recognition of body and facial gestures with 2.5D sensors and related software tools	2		
Persons detection and skeletal models detection	2		
Gopgle MediaPipe solutions for human-computer interfaces	2		
Facial expression recognition (FER): neural networks based methods	2		
Presentation and evaluation of individual study topics	2		
Presentation and evaluation of individual study topics	2		

Bibliography

[1] B. Kisacanin, V. Pavlovic, T.S. Huang, Real-Time Vision for Human-Computer Interaction, Springer 2005.
[2] G. Medioni, S.B. Kang, Emerging Topics in Computer Vision, Prentice Hall 2004.
[3] Trucco E., Verri A, Introductory techniques for 3D Computer Vision, Prentice Hall, 1998.
[4] S.Z. Li, A. Jain, Handbook of Face Recognition, Springer 2004.
[5] D. Maltoni, D. Maio, A.K. Jain, S. Prabhakar, Handbook of Fingerprint Recognition, 2-nd Ed, Springer, 2009.
[6] A.K. Jain, A.A. Ross, K. Nandakumar, Introduction to Biometrics, Springer, 2011.

Virtual didactic materials

[1] T. Marita, Interfete Om-Calculator, Lecture notes, http://users.utcluj.ro/~tmarita/IOC/IOC.htm

9.2 Applications - Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Presentation methods/technologies: OpenCV and applications	2	Oral with multimedia or e-learning means, interactive teaching style, open discussions	N/A
Hand and fingers segmentation based on OpenCV	2		
Face and face component detection based on OpenCV	2		
Persons detection and modelling based on OpenCV and CNNs	2		
Presentation of methods/technologies: Google MediaPipe and applications for face detection, 3D face modelling, iris detection, modeling and detection of bodys and hand skeletal representations	2		
Detection of simple gestures based on MediaPiape (1)	2		
Detection of simple gestures based on MediaPiape (2)	2		

Bibliography:

[1] A.K. Jain, A.A. Ross, K. Nandakumar, Introduction to Biometrics, Springer, 2011.

[2] Open Computer Vision Library, https://docs.opencv.org/4.9.0/

[3] Google MediaPipe Solutions, https://chuoling.github.io/mediapipe/solutions/solutions.html, cited dec. 2024

Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.

10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Human-computer interfaces based on non-standard interaction methods are an indispensable component of mobile communication and multimedia devices, having practically unlimited fields of applicability and intensively demanded on the IT market: security systems, multimedia "gadgets", virtual reality, etc. The content of the discipline tries to respond to these requirements by deepening the knowledge acquired in the disciplines based on artificial vision and digital signal processing and their applicative combination with emerging technologies in the field. The discipline was evaluated, along with the Computer Engineering master's study program, by ARACIS.

11. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Testing theoretical knowledge and problem solving skills	Written and/or oral exam.	50%
Seminar	The ability to understand, interpret and solve problems specific to the field. Attendance, (inter)activity during classes.	In the event that face-to-face examination is not possible, the exam will be conducted using e-learning platforms such as Moodle or MS Teams.	50%
Laboratory	-	-	-
Project	-	-	-
Minimum standard of performance: Modelling and solving design problems of human-computer interfaces based on non-standard interaction methods, using the domain-specific formal apparatus. Minimum passing grade: 5			

Date of filling in: 01.09.2025	**Responsible**	**Title First name Last name**	**Signature**
	Course	Assoc.prof.dr.eng. Tiberiu MARIȚA	
	Applications	Assoc.prof.dr.eng. Tiberiu MARIȚA	

Date of approval in the department 17.09.2025	Head of department, Prof.dr.eng. Rodica Potolea
Date of approval in the Faculty Council 19.09.2025	Dean, Prof.dr.eng. Vlad Mureșan