2023
TPG-153

Course Specification

(Postgraduate)

Course Title:	Image Processing and Computer Vision
Course Code:	503882-3
Program:	Master in Artificial Intelligence
Department:	Computer Science
College:	Computers and Information Technology
Institution:	Taif University
Version:	V2
Last Revision Date:	5 May 2024

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Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☒ Elective	
3. Level/year at which this course is offered: (Year: 1, Level: 1)				
4. Course general Description:				
The course will provide an overview of the challenges of computer vision and image processing, the common approaches, and current techniques. Students will gain familiarity with both established and emergent methods, algorithms, and architectures to solve various real-world problems, and develop skills for research in the fields. Topics to be covered include image enhancement, image segmentation and feature extraction, key point detectors, object recognition, object detection and tracking, selected emerging topics, etc.				
5. Pre-requirements for this course (if any)**:**				
None.				
6. Co-requirements for this course (if any)**:**				
None.				
7. Course Main Objective(s):				
The objectives of this course are as follows: ▪ Introduce major application domains where image processing computer vision techniques are used. ▪ Introduce methods and tools for developing computer vision applications. ▪ Develop techniques to emulate human vision capabilities.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**36**	**80%**
2	E-learning	**9**	**20%**
3	Hybrid ▪ Traditional classroom ▪ E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**-**
3.	**Field**	**-**
4.	**Tutorial**	**-**
5.	**Others (Mid Term and Final Exams)**	**-**
	Total	**45**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand the major concepts in digital image processing and computer vision.	**K1**	Lecture, Brainstorming, Self-learning	**Direct:** Quiz, Assignment **Indirect:** Survey
1.2	Explore emerging topics in the field.	**K1**	Lecture, Brainstorming, self -learning	**Direct:** Quiz, Assignment, Exam **Indirect:** Survey
2.0	Skills			
2.1	Analyze a computer vision problem and apply principles to identify solutions.	**S1**	Lecture, Project, Self-learning	**Direct:** Quiz, Project, Exam **Indirect:** Survey
2.2	Design and implement algorithms to solve practical problems.	**S2**	Lecture, Project, Self-learning	**Direct:** Quiz, Project, Exam **Indirect:** Survey
2.3	Evaluate deep learning models for various real-world computer vision problems.	**S2**	Lecture, Self-learning	**Direct:** Quiz, Project, Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Function effectively as a member or leader of a team engaged in activities appropriate to the field of Machine Learning	**V2**	Discussion, Groupwork, Project	**Direct:** Project **Indirect:** Survey

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to image processing and computer vision: Basic image processing operations	3
2.	Image Enhancement in Spatial and Frequency Domains: Filtering, smoothing, sharpening, morphological operations, Fourier transform, Histogram processing.	6
3.	Image Segmentation and Feature Extraction: Various methods of image segmentation, Contours, Gradients and edge detection, Thresholding, Haralick, LBP, HOG.	6
4.	Key point detectors, Local invariant descriptors: Haaris, SIFT, SURF.	3
5.	Object Recognition: Traditional Methods. Sliding windows and image pyramids, hand-crafted features, Bayes classifiers, SVM classifiers.	6
6.	Introduction to Neural Networks: ANN, loss functions, backpropagation and optimizer, batch normalization etc.	3
7.	Object Recognition: Deep Learning Methods: Image classification, object detection and semantic segmentation, CNN, transfer learning, visualization techniques.	6
8.	Motion analysis and Activity Recognition: Motion detection and tracking, Inference of human activity from image sequences.	6
9.	Selected Topics. Examples: Camera calibration (Surveillance), Biometric authentication- Facial Recognition (PCA, EigenFaces, etc.), Fingerprints, Iris Recognition.	6
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Project	From Week 6	20%
2.	Assignments	Week 4, 8	10%
3.	Quizzes	Week 4, 10, 13	10%
4.	Midterm Exam	Week 7	20%
5.	Final Exam	Week 16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	• Computer Vision: A Modern Approach by D. Forsyth and J. Ponce, 2010, 2nd Edition, ISBN-10: 013608592X • Deep Learning: Algorithms and Applications by I. Goodfellow, Y. Bengio and A. Courville, 2017, ISBN-10: 0262035618
Supportive References	• Digital Image Processing Using Matlab by Gonzalez,R.C, Woods,R.E and Eddin,S.L, Publisher: Gatesmark Publishing, 2nd Edition 2009, ISBN-10: 0982085400 • Computer Vision: Algorithms and Applications by Szeliski, R, Publisher Prentice Hall 1st Edition, Springer; 2011, ISBN-10: 1848829345
Electronic Materials	▪ The world's most trusted open ecosystem for sourcing, building, and deploying data science and AI initiatives: https://www.anaconda.com/
Other Learning Materials	▪ Links provided by the instructor. ▪ Handouts and Presentations Slides prepared by the instructor. ▪ Blackboard.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ Classroom (20 students/class) ▪ Computer labs
Technology equipment (Projector, smart board, software)	▪ Video projector / data show ▪ White board
Other equipment (Depending on the nature of the specialty)	▪ To be announced during the course!

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Coordinator	Indirect (Course exit survey) Indirect (Feedback from Course Coordinator)
Effectiveness of students assessment	Faculty member Coordinator	Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator)
Quality of learning resources	Students Faculty member Coordinator Council Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator) Indirect (Feedback from council) Indirect (Feedback from Graduate Committees)

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	Students Faculty member Coordinator Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member/ Course Coordinator/ Graduate Committee)
Other	-	-

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**GRADUATE PROGRAMS COMMITTEE – CS DEPT.**
REFERENCE NO.	**V2**
DATE	**5/5/2024**

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