Future Academy
Higher Future Institute for Specialized Technological Studies

Course Specification

1- Course information:	
Course Code:	CSC 453
Course Title:	Computer Vision
Year/level	4th
Academic Programs	Computer Science Program (B.Sc.)
Contact hours/ week	(Theoretical = 2, Practical = 2, Total = 4)

2- Course aims:

This course aims to provide students with

Introduce the principles, models and applications of computer vision. The course will cover: image formation, camera imaging geometry, feature detection and matching, edge and machine learning for image analysis. Issues will be illustrated using the examples of pattern recognition, image retrieval, and face recognition.

3- Intended learning outcomes of the course (ILOs):

a- Knowledge and understanding:

On successful completion of this course, the student should be able to:

a1. essential facts, concepts, principles and theories relating to computing and information and
a2. modeling and design of computer-**.**computer applications as appropriate to the program of study.
a3. tools, practices and methodologies used in the **.**based systems bearing in mind the trade-offs
a4. the extent to **.**specification, design, implementation and evaluation of computer software systems which a computer-based system meets the criteria defined for its current use and future development.

b- Intellectual skills:

On completing this course, the student should be able to:

b1. analyze computing problems and provide solutions related to the design and construction of computing systems.
b2. realize the concepts, principles, theories and practices behind computing and information as an academic discipline.
b3. evaluate the results of tests to investigate the functionality of computer systems.
b4. perform comparisons between (algorithms, methods, techniques...etc).

c- Professional and practical skills:

At the end of this course, the student will be able to:

c1. Operate computing equipment, recognizing its logical and physical properties, capabilities and limitations.
c2. Apply computing information retrieval skills in computing community environment and industry.
c3. Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material
c4. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.

d- General and transferable skills:

On successful completion of this course, the student should be able to:

d1. Demonstrate the ability to make use of a range of learning resources and to manage one's own learning.
d2. Demonstrate skills in group working, team management, time management and organizational skills.

4- Course contents

Topics/units	Number of hours		ILO's
	Lecture hours	Practical hours	
1) **Introduction to** computer vision, Applications and challenges. **Linear Filtering**	2	2	a1,b3,c4
2) **Edge Detection, Parametric Model e.g.** Hough transform	2	2	
3) **Features Detection**	2	2	
4) **Feature descriptor and matching :** SIFT, RANSAC - Quiz 1	2	2	
5) **Segmentation and grouping:** k-Means, Mixture of Gaussians, EM, Mean-Shift clustering	2	2	

6) **Segmentation by Thresholding. Interactive Segmentation:**	2	2	
7) Intelligent Scissors, Dijkstra's shortest path algorithm. **Energy Minimization:** Graph Cut, Max-flow algorithm	2	2	
8) Mid Term	2	2	
9) **Object recognition:** Sliding-Window based Object Detection, Global Representations, and Classifier Construction.	2	2	
10) Classification with SVMs, HOG Detector. Classification with Boosting.	2	2	
11) **Object Recognition II :** Decision tree, Radom Forest	2	2	
12) **Image Formation:** Pinhole Camera, Perspective Projection. **Camera Model.** - **Quiz 2**	2	2	
13) **Stereo vision. Epipolar geometry.**	2	2	
14) Revision	2	2	

5- Teaching and learning methods

Methods	**ILO's**																			
	a1	**a2**	**a3**	**a4**	**a5**	**b1**	**b2**	**b3**	**b4**	**b5**	**c1**	**c2**	**c3**	**c4**	**c5**	**d1**	**d2**	**d3**	**d4**	**d5**
Lectures	√		√			√	√				√	√				√				
Practical sections						√	√				√	√	√	√		√	√			
Self-learning		√			√			√												
Assays and reviews																				
Discussion groups																				

6- Teaching and learning methods for Low-achieving students

- Extra teaching hours for those who need help
- More quizzes to assess their ability for understanding the course

- Encourage the team work for those students with other advanced ones to increase their participation and understanding

7- Student assessment

Assessment method	Time	Grade weight (%)	ILOs
Written exam		60%	
Practical exam		20%	
Oral exam			
Mid-term exam		10%	
Others		10%	

8-List of references

8.1. Student notebooks:

Lecture handouts delivered to students at the end of each lecture.

8.2. Essential textbooks:

Richard Szeliski: Computer Vision: Algorithms and Applications, 1st Ed., Springer-Verlag London, 2011

8.3. Recommended textbooks:

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8.4. Journals, Periodical and Reports ……..etc.

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8.5. Websites

https://www.javatpoint.com/computer-vision

Course Coordinator:
Head of department: *Prof. Dr. Yasser F. Ramadan*
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