MULTIMEDIA UNIVERSITY®

COURSE INFORMATION

1 .	**Name of Course**	Visual Information Processing	
2 .	**Course Code**	TDS 3651	
3 .	**Type of Course** **(e.g. : Core, major, elective etc.)**	Specialization Elective for B. CS (DS) and Elective for all other Specializatons	
4 .	**Synopsis**	This course aims to provide students with the knowledge of fundamental concepts and techniques in visual data processing and how to apply them to design solutions for real-world problems. Students taking this course will learn various techniques on the extraction, representation and learning of visual information from raw image and video data.	
5 .	**Version** **(State the date of theSenate's approval - previous and the current approval date)**	Current: January 2018 Previous: June 2016	
6 .	**Name(s) of Academic Staff**	John See Su Yang Wong Lai Kuan	
7 .	**Semester and Year Offered**	Trimester 1 or 2 (Delta)	
8 .	**Credit Value**	4 credit hours	
9 .	**Pre-Requisite**	TCP1201 Object-Oriented Programming & Data Structures	
10 .	**Objective of the course in the programme:** To equip students with the fundamental concepts and techniques in image processing and computer vision, and to inculcate problem-solving skills for processing visual information and designing feasible solutions for real-world visual data processing problems.		
11 .	**Justification for including the course in the programme:** This course provides students with knowledge of fundamental concepts and techniques in visual data processing, with additional exposure towards the extraction, representation and learning of visual information from images and videos for use in real-world data processing applications.		
12 .	**Course Learning Outcomes (CLO)**	**Domain**	**Level**
	CLO1: Describe fundamental concepts and techniques in image processing and computer vision and identify their usages	Cognitive	2
	CLO2: Apply existing computer vision algorithms and schemes to process visual information in specific tasks	Cognitive	3
	CLO3: Design solutions and techniques to solve real-world visual processing problems	Cognitive	5

13 . **Mapping of the Course Learning Outcomes to the Programme Learning Outcomes, Teaching Methods and Assessment:**

Course Learning Outcomes (CLO) (Must tally with CLOs in item 12)	Programme Learning Outcomes (PLO)												Teaching Methods	Assessment Method
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO1							✓	✓					Lecture/Practical	Quiz/Final Exam
CLO2								✓	✓				Lecture/Practical	Assignment/Final Exam
CLO3									✓				Lecture/Practical	Assignment
Total							**1**	**2**	**2**				*Indicate the relevancy between the CLO and PLO by ticking "✓" the appropriate relevant box (This description must be read together with standards 2.1.2, 2.2.1, and 2.2.2 in Area 2 – pages 16 & 18 of COPPA 2.0)*	

14 . **Transferable Skills:**

Problem Solving, Concept Application

15 . **Distribution of Student Learning Time (SLT)**

	Course Content Outline	**CLO	Teaching and Learning Activities – Guided Learning (F2F)* *L	*T	*P	*O	Guided Learning (NF2F)*	Independent Learning (NF2F)*	Total SLT
1	**Introduction to Images** Image formation, Camera models, Perspective, Image acquisition, Image sampling and quantization		2		0		4	2	8
2	**Image Filtering** Point operations: Pixel transformations, Contrast stretching, Histograms, Histogram equalization; Neighborhood operations: Local neighborhoods, Linear filtering, Low and High-pass filters, Non-linear filtering, Unsharp masking		3		2		4	5	14
3	**Low Level Features** Binary image analysis: Thresholding, Morphological operators, Connected components; Edges: Gradient-based edge detectors, Canny edge detector; Textures: Texture representation, Filter banks, Local binary patterns. Color: Color spaces, Additive and subtractive color models		5		6			11	22
4	**Segmentation and Grouping** Gestalt theory for perceptual grouping, Segmentation by clustering: k-means clustering, agglomerative clustering; Mean shift segmentation, Graph cuts		3		2			5	10

5	**Feature Detectors and Descriptors** Local invariant features, Feature detectors: Harris corner detector; Feature descriptors: SIFT and other variants; Feature matching and alignment: RANSAC; Feature indexing: Visual words concept, Bag-of-words (BOW) representation, tf-idf weighting.		5		4			9	18
6	**Video Processing** Video representation, Motion estimation: Background subtraction, Frame differencing, Optical Flow; Tracking		2		4			6	12
7	**Visual Processing Applications** (I) Multimedia retrieval and search: Visual similarity, Content-based retrieval, Learning from large image collections, Learning with textual information; (II) Face recognition: Eigenfaces, Fisherfaces, Supervised classification methods; (III) Pedestrian counting in surveillance: HOG features		4		2		8	6	20
8	**Advanced Topics** Deep learning techniques, Aesthetic evaluation, Panoramic stitching, High dynamic range (HDR) imaging.		2		0			2	4
								Total SLT	**108**

SUMMATIVE ASSESSMENT

1. Continuous Assessment	**Percentage %**	**Total SLT**
Quiz	20%	4
Assignment	40%	28
Total SLT for Continuous Assessment		**32**

2. Final Assessment	**Percentage %**	**Total SLT**	
		F2F	**ILT**
Final Exam	40%	2	18
Total SLT for Final Assessment (F2F + NF2F)		**20**	
Grand Total	**100%**	**160**	

****Indicate the CLO based on the CLO's numbering in Item 12.**
***L= Lecture, *T= Tutorial, *P= Practical, *O= Others, F2F*= Face to Face, NF2F*= Non Face to Face**

16 . **Identify Special Requirement to Deliver the Course (e.g., software, nursery, computer lab, simulation room):**
Computer lab, software

17 . **Main References:**
Szeliski, R. (2011). Computer Vision: Algorithms and Applications. Springer.

18 . **Additional References:**

1. Klette, R. (2014). Concise Computer Vision: An Introduction into Theory and Algorithms. Springer.
2. Forsyth, D.A. & Ponce, J. (2011). Computer Vision: A Modern Approach (2nd Ed.). Pearson.
3. Gonzalez R.C. & Woods, R.E. (2007). Digital Image Processing (3rd Ed.). Prentice Hall.
4. Grauman, K. & Leibe, B. (2011). Visual Object Recognition. Morgan & Claypool Publishers.
Carter, C. (2009). Microsoft XNA Game Studio 3.0 Unleashed, SAMS Publishing, USA.

Note:

	Cells shaded light grey contain formulas / fixed values. Edit these formulas only if needed.