CS5187: VISION AND IMAGE

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Vision and Image

Subject Code
CS - Computer Science
Course Number
5187

Academic Unit
Computer Science (CS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
CS3334 Data Structures or
CS4335 Design and Analysis of Algorithms, or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course introduces algorithms in computer vision and image processing so as to develop students with basic knowledge to explain how computer could understand the visual world. The course describes visual understanding from the perspective of low-level image processing mid-level statistical inferencing and high-level vision recognition. The topics include feature extraction image segmentation, object recognition, motion analysis and scene understanding, along with real-world applications that vision algorithms have been successfully applied.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Perform low-level image processing for analysis of image properties.			x	
2	Apply computer vision algorithms for scene/ object understanding and 3D reconstruction.			x	
3	Assess and apply different computer vision and image processing approaches for real-world problems.		x		
4	Design and implement computer vision and image processing algorithms for innovative applications.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will engage in lectures on the introduction of computer vision and image processing techniques, and related real-world applications such as feature matching, image enhancement, object recognition, motion analysis and scene understanding.	1, 2, 3	2 hours/ week

2	Tutorial	Students will work on a different problem set each week during the tutorial sessions, through which they can discover the main characteristics of different computer vision and image processing techniques and integrate them for real-world problems. They will also be invited to present their solutions, and the class will be encouraged to provide comments.	1, 2, 3	1 hour/ week
3	Assignment	The students will implement selected computer vision and image processing approaches, apply these approaches to real-world problems, and interpret the results. In this way, students can analyse the performance of different approaches.	1, 2, 3	
4	Project	The students will create a new system design and implement appropriate computer vision and image processing approaches for innovative applications. The students will apply the principles they have learnt from the course for their design.	4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2	30	Expect to have two assignments with programming elements for algorithm implementation.
2	Project	4	20	Can be in groups of 2–3 students per project

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)
2

Additional Information for ATs
For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task
Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
The ability to implement and assess the effectiveness of different algorithms and techniques.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
The ability and creativity in designing and implementing appropriate algorithms and techniques for innovative applications.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
The extent to which the students can understand the algorithms and techniques, apply them with appropriate modification or design new solutions for different applications, and evaluate their performances.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
The ability to implement and assess the effectiveness of different algorithms and techniques.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate to Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
The ability and creativity in designing and implementing appropriate algorithms and techniques for innovative applications.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal

(B-, C+, C) Moderate to Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The extent to which the students can understand the algorithms and techniques, apply them with appropriate modification or design new solutions for different applications, and evaluate their performances.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate to Basic

Failure

(F) Not even reaching marginal level

Part III Other Information

Keyword Syllabus

Feature extraction and alignment; image segmentation; image enhancement / editing; 3D reconstruction; face detection and recognition; object recognition; motion analysis; scene understanding.

Reading List

Compulsory Readings

	Title
1	Richard Szeliski, Computer Vision: Algorithms and Applications Springer; 2011.
2	D. Forsyth and J. Ponce, Computer Vision: A Modern Approach 2nd Ed, Prentice Hall (2011)
3	Simon J. D. Prince, Computer Vision: Models, Learning, and Interference Cambridge University Press, 2012.
4	R. Gonzalez and R. Woods, Digital Image Processing 3rd Ed, Prentice Hall (2007)

Additional Readings

	Title
1	Nil