

Subject Description Form

Subject Code	COMP5523
Subject Title	Computer Vision and Image Processing
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ul style="list-style-type: none"> • To let the students learn the fundamental principles on the aspects of interdisciplinary research including acquiring, processing, analyzing, understanding and utilizing high-dimensional visual data from the real world; • To equip the students with the knowledge of how to develop artificial intelligent systems which automate tasks that the human visual system can do; • To guide the students to understand the relevant state of art technologies and gain experience throughout a variety of case studies.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. understand various methods for digital image processing and analysis and relate or apply them to different applications; b. understand various algorithms for vision related tasks and apply them to solve practical problems by considering various requirements and issues (e.g., legal/social/ethics issues); c. carry out in-depth analysis of the digital image data with different image data models, pattern recognition algorithms and learning theory; d. gain experience of team work by engaging in a group project on vision related topics and learn effectively through various learning activities; e. communicate effectively with competent presentation skills through reading and writing reports and documents.
Subject Synopsis/ Indicative Syllabus	<ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> a. The background b. An overview of the related fields; c. The development of vision systems 2. Image acquisition and formation models <ol style="list-style-type: none"> a. Imaging systems b. Geometry of image formation c. Camera models and calibration d. Orthographic and perspective projections 3. The fundamentals of image processing <ol style="list-style-type: none"> a. Image enhancement b. Image representation c. Image transformations d. Image feature extraction e. Image segmentation 4. High-level image processing <ol style="list-style-type: none"> a. Image recognition b. Image registration c. Image restoration 5. Computer vision related tasks

	<ul style="list-style-type: none"> a. Low-level vision <ul style="list-style-type: none"> -- image matching, optical flow and motion analysis b. Middle-level vision: 3D analysis from 2D images <ul style="list-style-type: none"> -- The geometry of multiple views -- Reconstruction: Shape from X (stereo, shading, defocus, motion, structured light) -- Video tracking, motion detection, scene analysis c. High-level vision: <ul style="list-style-type: none"> -- Image understanding, object recognition, pose estimation. <p>6. Computer vision algorithms and applications</p> <ul style="list-style-type: none"> a. The advanced computer vision algorithms <ul style="list-style-type: none"> -- Machine learning -- Artificial neural network and deep learning b. The selected computer vision applications <ul style="list-style-type: none"> -- Content-based image retrieval -- Gesture recognition -- Intelligent character recognition -- Medical imaging -- Mobile robots -- Visual sensor network <p>7. Professionalism and legal/social/ethics issues related to computer vision (e.g., personal data (privacy) ordinance)</p>
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Teaching/ Learning Methodology	<p>Lectures provide students with the content of main concepts and methods of the course, together with comprehensive examples, and class questions/answers/discussions for easy understanding.</p> <p>Tutorials and lab sessions offer the opportunity for students to review and consolidate the lecture and reference materials through exercises and software tools.</p> <p>Project assignments will give students the opportunity to solve practical visual information analysis problems.</p> <p>Written assignments help students to develop a solid foundation of visual information processing and analysis throughout the project work of case studies.</p>
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Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Written assignments and quiz</td> <td>20</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>2. Project Assignment</td> <td>35</td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>3. Examination</td> <td>45</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Written assignments, tests/quizzes, and examination are used to test and deepen</p>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					a	b	c	d	e	1. Written assignments and quiz	20	✓	✓	✓	✓	✓	2. Project Assignment	35		✓	✓	✓	✓	3. Examination	45	✓	✓	✓			Total	100					
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3. Examination	45	✓	✓	✓																																					
Total	100																																								

	students' understanding of the subject materials while project assignment is used to provide a hands-on experience of how the subject materials are applied.	
Student Study Effort Expected	Class contact:	
	▪ Lectures	26Hrs.
	▪ Tutorials/Labs	13Hrs.
	Other student study effort:	
	▪ Reading	26Hrs.
	▪ Written and Project Assignments, Quizzes/Tests, Examination	39Hrs.
	Total student study effort	104Hrs.
Reading List and References	<p>1. D.A. Forsyth and J. Ponce, <i>Computer Vision: A Modern Approach</i>, Prentice-Hall, 2003.</p> <p>2. Gonzalez, Rafael, <i>Digital Image Processing</i>, 3rd Ed., Pearson Hall, 2008, ISBN 9780131687288.</p> <p>3. Richard Szeliski, <i>Computer Vision: Algorithms and Applications</i>, 2011 Edition, Springer Publisher, ISBN-13: 978-1848829343 ISBN 10: 1848829345</p>	