City University of Hong Kong
Course Syllabus

offered by Department of Computer Science
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	Vision and Image
Course Code:	CS5187
Course Duration:	One Semester
Credit Units:	3
Level:	P5
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	CS3334 Data Structures or CS4335 Design and Analysis of Algorithms, or equivalent
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Perform low-level image processing for analysis of image properties.			✓	
2.	Apply computer vision algorithms for scene/object understanding and 3D reconstruction.			✓	
3.	Assess and apply different computer vision and image processing approaches for real-world problems.		✓		
4.	Design and implement computer vision and image processing algorithms for innovative applications.		✓	✓	✓
		100%			

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.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
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.	✓	✓	✓		2 hours/ week
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 hour/ week
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.	✓	✓	✓		
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 are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting	Remarks
	1	2	3	4		
Continuous Assessment: 50%						
Assignments	✓	✓			30%	Expect to have two assignments with programming elements for algorithm implementation.
Project				✓	20%	Can be in groups of 2–3 students per project
Examination^: 50% (duration: 2 hours)						
Final Exam	✓	✓	✓		50%	
					100%	

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignment	The ability to implement and assess the effectiveness of different algorithms and techniques.	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Project	The ability and creativity in designing and implementing appropriate algorithms and techniques for innovative applications.	High	Significant	Moderate	Basic	Not even reaching marginal level
3. Examination	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.	High	Significant	Moderate	Basic	Not even reaching marginal level

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignment	The ability to implement and assess the effectiveness of different algorithms and techniques.	High	Significant	Moderate to Basic	Not even reaching marginal level
2. Project	The ability and creativity in designing and implementing appropriate algorithms and techniques for innovative applications.	High	Significant	Moderate to Basic	Not even reaching marginal level
3. Examination	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.	High	Significant	Moderate to Basic	Not even reaching marginal level

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

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

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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)

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)