

SM3123: IMAGE PROCESSING AND AUGMENTED REALITY

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Image Processing and Augmented Reality

Subject Code

SM - School of Creative Media

Course Number

3123

Academic Unit

School of Creative Media (SM)

College/School

School of Creative Media (SM)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

SM2715 Creative Coding

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

The course aims to provide fundamental knowledge in digital image processing and its applications in pixel based computer graphics. The classes introduce the theory and practical tools to create, manipulate and display digital images with the use of simple computer programming. Students will master the basic mathematical background necessary to work creatively on image processing within the application framework of mixed reality applications, which spans from virtual reality and augmented reality systems. Additional topics will introduce the simple mechanism of computer vision and motion detection and tracking techniques in which students can apply to work on their interactive projects.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Identify key concepts in pixel based computer graphics and simple image processing techniques.		x		
2	Apply the image processing techniques to generate creative computer graphics.			x	
3	Describe simple computer vision mechanisms and motion tracking applications.		x		
4	Relate computer vision techniques in human computer interaction application areas.			x	
5	Associate, combine and integrate knowledge from different disciplines (e.g. mathematics, sciences, literature etc.) into course assignments			x	
6	Transform basic technical competence into a unique style or personal signature				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.

Teaching and Learning Activities (TLAs)

TLAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Introductory mini-lectures on image processing and computer visions.	1, 3	

2	Workshop	Practical workshops on image processing, augmented reality and computer vision with computer programming in the Flash Action Script language.	2, 4, 5, 6	
3	Presentation	Individual project presentation on creative ideas and final deliverables.	2, 4, 5, 6	

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	In-class programming exercises on image processing, computer vision and augmented reality.	1, 3	20	
2	Assignment on pixel based computer graphics, which can be interactive.	2, 5	40	
3	Assignment on computer vision, augmented reality application and human computer interaction.	4, 5, 6	40	

Continuous Assessment (%)

100

Examination (%)

0

Assessment Rubrics (AR)**Assessment Task**

1. In-Class Exercises

Criterion

Students should demonstrate ability to utilize primary and secondary sources, build up argument and analysis. The threshold of 'discovery' lied in a student's self initiatives to conduct additional research and to personalize theories for her/his personal daily experience.

Excellent (A+, A, A-)

- Excellent grasp of research material, able to explain key concepts, assumptions and debates
- Rigorous organization, coherent structure, distinct thesis, properly argued with strong narrative
- Insightful interpretation of the subject matter with distinct themes and thesis
- Critical analysis with insightful comments opening up new issues, or suggesting the ability to theorize
- Ability to approach a text or a theme using a variety of theories and analytical tools
- Strong bibliography suggesting breadth and depth of coverage and informed insights

Good (B+, B, B-)

- Firm grasp of materials, able to explain key concepts and assumptions

- Reasonable organization, balanced structure, adequate content, sufficient ability to integrate various resources based on demand
- Clear ideas which keep to the point, clear-cut subject, ability to interpret opinions independently
- Organized bibliography which can be utilized in accordance with the topic

Fair (C+, C, C-)

- Comprehensive grasp of materials, able to explain key concepts
- Fair organization, weak structure, adequate content, fair ability to integrate various resources based on demand
- Relevant points to the subject matter, fair ability to interpret opinions
- Unorganized bibliography which can be utilized in accordance with the topic

Marginal (D)

- Loose grasp of materials, cannot explain key concepts
- Poor organization and structure, weak content, limited use of resources
- Relevant points to the subject matter, marginal ability to interpret opinions
- Insufficient and/or unorganized bibliography

Failure (F)

- Poor grasp of materials
- No organization and structure, inadequate content, no/ irrelevant use of resources
- Irrelevant points to the subject matter, minimal ability to interpret opinions
- Irrelevant bibliography

Assessment Task

2. Computer Graphic Project, Human-Computer Interaction Project

Criterion

Students should demonstrate ability to utilize primary and secondary sources, execute creative ideas and projects. The threshold of 'discovery' lies in a student's proactively turning theory into praxis, to transform course material into self-owned authorship.

Excellent (A+, A, A-)

- Work has strong affective quality and the articulation of personal styles and signature
- Excellent appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium
- Work raises questions and instill insights about the process of conception, creative strategization and production
- Innovative exploration by combining knowledge from different disciplines (e.g. mathematics, psychology, physics, anthropology, etc.) to create an inter-disciplinary project
- Efficient adjustment of plans and strategies in response to resources (time, space, equipment, etc) available with constructive adjustment

Good (B+, B, B-)

- Strong appreciation, exploration and/or application of the aesthetic and expressive qualities of the medium
- Ability to create project/ work that demonstrate the processes of thinking and creative exploration
- Proper adjustment of plans and strategies in response to resources (time, space, equipment, etc) available and constructive feedback/ suggestions

Fair (C+, C, C-)

- Basic appreciation and/or application of the aesthetic and expressive qualities of the medium
- Limited ability to create project/ work that demonstrate the processes of thinking and creative exploration
- Adjustment of plans and strategies in response to resources (time, space, equipment, etc) available

Marginal (D)

- Marginal appreciation of the aesthetic and expressive qualities of the medium
- Marginal ability to create project/ work that demonstrate the processes of thinking and creative exploration

- Limited adjustment of plans and strategies in response to resources (time, space, equipment, etc) available

Failure (F)

- No appreciation of the aesthetics and expressive qualities of the medium
- Fail to create project/ work that demonstrate the processes of thinking and creative exploration
- Minimal adjustment of plans and strategies in response to resources (time, space, equipment, etc) available

Additional Information for AR

All A+/A/A- grade assignment should comply with the highest performance of Discovery-oriented learning.

Part III Other Information**Keyword Syllabus**

- Digital colour model
- Pixels
- Image transformation
- Image filter
- Convolution matrix
- Computer vision
- Image capture
- Motion analysis
- Motion tracking
- Virtual reality
- Augmented reality
- Interaction design

Reading List**Compulsory Readings**

Title	
1	Richard Szeliski (Author) (2010) Computer Vision: Algorithms and Applications
2	Lawrence O’Gorman (Author), Michael J. Sammon (Author), Michael Seul (Author) (2008) Practical Algorithms for Image Analysis
3	Borko Furht (Editor) (2011) Handbook of Augmented Reality
4	Tony Mullen (Author) (2011) Prototyping Augmented Reality

Additional Readings

Title	
1	Jens Grubert (Author), Dr. Raphael Grasset(Author) (2013) Augmented Reality for Android Application Development