Course Outline

Academic Year 2024, Semester 1

Institution:	Assumption University of Thailand (AU)
Department:	Computer Science (CS)
Campus:	Suvarnabhumi Campus
Faculty:	Vincent Mary School of Engineering, Science and Technology (VMES)

General Information

Course Code and Title:	CSX 4213 Computer Vision CSX 4613 Selected Topic in Computer Vision
Total Credits:	3 credits (3-0-6)
Program and Type of Course:	BS CS, Major Elective Course Group 1(B) Selected Topic, Major Elective Course Group 2

Name of Teaching Faculty Member	**Assigned Section**
Asst. Prof. Dr. Dobri Atanassov Batovski	541

Semester and Year the subject is offered according to the program's study plan:	
Semester: First Semester	Year: Third Year

Pre-requisite: (Please specify, otherwise state "none")	For Group 1(B): CSX 3001 Fundamentals of Computer Programming and ITX 2007 Data Science
Co-requisite: (Please specify, otherwise state "none")	None
Classroom: (Please specify, otherwise state "none")	LSM 0403

Objectives and Course Learning Outcomes

The Course's objectives - On completion of this subject, the students should be able to:
- Describe the main applications of computer vision.
- Describe the model fitting and optimization methods in computer vision.
- Describe the deep learning techniques in computer vision.
- Explain the need of forming image mosaics for specific computer vision applications.
- Explain the use of video surveillance techniques in computer vision.
- Explain the importance of recognizing, classifying and tracking objects in images.
- Master the methodology of problem solving in computer vision.
- Practice selected computer vision algorithms with specialized software tools.
- Describe known ethical issues related to computer vision.

Course Description and Implementation

Course Description
Fundamental problems and techniques in computer vision: image formation, camera image geometry, feature detection in images, edge/line detection, recovery of shape from images, forming image mosaics; video surveillance techniques; recognizing, classifying and tracking objects in images.

Number of lecture - lab - self-study hours			
Lecture hours	**Tutorial hours (if any)**	**Practice / Field Experience / Internship hours**	**Self-Directed Learning hours**
45 hours	-	-	90 hours

Academic Advice and Guidance provided
The lecturer provides academic advice and guidance to students (individual/group) for 6 hours/week on Wednesdays and Thursdays, 9 a.m. - 12 noon, in Room VME 0408.

Teaching Plan (Lesson Plan and Teaching Method)

Week	Topic(s)	Hours	Course Learning Objectives	Teaching Method (Teaching & Learning Activities)	Instructional Media (if any)	Faculty Members
1	Introduction to Computer vision: History of Computer Vision and Basics of Image Formation	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
2	Image Processing: Operators, Filters, Transforms and Geometric Transformations	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
3	Model Fitting and Optimization in Computer Vision	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
4	Deep Learning Techniques in Computer Vision Software Quiz #1	3	Understanding of theoretical and numerical concepts; Evaluation of software skill development	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
5	Recognition in Computer Vision: Classification, Object Detection, and Semantic Segmentation.	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation;	Asst. Prof. Dr. Dobri Atanassov Batovski

					Python software	
6	Feature Detection and Matching	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
7	Image Alignment and Stitching Software Quiz #2	3	Understanding of theoretical and numerical concepts; Evaluation of software skill development	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
8	Make-up session for the completion of software assignments; and Summary of Midterm Examination Topics	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
9	Midterm Examination	3	Evaluate the knowledge gained during weeks 1-7.	Evaluation: Midterm Examination		
10	Motion Estimation: Translational Alignment, Parametric Motion, Optical Flow, and Layered Motion	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
11	Computational Photography and Super-resolution	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski

12	Structure from Motion and Simultaneous Localization and Mapping (SLAM) Software Quiz #3	3	Understanding of theoretical and numerical concepts; Evaluation of software skill development	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
13	Depth Estimation and Deep Neural Networks	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
14	Three-dimensional (3D) Reconstruction and Surface Representations	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
15	Image-based Rendering: Video-based Rendering and Neural Rendering Software Quiz #4	3	Understanding of theoretical and numerical concepts; Evaluation of software skill development	Lecture, Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
16	Make-up session for the completion of software assignments; and Overview of Final Examination Topics	3	Understanding of theoretical and numerical concepts; Mastering computer vision using Python	Discussion/ Software Assignments, Directed Self-Study/ Assigned Reading Materials	Power point presentation, websites, video presentation; Python software	Asst. Prof. Dr. Dobri Atanassov Batovski
17	Final Examination	3	Evaluate the knowledge gained during weeks 10-15.	Evaluation: Final Examination		

Assessment - Evaluation Plan and Proportion of Evaluation (%)

Evaluation Methods	Week on which the evaluation of the degree of attainment of the learning outcomes would be administered	Total
1. Midterm Examination	Exam time specified by the Office of the Registrar	20%
2. Computer vision Project	Throughout the Semester	20%
3. Software Quizzes	Classes #4, #7, #11 and #14	20%
4. Final Examination	Exam time specified by the Office of the Registrar	40%
Total	At the end of the semester	**100%**

Note on Course Withdrawal

Students will not be automatically debarred from the final exam even if they have attended less than 80% of the classes. However, the university registrar examines attendance records to track Visa holders.

If a student decides to continue on the course after **the withdrawal deadline, Friday, 20 September 2024**, the student will get a grade that is calculated from their accumulated score.

Students who are absent from the final examination cannot pass this course.

Teaching and Learning Resources

Main Text(s) and Teaching Materials:
The main reading materials are to be provided in class.

Essential Teaching Resources:
Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd Edition, 2022, Springer, ISBN-13: 978-3030343712.

Recommended Teaching Resources:
IEEE Transactions on Computer vision, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?reload=true&punumber=83>.