الجامعة الافتراضية السورية
SYRIAN VIRTUAL UNIVERSITY

Course Definition

Computer Vision

Information

Technology

Engineering

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Syrian Arab Republic		الجمهورية العربية السورية
Ministry of Higher Education and Scientific Research		وزارة التعليم العالـــي والبحث العلمي
Syrian Virtual University		الجامعة الافتراضية السورية

1. Basic Information:

Course Name	Computer Vision
Course Code	ACV601
Number of Presentational Sessions*	20
Number of Synchronous Sessions**	10
Number of Shorter Tests***	2
Number of Exams***	1
Theoretical Sessions Work Load (hrs.)	60
Practical Sessions Work Load (hrs.)	30
Credit Hours	6

***Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs.).**

****Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs.).**

*****Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.**

N.B.

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions (. This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

2. Prerequisites courses:

Course	Code
Artificial Intelligence	BAI501
Intelligent Algorithms	BIA601

3. Course Objectives:

This course is an important and necessary complement to the basic courses of Artificial Intelligence. The course introduces the basic concepts in the sciences of computer vision. It aims to provide the students with the basic knowledge related to the automated processing of images and videos through the use of basic traditional models and algorithms, in addition to the artificial neural networks, and the application of these methods to real data sets for real problems.

4. Learning Outcomes (LO):

Upon completion of the course, the student must:

- Recognize the methods of processing images and videos using the basic of computer vision.
- Learn about artificial neural network techniques and how to use them to build different models and systems in computer vision.
- Design a system based on the concepts of machine learning oriented for computer vision, and characterize its input and output.
- The ability to configure data sets to train traditional machine learning models and neural networks and evaluate their performance.

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5. Assessment Results:

Chapter Number	Chapter Title	General Objectives	Assessment Type				
			Interactive Content & Recorded Sessions	Applied Activities (Synch. Sessions)	Final Exam*/ Shorter Tests**	Presentations and Interviews***	Reports****
CH1	**Introduction to Computer Vision, and Human Visual System**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH2	**Feature /Detection Extraction and Matching Techniques**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH3	**Camera Models and 3D Computer Vision**	Comprehension –Analytical Thinking – Tools and Application	√	√	√	√	√

		Hands– On					
CH4	**Machine Learning Fundamentals**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH5	**Deep Learning**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH6	**Object Detection**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH7	**Image Segmentation**	Comprehension –Analytical Thinking –	√	√	√	√	√

		Tools and Application Hands– On					
CH8	**Object Tracking and Action Recognition**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√
CH9	**Applications in Retail/ E–Commerce and Medical Image Diagnosis**	Comprehension –Analytical Thinking – Tools and Application Hands– On	√	√	√	√	√

***The final exam is two hours long and is given at the end of the course.**

****Shorter tests are about 30 minutes long and are given after three or four lectures throughout the semester during synchronous sessions.**

*****Presentations, interviews, and reports are submitted once after each three or four lectures throughout the semester during synchronous sessions.**

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6. Course Syllabus:

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
CH1	**Introduction to Computer Vision, and Human Visual System**	1. Basic Concepts 2. Human Visual System 3. Image Filtering Techniques 4. Practical Exercises	4	2
CH2	**Feature /Detection Extraction and Matching Techniques**	1. Introduction to Feature Detection and Matching Techniques 2. Edge Detection 3. Corner Detection 4. Spatial Filtering 5. Practical Exercises of Intensity Transformation and Histogram Equalization 6. Practical Exercises of Image Filtering 7. Practical Exercises of Edge Detection	7	3
CH3	**Camera Models and 3D**	1. Camera Calibration 2. Stereo Vision	4	2

	Computer Vision	3. Generating 3D Images from 2D Views 4. Practical Exercises of Morphology Operations		
CH4	**Machine Learning Fundamentals**	1. Introduction to Machine learning 2. Supervised Learning 3. Unsupervised Learning 4. Semi-Supervised Learning 5. Self-Supervised Learning	**5**	**2**
CH5	**Deep Learning**	1. Convolutional Neural Networks (CNN) 2. CNN Architectures 3. Practical Exercises of Feature Detection	**3**	**1**
CH6	**Object Detection**	1. RCNN, Fast-RCNN, Faster RCNN, Mask RCNN 2. YOLO, SSD for Object Detection 3. Feature Pyramid Networks 4. Efficient Det	**4**	**2**
CH7	**Image Segmentation**	1. UNET 2. Fast FCN (Fully Convolutional Network) 3. Gated SCNN (Gated Shape CNNs)	**5**	**2**

		4. Deep Lab 5. Comprehension Questions		
CH8	**Object Tracking and Action Recognition**	1. Single and Multiple Object Tracking using deep learning 2. Action Recognition Systems 3. Comprehension Questions	**3**	**1**
CH9	**Applications in Retail/ E-Commerce and Medical Image Diagnosis**	1. Tissue, bone and muscle segmentation in X-ray, CT and MRI 2. Automatic cancer detection 3. Radiologists in the loop systems 4. Image search, retrieval and recommendation systems 5. Autonomous Driving 6. Comprehension Questions	**6**	**3**

7. Practical Activity:

- **Tools and Labs:**

Tool Name	Description
Python	Scripting Language for engineering and machine learning applications

- **Practical Activities per Chapters:**

Chapter	Activities Type	Remarks
CH1	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH2	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH3	☑ Exercises ☑ Homework ☐ Webinars ☐ Project	

	☑ Experiment ☐ Other	
CH4	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH5	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH6	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH7	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	

CH8	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	
CH9	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	

8. References:

1. Computer Vision: Algorithms and Applications", Richard Szeliski, 2010.
2. Computer Vision: A Modern Approach", David Forsyth and Jean Ponce, 2011.