Course Syllabus

Image Processing and Point Cloud Processing

Super AI Engineer Course by AI Association of Thailand

Course	:	Image Processing and Point Cloud Processing
Credit	:	3 credits
Semester	:	January 2022 – April 2022
Course Outline	:	Basic image processing and computer vision. An overview across major application domains. Image Formation and Acquisition: Geometry of image formation. Pinhole camera and perspective projection. Geometry of stereopsis. Field of view and depth of field. Projective coordinates and perspective projection matrix. Image rectification and stereo calibration. Basic notions on image sensing, sampling, and quantization. Intensity Transformations including image histogram, linear and non-linear contrast stretching. histogram equalization. spatial filtering and linear shift-invariant operators. Convolution and correlation. Mean and Gaussian filtering. Median filtering. Bilateral filtering. Image Segmentation Binarization by global thresholding. Automatic threshold estimation. Spatially adaptive binarization. Color-based segmentation. Binary morphology including dilation, and erosion. Blob Analysis and distance on image plane and connectivity. Labeling of connected components. Point Cloud Registration / 2D to 3D Registration, Camera and object motion tracking. Feature Extraction and Matching. 2D-3D Reconstruction and Surface Reconstruction. Explicit and Implicit Surface. 2D to 3D Reconstruction and Vanilla ICP. Normalization Depth and World Origin. Tools and Pytorch 3D / 3D Machine Learning. Introduction 3D Deep Learning. Voxel-based, Point-based and Graph-based 3D Deep Learning. Point Attention Network for Gesture Recognition with Point Cloud Data.
Instructor	:	Dr. Sanparith Marukatat (sanparith.marukatat@nectec.or.th) (NECTEC) Assoc. Prof. Dr. Parinya Sanguansat (parinyasan@pim.ac.th) (PIM) Dr. Cherdsak Kingkan (cherdsak.kingkan@nectec.or.th) (NECTEC)
Grading	:	Attendance / Quiz 20% Examination 40% On-hand Project 40% Top 20% → 'A'. Bottom 20% and/or students whose score < 30% → 'F'
Quiz	:	Quizzes are randomly conducted in the classes
Projects	:	The project aims to give you experience of image processing and point cloud processing. The project will be classified into individual hackathon projects, small group projects, and big bang group projects.
Course Material	:	http://mooc.aiat.or.th/ https://www.unibo.it/en/teaching/course-unit-catalogue/course-unit/2020/446598

Schedule:

No.	Topics	Hours
1	Basic image processing Color, Light, and Image Formation	3
2	Mathematics in Computer vision	3
3	Image restoration, sizing, noise, segmentation, and contours	3
4	Color detection, background subtraction, with and without background.	3
5	Noise addition, line sensor, perspective transformation.	3
6	Convolution / Image Gradient / Corner Detection / SIFT	3
3	Histogram equalization, Integral image, local intensity distribution equalization	3
4	Maximum likelihood, Mixture Model, and Pixel sorting	3
9	Point cloud (PC) basics: PC registration, 2D to 3D registration	3
10	Feature extraction and matching. 2D to 3D reconstruction and Vanilla ICP	3
11	Tools and Pytorch 3D / 3D Machine Leaning	3
12	Point- and Graph-based deep learning and gesture recognition	3
13	Project Workshop 1	10
14	Project Workshop 2	10
15	Project Workshop 3	10
16	Examination	
	Lecture	36
	Workshop	30