THE CHINESE UNIVERSITY OF HONG KONG
Print Course Catalog Details

Academic Org: Dept of Computer Sci & Engg – Subject: Computer Science

Course: CSCI3330 **Course ID:** 014446 **Eff Date:** 2023-07-01 **Crse Status: Active** **Apprv. Status:** Approved **[**New Course**]**

Fundamentals of Applied Computer Vision **應用計算機視覺基礎**

This course provides a comprehensive introduction and foundation of applied computer vision. Computer vision is the enterprise of building machines that can sense and extract information from 3D scenes. It is one of the fastest growing and exciting disciplines in today's academia and industry, with a wide variety of applications in robotics, video surveillance, navigation, consumer electronics, human-computer interaction, medical imaging, remote sensing, space exploration, and so on. This course is designed to open the doors for students who are interested in learning about the fundamental principles and important applications of computer vision. The following topics will be covered: cameras and image formation, image filtering, edge and corner detection, image features and matching, image alignment, geometric camera models, binocular stereo, optical flow, radiometry, photometric stereo, structured light, and other applications in machine vision. We will expose students to a number of real-world applications that are important to our daily lives. Students will learn core concepts of computer vision, as well as hands-on experience to solve real world problems with computer vision.

本科提供應用計算機視覺的全面介紹和基礎知識。計算機視覺的目標是構建能夠從三維場景中感知和提取信息的機器眼睛和大腦。它是當今學術界和工業界發展最快和令人興奮的學科之一，在機器人、視頻監控、導航、消費電子、人機交互、醫學成像、遙感、太空探索等領域有著廣泛的應用。本科旨在爲有興趣了解計算機視覺的基本原理和重要應用的學生打開大門。本科將涵蓋以下主題：相機和圖像形成、圖像濾波、邊緣和角落檢測、圖像特徵和匹配、圖像對齊、幾何相機模型、雙目立體、光流、輻射測量、光度立體、結構光和其他機器視覺的應用。我們將使學生接觸到許多對我們日常生活很重要的現實應用。學生將學習計算機視覺的核心概念和基礎知識，以及使用計算機視覺解決現實世界問題的實踐經驗。

Grade Descriptor:

A

EXCELLENT – exceptionally good performance and far exceeding expectation in all or mostof the course learning outcomes; demonstration of superiorunderstanding of the subjectmatter, the ability to analyze problems and apply extensive knowledge, and skillful use of concepts and materials to derive propersolutions.

有關等級說明的資料，請參閱英文版本。

B

GOOD – good performance in all course learning outcomes and exceeding expectation insome of them; demonstration of good understanding of the subject matterand the ability to use proper concepts and materials to solve most of the problems encountered.

有關等級說明的資料，請參閱英文版本。

C

FAIR – adequate performance and meeting expectation in all course learning outcomes;demonstration of adequate understanding of the subject matter and theability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

D

MARGINAL – performance barely meets the expectation in the essential course learningoutcomes; demonstration of partial understanding of the subject matter andthe ability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

F

FAILURE – performance does not meet the expectation in the essential course learningoutcomes; demonstration of serious deficiencies and the need to retake thecourse.

有關等級說明的資料，請參閱英文版本。

Equivalent Offering:
Units: 3 (Min) / 3 (Max) / 3 (Acad Progress)
Grading Basis: Graded
Repeat for Credit: N
Multiple Enroll: N
Course Attributes:

Topics:

COURSE OUTCOMES

Learning Outcomes:

At the end of the course of studies, students will have acquired:
1. mathematical fundamentals of image formation and camera models in computer vision
2. core concepts and algorithms of image processing as well as feature extraction and matching
3. core concepts and algorithms of 3D reconstruction with computer vision
4. core concepts and algorithms of radiometry, motion, and other aspects of computer vision
5. hands-on programming experiences to implement computer vision algorithms.

Course Syllabus:

Week 1: Course introduction;Camera model, image formation;
Week 2: Practical linear algebra;Image filtering (1)
Week 3: NImage filtering (2);Edge and corner detection;
Week 4: Image features and matching (1);Image features and matching (2)
Week 5: Camera ISP pipeline (1);Camera ISP pipeline (2)
Week 6: Geometric camera model;Camera calibration;
Week 7: Homography and stitching (1);Homography and stitching (2);
Week 8: Binocular stereo (1);Binocular stereo (2);
Week 9: Motion and optical flow (1);Motion and optical flow (2);
Week 10: Radiometry (1);Radiometry (2);
Week 11: Shape from shading;Photometric stereo;
Week 12: Structured light;Advances in Computer Vision;
Week 13: Review session;

Assessment Type:

Examination	: 30%
Homework or assignment	: 70%

Feedback for Evaluation:

1. Quiz and examinations
2. Course evaluation and questionnaire
3. Question-and-answer sessions during class
4. Student consultation during office hours or online

Required Readings:

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Recommended Readings:

- Richard Szeliski. Computer Vision: Algorithms and Applications (2nd ed), Free online
- Bhandari, Kadambi and Raskar. Computational Imaging. MIT Press. Free online
- Shree Nayar. First Principles of Computer Vision. Free online
- David Forsyth and Jean Ponce. Computer Vision: A Modern Approach. Free online

OFFERINGS

1. CSCI3330 Acad Organization=CSD; Acad Career=UG

COMPONENTS

LEC : Size=50; Final Exam=Y; Contact=3

TUT : Size=50; Final Exam=N; Contact=1

ENROLMENT REQUIREMENTS

1. CSCI3330

Enrollment Requirement Group:
Prerequisite: CSCI2100

New Enrollment Requirement(s):
Pre-requisite = CSCI2100

CAF

eLearning hrs for blended cls	0
VTL-Onsite face-to-face hrs	0
VTL-Online synch. hrs	0
VTL-Online asynch. hrs	0
No. of micro-modules	0
Research components (UG)	1% - 49%

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