Tamkang University Academic Year 111, 2nd Semester Course Syllabus

Course Title	VISUAL SENSING TECHNOLOGY AND APPLICATIONS	Instructor	WANG YIN-TIEN
Course Class	TEBXM1A MASTER'S PROGRAM, DEPARTMENT OF MECHANICAL AND ELECTRO-MECHANICAL ENGINEERING, 1A	Details	◆ General Course ◆ Selective ◆ One Semester
Relevance to SDGs	SDG4 Quality education SDG8 Decent work and economic growth SDG9 Industry, Innovation, and Infrastructure		

Departmental Aim of Education

Ⅰ. To prepare students who have a comprehensive understanding of the principles of applied sciences and engineering to be innovators in the field of mechanical and electromechanical engineering.

Ⅱ. To train emerging professionals who possess a high level of expertise and ethical standards who will become independent research and development leaders in the industry.

Ⅲ. To motivate students who will pursue continuing education as a means to stay on the cutting edge of global competiveness and meet changes in their careers and the workplace with confidence and ease.

Subject Departmental core competences

A. Head: Knowledge of mechanical and electromechanical engineering.(ratio:40.00)

B. Hand: Hands-on skills and practical realization.(ratio:20.00)

C. Heart: Love of learning and innovation.(ratio:20.00)

D. Eye: Vision of progress and improvements.(ratio:20.00)

Subject Schoolwide essential virtues

1. A global perspective. (ratio:10.00)

2. Information literacy. (ratio:30.00)

3. A vision for the future. (ratio:20.00)

4. Moral integrity. (ratio:5.00)

5. Independent thinking. (ratio:20.00)

6. A cheerful attitude and healthy lifestyle. (ratio:5.00)

7. A spirit of teamwork and dedication. (ratio:5.00)

8. A sense of aesthetic appreciation. (ratio:5.00)

Course Introduction	This course provides basic concepts of visual sensing technology and its applications in the industry. Four major topics include (a) Introduction of the integration of sensing technology, image processing algorithms, and programming language and library. (b) The environment of programming language and OpenCV library. (c) The Sensing technology of object detection and recognition algorithms. (d) The applications of sensing technology in the industry. The students will implement many experiments to understand the practical sensing technology for the automatic industry.

The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.
II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.
III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	The students will learn to build the environment of programming language and OpenCV library.	Cognitive
2	The students will learn to use OpenCV for object detection and recognition.	Cognitive
3	The students will learn how to use CNN to solve the problems of image classification, object detection, and object recognition.	Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

No.	Core Competences	Essential Virtues	Teaching Methods	Assessment
1	AB	123	Lecture, Practicum	Study Assignments, Practicum
2	BC	3456	Lecture, Practicum	Testing, Practicum
3	CD	5678	Lecture, Practicum	Testing, Practicum

Course Schedule

Week	Date	Course Contents	Note
1	112/02/13 ~ 112/02/19	Introduction; Python programming; Programming tools	

2	112/02/20 ~ 112/02/26	Image processing; Image Augmentation; OpenCV-Python; Pillow	
3	112/02/27 ~ 112/03/05	228 Peace Memorial day	
4	112/03/06 ~ 112/03/12	Supervised machine learning; Image classification; Scikit-learn	
5	112/03/13 ~ 112/03/19	Ensemble machine learning and image classification	
6	112/03/20 ~ 112/03/26	Artificial neural networks (ANN); Convolutional neural networks (CNN); Deep neural networks; Tensorflow; Pytorch	
7	112/03/27 ~ 112/04/02	ANN/CNN and image classification	
8	112/04/03 ~ 112/04/09	No class (Teaching Administration Observation Period)	
9	112/04/10 ~ 112/04/16	Deep learning and image object classification: LeNet, AlexNet, NiN, VGG, GoogLeNet, ResNet; Nvidia Kuda	
10	112/04/17 ~ 112/04/23	Mid-term exam. (Project presentation)	
11	112/04/24 ~ 112/04/30	Image object detection: R-CNN, SSD ((Single Shot MultiBox Detector) , UNet, YOLO (You Only Look Once)	
12	112/05/01 ~ 112/05/07	Semantic segmentation: Fully convolutional networks (FCN), Deeplab, RefineNet	
13	112/05/08 ~ 112/05/14	Instance segmentation: Mask R-CNN, YOLACT (You Only Look At CoefficienTs)	
14	112/05/15 ~ 112/05/21	Spatial-temporal action detection: 3D CNN, Inflated 3D ConvNet	
15	112/05/22 ~ 112/05/28	Transformers	
16	112/05/29 ~ 112/06/04	Vision Transformers	
17	112/06/05 ~ 112/06/11	Multi-modal Transformers	
18	112/06/12 ~ 112/06/18	Final exam (Project presentation)	

Requirement	
Teaching Facility	Computer, Projector

Textbooks and Teaching Materials	課堂講義 Richard Szeliski, Computer Vision: Algorithms and Applications, Springer. Joseph Howse and Joe Minichino, Learning OpenCV 4 Computer Vision with Python 3, Packt Publishing. Python 機器學習超進化(Machine Learning Evolution with Python), 鄧文淵
References	
Number of Assignment(s)	(Filled in by assignment instructor only)
Grading Policy	◆ Attendance： 20.0 % ◆ Mark of Usual：40.0 % ◆ Midterm Exam： 20.0 % ◆ Final Exam： 20.0 % ◆ Other〈 〉： %
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php . **※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.**