TQF 3 Course Specifications

Section 1 General Information

1. Course code and course title

Thai EGCI 486 การประมวลผลภาพ

English EGCI 486 Image Processing

2. Number of credits 4 Credits (4-0-8) (Lecture/Lab/Self-study)

3. Program and type of subject

3.1 Program Bachelor of Engineering (Computer Engineering)

3.2 Type of Subject Elective Major Course

4. Course Coordinator and Course Lecturer

4.1 Course Coordinator Asst. Prof. Dr. Lalita Narupiyakul

4.2 Course Lecturer Asst.Prof. Dr. Narit Hnoohom

5. Trimester/ Year of Study

5.1 Trimester Second trimester / for 3rd-4th year Computer Engineering

5.2 Course Capacity Approximately 12-20 students

6. Pre-requisite None

7. Co-requisites None

8. Venue of Study Mahidol University, Salaya campus

Section 2 Goals and Objectives

1. Course Goals

1.1 Students should describe the concept of image processing.

1.2 Students should be able to design and develop an application of image processing.

1.3 Students should be able to apply an understanding of the concepts in image processing methods to solve engineering problems.

2. Objectives of Course Development/Revision

To up-date the knowledge content of the course

Section 3 Course Management

1. Course Description

(Thai) แนะนำการประมวลผลภาพดิจิตอล พื้นฐานการประมวลผลภาพดิจิตอล การปรับปรุงภาพในสปาเชียลโดเมน ประมวลผลภาพสี การประมวลผลภาพแบบมอร์โฟโลยี การแบ่งส่วนภาพ การดึงคุณลักษณะและการจับคู่ อัลกอริทึมการเรียนรู้ของเครื่องและการเรียนรู้เชิงลึกสำหรับการจำแนกภาพ

(English) Introduction to digital image processing, digital image fundamentals, image enhancement in the spatial domain, image enhancement in the frequency domain, color image processing, morphological image processing, image segmentation, feature extraction and matching, machine learning and deep learning algorithms for image classification.

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
48 hours (4 hours x 12 weeks)	-	96 hours (8 hours x 12 weeks)

3. Number of hours that the lecturer provides individual counseling and guidance.

1 hours/week

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to

1. CLO1 Understand the concept of image processing.
2. CLO2 Apply image processing programming methods to design and develop an application of image processing.

3. CLO3 Apply an understanding of the concepts in image processing methods to solve engineering problems.

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

Course Code	Teaching methods	Evaluation Methods
CLO1	Interactive lecture, practical programming, individual assignment	Written examination, individual evaluation
CLO2	Interactive lecture, practical programming, individual assignment	Written examination, individual evaluation
CLO3	Group assignment with a project report, discuss on project	Group evaluation, oral presentation evaluation

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Number of Hours		Teaching Activities/ Media	Lecturer
		Lecture Hours	Lab/Field Trip/Internship Hours		
1	Introduction to image processing and Python programming	4	0	Interactive lecture, practical programming, individual assignment	Individual Evaluation
2	Image fundamentals and introduction to OpenCV library	4	0		
3	Image enhancement in the spatial domain 1	4	0		
4	Image enhancement in the spatial domain 2	4	0		

5	Image enhancement in the spatial domain 3	4	0	Interactive lecture, practical programming, individual assignment	Individual Evaluation
6	Color image processing	4	0		
7	Image segmentation	4	0		
8	Morphological image processing	4	0		
9	Feature extraction and matching	4	0		
10	Machine learning algorithms for image classification	4	0		
11	Deep learning algorithms for image classification	4	0		
12	Project presentation and discussion	4	0	Group assignment	Group evaluation, oral presentation evaluation
13	Examination	4	0	Final exam	Written examination
	Total	48	0		

2. Plan for Assessing Course Learning Outcomes

2.1 Assessing and Evaluating Learning Achievement

a. Formative Assessment

The assessment tools such as individual assignment, quizzes and final exam are used to evaluate student's understanding by their ability to describe digital image processing, digital image fundamentals, image enhancement in the spatial domain, image enhancement in the frequency domain, color image processing, morphological image processing, image segmentation, feature extraction and matching, machine learning and deep learning algorithms for image classification. Students should be able to demonstrate how to design and develop an application for solving a problem practice using image processing methods given during lectures. The assessments are made through their individual assignment, quizzes and final exam. The image processing project has to be

shown by applying an understanding of the concepts in image processing methods to solve engineering problems. The assessments are made through their group assignment with a project report, discuss on project.

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Understand the concept of image processing.	Individual assignment	10	20
	Quiz	5	
	Final Exam	5	
CLO2 Apply image processing programming methods to design and develop an application of image processing.	Individual assignment	25	50
	Quiz	10	
	Final Exam	15	
CLO3 Apply an understanding of the concepts in image processing methods to solve engineering problems.	Group assignment (Project)	30	30
Total			100

(2) Grading System

Student's achievement will be evaluated according to the Mahidol University International College standard, using the symbols: A, B, B+, C, C+, C, D+, D, and F.

Grade	Achievement	Final Score (% range)	GPA
A	Excellent	90-100	4.0
B+	Very Good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly Good	75-79	2.5
C	Fair	70-74	2.0

D+	Poor	65-69	1.5
D	Very Poor	60-64	1.0
F	Fail	Less than 60	0.0

(3) Re-examination

N/A - (Not applicable with MUIC)

3. Student Appeals

The student wishing to appeal according to grading result must submit a written and signed appeal form personally to the academic affair unit. It is prohibited to assign another person to appeal on one' s behalf. The written appeal form is then sent to the program director and chair of department. The final decision is transferred for approval by the faculty committee. The result of appeal then is informed to the student.

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials
    1) Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Fourth Edition, Pearson Education Limited, 2018.
    2) David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach, Second Edition, Pearson, 2011.
2. Recommended textbooks and/or other documents/materials
    1) Python (https://wiki.python.org/moin/BeginnersGuide)
    2) OpenCV (https://docs.opencv.org/master/d9/df8/tutorial_root.html)
    3) Keras (https://keras.io/getting_started/)
    4) Scikit-Learn (https://scikit-learn.org/stable/)
3. Other Resources (If any)

    IEEE Transactions on Image Processing

Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students

1.1 Evaluation of peers by students

1.2 Student evaluation

1.2.1 Course content

1.2.2 Course management

1.2.3 Suggestions

1.2.4 Overall opinions

2. Evaluation strategies in teaching methods

2.1 Student evaluation

2.2 Presentation

3. Improvement of teaching methods

Workshop on course improvement with the participation of all instructors in the course.

4. Evaluation of students' learning outcome

Analysis of students' learning outcomes using scores from class attendance, group activity and presentation of project and poster presentation.

5. Review and improvement for better outcome

Review the course before trimester starts and before each teaching period.

Appendix

Alignment between Courses and General Education courses

Relations between the course and the program

Table 1 Relations between the course and the PLOs

Image processing	*PLOs*					
	PLO1	*PLO2*	*PLO3*	*PLO4*	*PLO5*	*PLO6*
EGCI 486		R		R		R

Table 2 Relations between CLOs and PLOs

EGCI 486	*PLOs*

	PLO1	*PLO2*	*PLO3*	*PLO4*	*PLO5*	*PLO6*
CLO1 Understand the concept of image processing.				x		
CLO2 Apply image processing programming methods to design and develop an application of image processing.		x				
CLO3 Apply an understanding of the concepts in image processing methods to solve engineering problems.		x				x

Table 3 PLOs that the course is responsible for

PLOs	*SubPLOs*
PLO2: Integrate computer engineering knowledge with other related sciences and pursue new knowledge in computer engineering.	2.1 Use computer engineering knowledge to solve problems in other fields
PLO4: Generate potential solutions for problem solving with computer engineering knowledge and skills.	4.2 Explain individual steps of methodology and reason for each steps

PLO6: Create a related computer engineering development based on information technology in mathematics or applied statistics.	6.1 Choose information technology tools properly for computer engineering development