Mansoura University

Faculty of Computers and Information Sciences

Course Specifications of

Elective 2 (Computer Vision)

University: Mansoura University **Faculty**: Computer and Information Sciences

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Program on which the course is given: Undergraduate

Department offering the course: Department of Computer Science and Department of Information Technology

Academic year/ Level: Fourth Year

Date of specification approval:

A- Basic Information

Title : Elective 2 (Computer Vision) **Code :** CS435P

Credit Hours : 3 **Lecture :** 2 **Practical :** 2 **Tutorial :** 0

B- Professional Information

1- Overall Aims of the Course

This course aims to:

- 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.

2- Intended Learning Outcomes of the course (ILOs)

By completing this course successfully, the student will be able to:

a- Knowledge and Understanding

a1. Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study.

a2 Modeling and design of computer-based systems bearing in mind the trade-offs.

a3 Tools, practices and methodologies used in the specification, design, implementation and evaluation of computer software systems.

a5 The extent to which a computer-based system meets the criteria defined for its current use and future development.

a10 Current developments in computing and information research.

a12 Understand the essential mathematics relevant to computer science.

a17 Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.

a19 Select advanced topics to provide a deeper understanding of some aspects of the subject, such as hardware systems design, object-oriented analysis and design, and artificial intelligence, and parallel and concurrent computing

b- Intellectual Skills

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.

b6 Evaluate the results of tests to investigate the functionality of computer systems.

b11 Perform comparisons between (algorithms, methods, techniques...etc).

b12 Perform classifications of (data, results, methods, techniques, algorithms..etc.).

b13 Identify attributes, components, relationships, patterns, main ideas, and errors.

b17 Identify a range of solutions and critically evaluate and justify proposed design solutions.

c- Professional and Practical Skills c1 Operate computing equipment, recognizing its logical and physical properties, capabilities and limitations.

c4 Apply computing information retrieval skills in computing community environment and industry.

c5 Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material

c16 Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.

c18 Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems.

c21 Prepare technical reports, and a dissertation, to a professional standard.

d- General and Transferable Skills 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.

d3 Show the use of information-retrieval.

3- Contents

No	Course Content	Lecture	Tutorial	Total
1	**Introduction to** computer vision, Applications and challenges. **Linear Filtering**	2	2	4
2	**Edge Detection, Parametric Model e.g.** Hough transform	4	4	8
3	**Features Detection**	4	4	8
4	**Feature descriptor and matching :** SIFT, RANSAC	2	2	4
5	**Segmentation and grouping:** k-Means, Mixture of Gaussians, EM, Mean-Shift clustering	2	2	4
6	**Segmentation by Thresholding. Interactive Segmentation:** Intelligent Scissors, Dijkstra's shortest path algorithm. **Energy Minimization:** Graph Cut, Max-flow algorithm	2	2	4
7	**Object recognition:** Sliding-Window based Object Detection, Global Representations, and Classifier Construction. **Classification with SVMs, H**OG Detector. **Classification with Boosting.**	2	2	4
8	**Object Recognition II :** Decision tree, Radom Forest	2	2	4
9	**Image Formation:** Pinhole Camera, Perspective Projection. **Camera Model.**	2	2	4
01	**Stereo vision. Epipolar geometry.**	2	2	4
	Total Hours	24	24	48

4- Assessment Schedule

Assessment Method	No.	Description	Week No.	Weight (%)
Assignment	1	Lab no. 1	3	5
Assignment	2	Lab no. 2	4	5
Written Exams	3	Midterm Exam	6	10
Assignment	4	Lab no. 3	7	5
Assignment	5	Lab no. 4	8	5
Oral Exam	6	Oral questions	11	10
Written Exams	7	Final Exam	14	60
Total				100

5- List of references

5.1 Course Notes

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

5.2 Essential Books (Text Books)

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

6- Facilities Required for Teaching and Learning -

Data show.

- Speakers for audio and video files used to practice listening.

Course Content/ILO Matrix

Course Content	a1	a2	a3	a5	a10	a12	a17	a19	b1	b2	b6	b11	b12	b13	b17	c1	c4	c5	c16	c18	c21	d1	d2	d3
Lecture 1	•	•	•		•	•	•			•		•			•	•	•	•				•	•	•
Lecture 2	•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Lecture 3	•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Lecture 4	•	•	•			•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Lecture 5	•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Lecture 6	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lecture 7	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lecture 8	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lecture 9	•	•	•			•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Lecture 10	•	•	•			•	•	•		•		•			•	•	•	•	•	•	•	•	•	•

Learning Method/ILO Matrix

Course Content	a1	a2	a3	a5	a10	a12	a17	a19	b1	b2	b6	b11	b12	b13	b17	c1	c4	c5	c16	c18	c21	d1	d2	d3
Lectures	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				
Tutorials	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Assessment Methods/ILO Matrix

Assessment	a1	a2	a3	a5	a10	a12	a17	a19	b1	b2	b6	b11	b12	b13	b17	c1	c4	c5	c16	c18	c21	d1	d2	d3
Assignment	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•
Midterm Exam	•		•			•	•		•	•		•	•	•										•
Oral exam	•		•			•	•		•	•				•				•	•					•

Final Exam	•	•	•	•	•	•	•	•	•	•		•	•	•							•		•

Course Coordinator: Dr. Ehab Essa
Head of Department: Prof. Samir El Mougy
Date: 16/09/2017