COURSE SYLLABUS

COMPUTER VISION

Course code: 220145

1. General information

Course type		*Number of credits*	*Number of learning periods*
General ☐ Basic ☐ Specialized ☑		Theory: 02 Exercise: 00 Practice: 01	Theory: 30 Exercise: 00 Practice: 30
Required ☑ Elective ☐			

*Learners***:**

Level	Bachelor
Discipline	Information Technology

Course requirements:

Prerequisites	Programming Techniques
Parallels	None
Other requirements	None

2. Learning resources

Books	[1] Klette, R. (2014). *Concise computer vision*. Springer, London. [2] Szeliski, R. (2010). *Computer vision: algorithms and applications*. Springer Science & Business Media.
References	[3] Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). *Deep learning* (Vol. 1). Cambridge: MIT press.

Other learning materials	[4] Websites:
	  1. https://opencv.org
	  2. https://www.fast.ai

3. https://www.deeplearningbook.org		

3. Course description

The course provides students basic and specialized knowledge of computer vision. The course also aims to provide opportunities to practice professional skills including problem analysis, programming to solve problems using machine learning algorithms as well as deep learning. Additionally, the course develops students' appropriate awareness and attitudes about the importance of computer vision in computer science, teamwork skills, and public speaking skills.

4. Course learning outcomes (CLOs)

After finishing the course, students will be able to:

		Satisfy LOs of the program	*Satisfy LOs of the ABET*
❖ *Topic 1: Disciplinary Knowledge and Reasoning*			*B.1.1*
L1.	Describe concepts related to Computer Vision	*1.3.7*	*B.1.2*
			B.1.3
L2.	Utilize techniques related to Feature Detection and Matching, and Recognition		*B.1.4*
			B.1.5
L3.	Classify Supervised Learning and Unsupervised Learning.		*B.1.6*
L4.	Describe Deep Learning and architectures: ResNets, R-CNNs, YOLO.		
L5.	Utilize Deep Learning and architectures: ResNets, R-CNNs, YOLO to solve real-world problems.		
L6.	Describe Cameras, Multiple Views, and Motion.		
❖ *Topic 2: Personal and Professional Skills and Attributes*			
L7.	Problem Identification and Formulation	*2.1.1*	
L8.	Modeling	*2.1.2*	
L9.	Solution and Recommendation	*2.1.5*	
❖ *Topic 3: Interpersonal Skills: Teamwork and Communication*			
L10.	Forming Effective Teams	*3.1.1*	

L11.	Team Operation	*3.1.2*	
L12.	Using English for Computer Science	*3.3.1*	
❖ *Topic 4: Conceiving, Designing, Implementing and Operating Systems in The Enterprise, Societal and Environmental Context – The Innovation Process*			
L13.	Understanding Needs and Setting Goals	*4.2.1*	
L14.	System Engineering, Modeling and Interfaces	*4.2.3*	

5. Course content:

Course content	CLOs	Number of learning periods		
		Theory	*Practice*	*Others*
Chapter 1. Introduction to Computer Vision	**L1**	**4**	**3**	
1.1. Introduction to Computer Vision				
1.2. Light and Color and Image Filtering				
☑ *Personal and Professional Skills and Attributes*	L7(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*				
Chapter 2. Feature Detection and Matching	**L1; L2**	**6**	**5**	
2.1. Edge Detection				
2.2. Interest Points and Corners				
2.3. Local Image Features				
2.4. Model fitting, Hough Transform				
2.5. RANSAC and transformations				
☑ *Personal and Professional Skills and Attributes*	L7(I) L8(I)			

☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L11(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*	L13(U)			
Chapter 3. Recognition	**L2**	**5**	**5**	
3.1. Recognition and Bag of Words				
3.2 Large-scale retrieval: Spatial Verification, feature encoding				
3.3. Large-scale Scene Recognition and Advanced Feature Encoding				
3.4. Detection with Sliding Windows				
☑ *Personal and Professional Skills and Attributes*	L7(I) L8(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L11(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*	L13(U)			
Chapter 4. Machine Learning Crash Course	**L3**	**3**	**5**	
4.1. Unsupervised Learning				
4.2. Supervised Learning				
☑ *Personal and Professional Skills and Attributes*	L7(I) L8(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L11(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*	L13(U)			
Chapter 5. Deep Learning	**L4; L5**	**7**	**7**	

5.1. Neural Networks and Convolutional Neural Networks				
5.2. Architectures: ResNets, R-CNNs, YOLO				
☑ *Personal and Professional Skills and Attributes*	L7(I) L8(I) L8(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L11(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*	L13(U) L14(U)			
Chapter 6. Cameras, Multiple Views, and Motion	**L6**	**5**	**5**	
6.1. Cameras and Calibration				
6.2. Stereo Vision, Epipolar Geometry, and RANSAC				
6.3. Stereo Disparity Matching				
☑ *Personal and Professional Skills and Attributes*	L8(U) L9(U)			
☑ *Interpersonal Skills: Teamwork and Communication*	L11(U) L12(U)			
☑ *CDIO in the enterprise, societal and environmental context*	L14(U)			
Summary of skills in course level				
☑ *Personal and Professional Skills and Attributes*	L7(I) L8(I) L8(I)			
☑ *Interpersonal Skills: Teamwork and Communication*	L10(U) L11(U) L12(U)			

☑ *CDIO in the enterprise, societal and environmental context*	L13(U) L14(U)	

6. Teaching and learning methods

ID	Teaching method/technique		Description
M1.	Lecturing	☑	
M2.	Questions – Answers	☑	
M3.	Group-based Learning	☑	
M4.	Problem-based Learning	☐	
M5.	Project-based Learning	☑	
M6.	Case studies	☐	
M7.	Roleplay	☐	
M8.	Demo	☑	
M9.	Simulations	☐	
M10.	Debate	☐	
M11.	Game	☐	
M12.	Brainstorming	☑	
M13.	Think-Pair-Share	☐	

7. Course assessment

ID	Assessment activity		Quantity	Weight	LOs assessed
T1.	Text-based midterm exam	☑	01	20%	L1, L3
T2.	Text-based final exam	☐			
T3.	Practice midterm exam	☐			
T4.	Practice final exam	☐			
T5.	Report	☐			
T6.	In-class exercises	☐			

ID	Assessment activity		Quantity	Weight	LOs assessed
T7.	Homework assignments	☑	03	30%	L2-L5
T8.	Question – Answer	☐			
T9.	Term Project	☑	01	50%	L1-L6
T10.	Final Exam	☐			
Formula for Overall score		**T1*0.2+T7*0.3+T9*0.5**			

8. Course requirements and expectations

8.1. Requirements on attendance

- Students are responsible for attending in all classes. In case of absence due to force majeure circumstances, there must be sufficient and reasonable evidence.
- Students who do not attend more than 20% of the class sections, whether for reason or not, are deemed not to have completed the course and must re-enroll in the following semester.

8.2. Requirements and expectations on student behaviors

- Students must show their respects for teachers and other learners.
- Students must be on time. Students who are late more than five minutes will not be allowed to attend the class.
- Students should not make noise and interfere with others in the learning process.
- Students should not eat, chew gum, and use devices such as cell phones, music players during class hours.
- Laptops and tablets can only be used in class for the purpose of learning.
- Students who violate the above principles will be asked to leave the class and considered absent from the class.

8.3. Requirements on learning issues

Issues related to applying for score reservation, scoring complaints, scoring, exam disciplines are done according to the Learning Regulation of Tra Vinh University.

9. Tentative course instructor

Nguyen Nhut Lam

  DEAN   **DEPARTMENT HEAD**   **LECTURER**