

Subject Description Form

Subject Code	COMP6706
Subject Title	Advanced Topics in Visual Computing
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Nil.
Objectives	<p>The objectives of this course are to:</p> <ol style="list-style-type: none"> 1. teach the students comprehensive and in-depth knowledge in visual computing, including mathematical theory, models, and algorithms 2. apply the knowledge learned in this class to solve real-life problems in visual sensing, image processing, computer vision, visualization, visual communications and networking, and virtual reality.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> (a) develop new insights into issues and challenges in research topics of visual computing, in particular the relationship of the advanced topics in visual computing to today's fast-growing information technology; (b) critically review and grasp relevant advanced mathematical theories for visual information modeling, representation, analysis, understanding, synthesis, communication and networking; (c) acquire in-depth knowledge of the algorithmic principles on different aspects of visual computing research and extend them to develop creative and advanced visual systems for various applications; and (d) apply visual computing technology to develop innovative and original solutions for a wide range of challenging research problems.
Subject Synopsis/ Indicative Syllabus	<p>The content of the subject consists of three parts as follows:</p> <p><u>Part 1: Advanced mathematics</u> Discrete Transforms, mathematical modeling, statistical analysis, optimization, transformation geometry, topology, graph, Markov random field, game theory and information theory</p> <p><u>Part 2: Advanced algorithms for visual computing</u> Image processing and analysis: feature extraction, representation and fusion, image segmentation, image matching, classification, and content-based image retrieval Computer vision: stereo vision, optical flow, shape from X, motion, object recognition and tracking, image registration, multi-view 3D reconstruction, scene understanding)</p> <p>Learning in visual computing: deep learning, convolutional neural network, generative adversarial network, support vector machines, discriminant analysis and Bayesian image analysis</p> <p><u>Part 3: The challenging research topics and emerging applications</u></p> <ul style="list-style-type: none"> - Visual computing in digital multimedia - Visual computing in communication and networking - Visual computing in the Internet of Things - Graphical model and inference for visual computing - Visual computing with multimodal data structure

Teaching/Learning Methodology	Lectures/Seminars/ Group discussions																																	
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1" data-bbox="536 286 1481 533"> <thead> <tr> <th data-bbox="536 286 847 383" rowspan="2">Specific assessment methods/tasks</th> <th data-bbox="847 286 1002 383" rowspan="2">% weighting</th> <th colspan="4" data-bbox="1002 286 1481 383">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th data-bbox="1002 383 1134 421">a</th> <th data-bbox="1134 383 1257 421">b</th> <th data-bbox="1257 383 1380 421">c</th> <th data-bbox="1380 383 1481 421">d</th> </tr> </thead> <tbody> <tr> <td data-bbox="536 421 847 459">1. Assignments</td> <td data-bbox="847 421 1002 459">40</td> <td data-bbox="1002 421 1134 459">✓</td> <td data-bbox="1134 421 1257 459">✓</td> <td data-bbox="1257 421 1380 459">✓</td> <td data-bbox="1380 421 1481 459">✓</td> </tr> <tr> <td data-bbox="536 459 847 497">2. Project & Test</td> <td data-bbox="847 459 1002 497">60</td> <td data-bbox="1002 459 1134 497">✓</td> <td data-bbox="1134 459 1257 497">✓</td> <td data-bbox="1257 459 1380 497">✓</td> <td data-bbox="1380 459 1481 497">✓</td> </tr> <tr> <td data-bbox="536 497 847 533">Total</td> <td data-bbox="847 497 1002 533">100</td> <td colspan="4" data-bbox="1002 497 1481 533"></td> </tr> </tbody> </table> <p data-bbox="536 568 1481 674">Assignment(s): assessment of the theoretic studies with respect to the understanding of the relevant subject matters including new concepts, algorithms and techniques by proving answers to the assignment questions</p> <p data-bbox="536 674 1481 734">Project: assessment of the ability for problem solving through real case studies and implementation of a prototype system for demonstration</p> <p data-bbox="536 734 1481 795">Test: assessment of the overall performance by written report, oral presentation and exam or quiz.</p>						Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				a	b	c	d	1. Assignments	40	✓	✓	✓	✓	2. Project & Test	60	✓	✓	✓	✓	Total	100				
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Student Study Effort Expected	Class contact:																																	
	Lecture/Tutorial/Lab					39 Hrs.																												
	Other student study effort:																																	
	Self-study					83 Hrs.																												
	Total student study effort					122 Hrs.																												
Reading List and References	<ol data-bbox="544 1122 1487 1619" style="list-style-type: none"> Nielsen, Frank (2005). <i>Visual Computing: Geometry, Graphics and Vision</i>, Charles River Media, ISBN 1-584-50427-7. Aditi Majumder and M. Gopi (2018). <i>Introduction to Visual Computing: Core Concepts in Computer Vision, Graphics, and Image Processing</i>, 1st Edition, CRC Press, ISBN-13: 978-1482244915, ISBN-10: 1482244918 Rafael C. Gonzalez and Richard E. Woods (2018). <i>Digital Image Processing</i>, 4th Edition, ISBN-13: 978-0133356724, ISBN-10: 9780133356724 IEEE Transactions on Pattern Analysis and Machine Intelligence IEEE Transactions on Image Processing IEEE Transactions on Multimedia IEEE Internet of Things Journal IEEE Transactions on Mobile Computing IEEE Transactions on Visualization and Computer Graphics IEEE Transactions on Circuits and Systems for Video Technology 																																	